Introduction: The Burn Navigator (BN) is an FDA-cleared clinical decision support tool used to aid fluid resuscitation after major burn injury. The BN provides users with hourly recommendations for fluid titration during the initial resuscitation based on various factors. The objective of this multicenter observational study was to evaluate the resuscitation volumes and related outcomes of patients admitted to five ABA verified burn centers who underwent intravenous fluid resuscitation utilizing the BN.

Methods: Data was collected from 300 patients who were resuscitated utilizing the BN. Two analyses were performed: examination of the first 24 hours of resuscitation after burn injury and examination of 24 hours of resuscitation using the BN, regardless of when the resuscitation began, to account for patients who presented in a delayed fashion. Patients were classified as having followed the BN device if all hourly fluid rates were within 40 mL of the BN recommendations (20 mL above or below) for that hour at least 75% of the time.

Results: For 285 patients, average age, weight, and TBSA were 45.6 ± 16.8 years, 87.0 ± 22.8 kg, and 39.0 ± 17.8%, with partial/full thickness percentages of 22.2 ± 15.2% and 17.0 ± 19.7%, respectively. Analysis of 286 patients in the first 24 hours of resuscitation revealed an average of 4.07 ± 1.76 mL/kg/TBSA and 151.48 ± 77.46 mL/kg of primary crystalloid fluid. When considering all fluids administered to include colloids and medications, enteral and oral feeds, and oral resuscitation fluids, average volumes in the first 24 hours were 4.68 ± 2.06 mL/kg/TBSA and 175.01 ± 92.22 mL/kg. To account for delayed presentation after burn injury, examining 24 hours of resuscitation regardless of the initiation of resuscitation, average volumes for primary and total fluids were 5.28 ± 2.54 mL/kg/TBSA, 201.11 ± 106.53 mL/kg, 6.35 ± 2.95 mL/kg/TBSA and 244.08 ± 133.5 mL/kg respectively. There was a significant decrease incidence of shock in the BN-guided group versus the non-BN-guided group (p< 0.05).

Conclusions: The Burn Navigator provides comparable resuscitation volumes of primary crystalloid fluid to the Parkland Formula. When all fluids are considered, the BN device recommends total fluid infusion less than the Ivy Index (250 mL/kg/24 hrs) and was associated with a decreased incidence of shock. Early initiation of the BN device resulted in lower overall fluid volumes during the first 24 hours of resuscitation.

Top Six Abstracts

T1 Initial Results of the American Burn Association (ABA) Multi-Center Evaluation on the Effectiveness of the Burn Navigator
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T2 One Year Follow up Results of the DETECT Enzymatic Debridement Multicenter RCT
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Introduction: Bromelain Based Debridement (BBD) of deep thermal burns has been approved for use in Europe, Argentina, Russia, South Korea, Peru, and Israel, and is an investigational product in the United States. Topline results of acute stage endpoints of the DETECT Phase 3 multicenter RCT have been reported previously. The aim of this abstract is to present the 12-month follow-up of predefined endpoints of scar quality, function and quality of life (QoL).

Methods: One-hundred and seventy-five adult patients with deep burns were randomized in a Phase 3 clinical trial to one of 3 treatment arms – BBD, Standard of Care (SOC), or Gel vehicle (placebo control) in a 3:3:1 ratio (75 BBD, 75 SOC, and 25 Gel). Scar quality (cosmesis) and function data were analyzed for longer-term data collected at 3, 6, 12 (and 24 - data not yet final) months. Cosmesis and function were measured using Modified Vancouver Scar Scale (MVSS) and Patient and Observer Scar Assessment Scale (POSSA) to demonstrate that BBD treatment was non-inferior to SOC treatment, as measured at 12 months from wound closure date, evaluated by assessors blinded to the treatment arm. QoL was measured by the EQ-5D (EuroQol 5 Dimensions), VAS (Visual Analog Scale) and BSFS-B (Burn Specific Health Scale – Brief) scales. Missing values were imputed in the analysis using multiple imputation, with best case-worst case imputations as sensitivity analyses.
**Results:** The 12-month follow-up mean MVSS scores were lower (better) for the BBD group (3.70±2.10) than for the SOC (5.08±3.11) and Gel groups (5.63±2.99). A regression analysis showed that BBD has a 1.36 MVSS point advantage over SOC after adjustment for all other variables in the model (p-value = 0.0027). The 95% CI for this treatment effect was -2.24 to -0.48, excluding the pre-defined non-inferiority margin of +1.9 points, thus establishing non-inferiority of BBD treatment compared with SOC. Note that the interval also excludes 0, indicating superiority of BBD over SOC. The 3- and 6-month follow-up MVSS scores are also lower for the BBD group (5.51±3.09, 4.43±2.59) than for the SOC (6.63±3.44, 5.43±3.75) and Gel (7.56±2.67, 8.89±3.37) groups. POSAS total scores followed similar trends to MVSS scores but did not reach statistical significance at 12 months. QOL was generally similar among the treatment arms.

**Conclusions:** In addition to the significant acute stage results presented previously, the long-term results of this RCT further demonstrate the safety of BBD treatment, including significantly better 12-month follow-up MVSS scores.

**T3 Are Burns a Chronic Condition: Examining Physical and Mental Functioning up to 20 Years After Injury**

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**Introduction:** Burn survivors often face many long-term physical and psychological symptoms associated with their injury. To date, however, few studies have examined the impact of burn injuries on quality of life beyond 2 years post-injury. The purpose of this study is to examine the physical and mental well-being of burn survivors up to 20 years after injury.

**Methods:** Data from the Burn Model System National Database (1997–2020) were analyzed. Patient-reported outcome measures were collected at discharge with a recall of preinjury status, and then at 5, 10, 15, and 20 years after injury. Outcomes examined were the Physical Component Summary (PCS) and Mental Component Summary (MCS) of the Short Form-12. Trajectories were developed using linear mixed methods model with repeated measures of PCS and MCS scores over time and controlling for demographic and clinical variables. The model fitted score trajectory was generated with 95% confidence intervals to demonstrate score changes over time and associations with covariates.

**Results:** The study population included 420 adult burn survivors with a mean age of 42.4 years. The population was mainly male (66%) and white (76.4%) with a mean burn size of 21.5% and length of hospital stay of 31.3 days. Higher PCS scores were associated with follow-up time points closer to injury, shorter hospital stay, and younger age. Similarly, higher MCS scores were associated with earlier follow-up time points, shorter hospital stay, female gender, and non-perineal burns. MCS trajectories are demonstrated in the Figure.

**Conclusions:** Burn survivors’ physical and mental health worsened over time. Such a trend is different from previous reported results for mental health in the general population. Demographic and clinical predictors of recovery over time are identified.
Introduction: Traditionally, opioids have been the mainstay of treatment for background, breakthrough, procedural, and postoperative pain after burns. However, in addition to an impetus to reduce provider-driven opioid exposure, there is increasing evidence that opioids can worsen acute pain through induction of hyperalgesia. In 2019, we implemented a pill-based, opioid-minimizing pain protocol and protocolized moderate sedation for dressing changes. We hypothesized that these protocols would reduce inpatient opioid exposure without increasing acute pain scores.

Methods: Two groups of consecutive patients admitted to the burn service were compared: Pre (01/2018 to 07/2019) and Post (01/2020 to 06/2020) implementation of the protocols (08/2019 to 12/2019). Patient demographics, burn characteristics, and lengths of stay were abstracted from the burn registry. Opioid exposure and pain scale scores were obtained from the electronic medical record. The primary outcome was total morphine milligram equivalents (MME). Secondary outcomes included MME/day, pain domain specific MME, pain scores, and lengths of stay. Pain was estimated by creating a normalized pain score (range 0–1) from three different pain scales (Numeric Rating Scale, Behavioral Pain Scale, and Behavioral Pain Assessment Scale). Groups were compared using Wilcoxon Rank Sum and Chi Square. Treatment effect was estimated using Bayesian generalized linear models.

Results: There were no differences in demographics or burn characteristics between the Pre (n=495) and Post groups (n=174), including TBSA burn (Pre 4% [2, 10] versus Post 5% [2, 10], p=0.898). The Post group had significantly lower total MME (IRR 0.72, 95% CrI 0.57–0.93, posterior probability 99%), MME/day (IRR 0.76, 95% CrI 0.65–0.90, posterior probability 99%), and domain-specific total MME (Table). No difference in average normalized pain scores was seen. The Pre group were hospitalized longer than the Post group (5 days [2, 14] versus 4 days [1, 9], p=0.012).

Conclusions: Implementation of opioid-minimizing protocols for acute burn pain were associated with a significant reduction in inpatient opioid exposure without increased pain scores. More information is needed to understand the association with reduced hospital days.
Introduction: The critical care, surgery, and rehabilitation required to recover patients with serious burn injuries are associated with high financial costs. In the US, these costs are often borne by patients. However, the relationship between pre-injury finances (personal income and payer) and health-related quality of life (HRQL) of burn survivors has not been reported. We hypothesized that lower income and public payers would be independent predictors of poorer HRQL.

Methods: Burn survivors with complete data for pre-injury personal income and payer were extracted from the NIDILRR Burn Model System National Database. HRQL outcomes included VA-Rand 12 (VR-12) scores at 6-, 12-, and 24-months post-injury. VR-12 scores were evaluated using generalized linear models and adjusted for potential confounders (age, gender, self-identified race, measures of burn injury severity). Model performance was assessed with Akaike Information Coefficient.

Results: 453 burn survivors had complete data for income and payer status. 36.4% earned less than $25k/year, 24% earned $25k-49k/year, 23% earned $50k-99k/year, 10% earned $100k-149k/year, 3% earned $150k-199k/year, and 3% earned ≥ $200k/year. Mental component summary (MCS) and physical component summary (PCS) scores were highest for those who earned $150-199k/year (55.8, 55.8), and lowest for those who earned < $25k/year (49.0, 46.4). There was a negative relationship between income < $25k/year and MCS scores at 6-, 12-, and 24-months post-injury (p< 0.05). This relationship was not observed with PCS scores. After adjusting for demographics, payer, and burn severity, 24-month PCS scores were negatively associated with Medicare payer (p=0.025), black race (p=0.008) and number of operations during index admission (p=0.026). There were no significant associations with MCS scores.

Conclusions: HRQL was highest for burn survivors earning between $150-199k/year. Participants who earned < $25k/year had the lowest VR-12 scores and particularly MCS scores. On multivariable analysis, most of the differences in HRQL associated with pre-injury income were explained by differences in demographic, payer and burn severity factors.
Burn Survivors Can Perform Mild/moderate-intensity Exercise in Thermoneutral Conditions Without a Risk of Excessive Elevations in Core Body Temperature

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Introduction: Burned skin excision and subsequent grafting removes sweat glands, which impairs thermoregulation. Consequently, exercise prescribed for rehabilitation may expose individuals with burn injuries to a greater risk of hyperthermia, depending on exercise duration, intensity, and environmental temperature. Little is known regarding the risk of hyperthermia in adult burn survivors performing mild/moderate-intensity exercise under thermoneutral environmental conditions, i.e. conditions similar to the rehabilitation clinic and/or the gym. This project tested the hypothesis that burn survivors, across a wide range of percent total body surface area (%TBSA) burned, can participate in mild/moderate-intensity exercise in a thermoneutral environment without excessive elevations in core body temperature.

Methods: Twenty-eight well-healed burn survivors with low (23±5%TBSA; N=10), moderate (42±7%TBSA; N=9), and high (60±8%TBSA; N=9) sized burn injuries performed 60 minutes of cycle ergometry exercise (72±15 Watts, oxygen uptake rate of 1.25±0.21 L/min equivalent to 4.5±0.2 METs) in a 25°C and 23% relative humidity environment. Absolute gastrointestinal temperatures (Tcore) and changes in gastrointestinal temperatures (ΔTcore) were obtained at 15-minute increments throughout the exercise bout. A participant with an absolute Tcore of greater than 38.5°C, and/or a ΔTcore of >1.5°C, at any time point during the trial was categorized as being at risk for hyperthermia.

Results: Sixty minutes of exercise increased Tcore in all groups (Low: 0.72±0.21°C; Moderate: 0.42±0.22°C; High: 0.77±0.25°C, all P< 0.01 from pre-exercise baseline), resulting in similar absolute Tcore values of upon exercise termination (Low: 37.87±0.24°C; Moderate: 37.56±0.34°C; High: 37.76±0.47°C, P=0.19). Importantly, no participant was categorized as being at risk for hyperthermia, based upon the aforementioned criteria.

Conclusions: These data indicate that individuals with substantial %TBSA burned can exercise at a mild/moderate intensity for 60 minutes in thermoneutral environmental conditions without a risk of excessive elevations in body core temperature.

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Introduction: Pediatric burn injuries can alter the trajectory of the survivor’s entire life. Patient-centered outcome measures are helpful to capture and assess their unique physical and psychosocial needs and long-term recovery. This study aimed to develop a conceptual model framework to measure outcomes most important to pediatric burn survivors aged 5 to 12 years as a part of the SA-LIBRE 5-12, Computer Adaptive Test (CAT) development.

Methods: This study used a systematic literature review guided by the WHO International Classification of Functioning – Child and Youth. Previously established domains in the American Burn Association/Shriners Hospitals for Children Burn Outcomes Questionnaire,1-18 further guided framework development. Individual interviews with parents and clinicians were conducted to obtain perspectives on domains most important to assess following a burn injury in children aged 5 to 12 years. One clinician focus group was completed to identify gaps in the preliminary framework, and semi-weekly expert consensus meetings were conducted to solidify the framework. Qualitative data were analyzed by grounded theory methodology in NVivo 12 software.

Results: The literature review identified 82 articles. Eight parents and seven clinicians participated in individual interviews, four clinicians participated in one focus group, and three consultants were included in the expert consensus meetings. The consultants included a burn surgeon, psychiatrist, and health services researcher. Three major domains emerged from the grounded theory approach, including: 1) Physical Functioning: fine motor and upper extremity, gross motor and lower extremity, pain, skin sensitivity, sleep and fatigue, and physical resilience; 2) Psychological Functioning: cognitive, behavioral, emotional, resilience, and body image; and 3) Family and Social Functioning: school, peer relations, community participation, family relationships, and parental satisfaction.

Conclusions: The comprehensive literature review, clinician and parent individual interviews, clinician focus group, and expert consensus meetings resulted in a conceptual model framework for parent-reported health outcomes after a burn injury in school-aged children aged 5 to 12 years. The framework will be used to develop item banks for a CAT-based assessment of school-aged children’s health and developmental outcomes.
Rates of Follow up After Burn Injury Are Disturbingly Low and Linked with Social Factors

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Introduction: Due to risks of scarring and difficulties with re-socialization, it is important that burn patients attend follow up appointments to minimize adverse sequelae. Studies in trauma and emergency medicine have shown a correlation between reduced follow up and low socioeconomic status. Our goal was to examine the factors leading to missed follow up appointments in the burn center population.

Methods: Following IRB approval, a retrospective chart review was conducted using electronic medical records of all adult patients admitted to the burn center from 2016–2018. Data collected included information on burn injury, social status, substance use, and zip code demographics. Exclusions included patients with non-burn injuries, who died in the hospital, who were transferred to another hospital, who did not have any scheduled outpatient follow up, who had insurance which precluded follow up at our institution, and prisoners. Data analysis was conducted using chi-square, t-test, linear, and logistic regression models.

Results: A total of 878 patients (mean age 45.1 ± 16.8 years, 646 males (73.6%), mean burn size (TBSA) 10.16±11.7%) were analyzed. In our population, 96 (10.93%) patients were homeless, 284 (32.35%) had drug dependence, 128 (14.58%) had alcoholism, and the mean poverty level was 17.7±8.34%. Of those analyzed, 224 (25.5%) failed to attend any follow up appointments and 492 (56.0%) had at least one missed appointment. Patients who did not attend any follow up appointments had smaller burns (8.2±9.5% vs. 10.8±12.3%), traveled farther (91.8±101.1 miles vs. 69.0±68.7 miles), were more likely to be homeless (22.8% vs. 6.9%) and to have drug dependence (47.3% vs. 27.2%). Patients who missed at least one appointment were younger (43.8±16.1vs. 46.8±17.4 years), more likely to be homeless (17.5% vs. 2.6%) and have drug dependence (42.5% vs. 19.4%). On multivariate analysis, factors associated with never returning to clinic were: Distance from hospital (odds ratio (OR) 1.004, p=0.0001), TBSA (OR 0.96, p= 0.0001), Drug Dependence (OR 0.49, p< 0.0001), and Homelessness (OR 0.31, p< 0.0001). Factors associated with missing at least one appointment were: Age (OR 0.99 p< 0.03), Drug Dependence (OR 0.51, p< 0.0001), Homelessness (OR 0.20, p< 0.0001), and ED visits (OR 0.57, p< 0.05).

Conclusions: In our population, a high percentage of patients fail to make any appointment following their injury and an even higher number miss at least one appointment. The factors that influence failure to return and missing at least one appointment are similar but not exactly the same. Both follow up and missed appointments are influenced by social determinants of health.

Development of School-Aged Life Impact Burn Recovery Evaluation (SA-LIBRE 5–12) Profile: Item Pool

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Introduction: The transition from early childhood to teen years (5–12) is a critical time of development, which can be made particularly challenging by a burn injury. Currently, few validated standardized measures exist for this age group. This study aimed to generate item pools to create a computer adaptive test (CAT) assessing post-burn recovery in school-aged children.

Methods: Item pool development was based on the School-Aged Life Impact Burn Recovery Evaluation (SA-LIBRE<sub>5–12</sub>) Conceptual Model and the World Health Organization’s International Classification of Functioning, Disability, and Health for Children and Youth. Additional elements included a literature review, expert consensus meetings, and parent cognitive interviews. Candidate items assessing health outcomes were extracted from existing legacy measures during the literature review. Details of expert consensus meetings and parent cognitive interviews are in Table 1.

Results: Items assessing health outcomes (n=3,732) were extracted during the literature review. Experts binned items across three domains: 1) Physical Functioning (55 items), 2) Psychological Functioning (80 items), and 3) Family and Social Functioning (57 items). Six cognitive interviews were conducted. Qualitative data resulted in further review of 86 items. The results of the cognitive interviews indicated that item stems and response choices were interpretable by respondents.

Conclusions: This study developed an item pool (n=192) to assess post-burn recovery of school-aged children. The next step in the SA-LIBRE<sub>5–12</sub> CAT Profile development will be field-testing for the calibration and item response theory-based validation of the assessment.
Validation of PROMIS-29 Among Adult Burn Survivors

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Introduction: Patient-reported outcomes are important for burn injury research and clinical practice. The PROMIS-29 profile has been validated for use in diverse populations and numerous conditions, though not among people living with burn injuries. The purpose of this study was to examine validity and reliability of PROMIS-29 scores in adults with burn injury.

Methods: Data were provided by adult burn survivors participating in a multi-center longitudinal study of outcomes after burn injury. The PROMIS-29 Profile, which includes 4 items for each domain of physical function, anxiety, depression, fatigue, sleep disturbance, ability to participate in social roles, and pain interference, was evaluated for validity and reliability. Floor and ceiling effects, unidimensionality, internal consistency, and reliability were examined. Differential item functioning (DIF) with respect to age, sex, education, race, ethnicity and burn size was assessed using ordinal logistic regression models and McFadden's pseudo $R^2$-change of ≥2% as critical value. Correlations with other measures (Community Integration Questionnaire, Satisfaction with Life Scale, Post-Traumatic Stress Checklist-Civilian, and Veteran's Rand-12) and known group differences were examined to assess validity.

Results: 876 burn survivors with moderate to severe injury from 6 months-20 years post burn provided responses on PROMIS-29 domains. Participant ages ranged from 18–93 years at time of assessment; mean years since injury was 3.4. All PROMIS-29 domains showed high internal consistency (Cronbach’s $\alpha=0.87–0.97$). Substantial portions of the sample reported no symptoms (anxiety [42.6%], depression [50.9%], fatigue [26.3%], pain [47.7%]). There was a large ceiling effect on social roles (39.7%) and physical function (43.3%). One-factor confirmatory factor analyses supported unidimensionality for all domains (all CFI >0.95). We found no bias (DIF) across any demographic or clinical groups. Reliability was high (>0.9) across trait levels for all domains except sleep, which reached moderate reliability (>0.85). Known-group differences by demographic and clinical characteristics performed as hypothesized except burn size categories, which showed no significant relationship with PROMIS-29 physical function, fatigue, and pain interference scores.

Conclusions: The results provide strong evidence of reliability and validity of PROMIS-29 scores among adult burn survivors. Reliability of the extreme scores can potentially be increased and the ceiling effects reduced by administering PROMIS-43, which includes 6 items per domain.
Examining ‘Return to Productivity’ Among People Living with Burn Injury: A Burn Model System National Database Report

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Introduction: Burn injuries can be life-altering events that involve intensive healthcare, changes in body image, psychological stress and financial toxicity. Burn survivors frequently experience numerous and varied barriers to returning to work. For those who return to work, little is known regarding whether they achieve pre-injury productivity (i.e., equivalent work output and/or pay). Understanding return to productivity and patients at risk of not achieving pre-injury productivity is important for targeting services that support this population and their families.

Methods: Burn survivors with complete occupational and personal income data through 24 months post-injury were extracted from the NIDILRR Burn Model System National Database. Participant annual income was reported in six groups: < $25k, $25k-50k, $50k-99k, $100k-149k, $150k-199k, $>199k. Participants were classified by their change in income at each follow up (i.e., gain, loss, equivalent). Explanatory variables of interest included demographics, payer, job type, and injury characteristics. Logistic regression modeled return to productivity (i.e., equivalent or gain in income compared to pre-injury status) at each follow up interval.

Results: Data from 402 participants were analyzed. At 6-, 12-, and 24-months post-injury, 77%, 79%, and 71% of participants reported equivalent or gain in income, respectively. Physical and labor-based jobs were reported by 60% of participants who had return to productivity versus 63% of those who lost income. Demographics, payer, and job type were not significantly associated with differences in return to productivity. Mean %TBSA burn size was 17.4% in those who returned to productivity versus 26.1% among those who did not. Burn size ≥50% TBSA was the only predictor of decreased likelihood for return to productivity (OR 0.24, 95%CI 0.06–0.90). Post hoc comparison to participants who did not have complete financial data demonstrated that participants with complete data were significantly more likely to be older, white, have smaller burns, and carry private insurance.

Conclusions: Most burn survivors returned to pre-injury productivity by 24-months after injury regardless of demographics, job type, and payer status. Burn survivors who experienced ≥50% TBSA burns were much more likely to not return to pre-injury productivity.
Introduction: Post-discharge services, such as outpatient wound care, may affect long-term health outcomes and post-recovery quality of life. Access to these services may vary according to insurance status and ability to withstand out-of-pocket expenses. Our objective was to compare discharge location between burn patients who were uninsured, publicly insured, or privately insured at the time of their burn unit admissions. We hypothesized that uninsured patients were more likely to be discharged to locations with fewer wound care resources.

Methods: A retrospective review from July 1, 2015 to November 1, 2019 was performed at an ABA-verified burn center. All inpatient burn admission patients were identified and categorized according to insurance payer type. Patient and burn characteristics were recorded. The primary outcome was discharge location, and secondary outcomes included readmission and outpatient burn care attendance.

Results: In total, 284 uninsured, 565 publicly insured and 293 privately insured patients were identified. There were no significant differences in TBSA (P=0.3), presence of full thickness burn (P=0.3), inhalation injury (P=0.3), ICU days (P=0.09), ventilator days (P=0.2), or need for grafting (P=0.1). Uninsured patients were found to be younger (P<0.0001) and more likely to be male (P=0.03). For primary outcome, uninsured patients were more likely to be discharged without ancillary services (self-care) (80.3% vs. 66.7% vs. 66.9%, P< 0.0001). Publicly insured patients were more likely to receive skilled nursing care (1.1% vs. 6.6% vs. 2.4%, P=0.0007). Privately insured patients were more likely to receive homecare (3.2% vs. 5.8% vs. 10.9%, P=0.0005) or transfer to other institutions for ongoing inpatient care (2.5% vs. 5.1% vs. 11.6%, P< 0.0001). For secondary outcomes, there was no difference in burn unit readmission (P=0.5) while uninsured were more likely to follow up in the same institution's outpatient burn clinic after discharge (82.4% vs. 72.0% vs. 75.4%, P=0.004).

Conclusions: Despite no differences in burn injury severity, uninsured patients were less likely to receive post-discharge resources. However, these patients were younger, which may partially explain their disproportionate discharge to self-care. Nevertheless, insured patients have greater access to non-emergent medical resources and a broader range of treatment options. Although there were no significant differences in hospital readmission, the long-term implication to differential post-discharge care is unknown. Additional studies are needed to better elucidate if discrepancies in long-term wound healing or perceived quality of life amongst these populations exist.
Introduction: Variant single nucleotide polymorphisms (SNPs) in the catechol-O-methyl transferase (COMT) gene have previously been associated with pain thresholds, resilience, and cognitive functioning. Known colloquially as the “warrior/worrier” gene, the GG variant is associated with higher resilience whereas the AA variant is associated with lower resilience. The aim of this study is to demonstrate the feasibility of correlating a genomic data repository with multicenter national longitudinal burn data.

Methods: From August 2018 to July 2020, participant cheek swabs were collected in-person or by mail at three burn centers and sent to the lead center for DNA isolation and storage. COMT SNPs were determined by polymerase chain reaction (PCR). SNP data were merged with a multicenter burn database. Outcomes of interest included the Patient-Reported Outcomes Measurement Information System (PROMIS-29), Community Integration Questionnaire (CIQ), Veterans RAND 12 (VR-12) physical (PCS) and mental component summary (MCS) scores, posttraumatic stress disorder (PTSD) measure, and Posttraumatic Growth Inventory (PTGI). Follow-up data were obtained at 6 months post-discharge. We used a Kruskal-Wallis test to determine associations between COMT SNPs and outcomes.

Results: Of the 126 cheek swabs obtained, DNA was successfully isolated from 124 swabs, and PCR SNP analysis was successful for 111 swabs. The distribution of COMT SNPs in our study population was consistent with the general population. Kruskal-Wallis analysis revealed no association between COMT SNPs and patient outcomes. Median PTGI scores trended toward significance, but in the opposite direction than predicted for COMT genotypes.

Conclusions: A national longitudinal database can be feasibly supplemented by a genomic data repository. Variation in the COMT gene did not correlate with health-related quality of life measures examined in a small cohort of burn survivors. Lack of statistical significance can be attributed to small sample size.
Impact of Methadone Initiation in Intubated Burn Patients: A Retrospective Review

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Introduction: Methadone can be used to wean opiates and reduce length of mechanical ventilation (MV) in critical care and burn patients. The objective of this study was to assess the impact of methadone use on ventilator-free days and clinical outcomes in burned patients requiring MV.

Methods: This was a retrospective study of adult patients admitted to a burn center for initial management of burn injuries who required MV for at least 48 hours between September 2013 and November 2019. Patients were excluded from the study if they had prior methadone use, total body surface area (TBSA) of less than 5%, or expired within the first 28 days of admission. The primary endpoint was the difference in ventilator-free days among those who received methadone compared to those who did not. Secondary endpoints include length of stay, mortality, sedative agent and average daily dose, analgesic agent and average daily dose, and incidence of delirium. Baseline demographics were compared using descriptive statistics. Nominal data was compared using Chi-square test. Continuous data was analyzed using student's t-test or Mann-Whitney U test, as appropriate. Multivariate regression was used to identify variables for possible association with MV duration.

Results: A total of 83 patients were included in the study; 52 received methadone and 31 were controls. Patients were generally well-matched between groups, however patients receiving methadone were younger (45.3 vs 56.2 years, p = 0.002) and had a larger TBSA (30.4 vs 19.1%, p = 0.001). Patients who received methadone had fewer ventilator free days of the first 28 (9.5 vs 15.0 days, p = 0.009) and a longer ICU stay (57.2 vs 35.8 days, p = 0.025). There was no difference between groups in terms of mortality, reintubations, and incidence of delirium. Patients who received methadone had longer duration of analgesia (20.7 vs 12.0 days, p = 0.011) and sedation (19.0 vs 12.4 days, p = 0.026) while on MV.

Conclusions: This study found that methadone use contributed to fewer ventilator-free days and longer ICU stays, which was unexpected but worth discussing. There are several limitations to this study. This study occurred during a time period in which the pain management and sedation strategies of this burn unit were evolving, and strategies may not have been consistent between providers. The study included a small sample size and baseline demographics demonstrated significant differences in age and TBSA between the two groups. Additionally, pain scores were not collected as part of this study, which would have provided better insight into the effectiveness of pain management. The use of methadone as an adjunct for pain control remains undetermined.

A Multi-center Study Analyzing Association of Vitamin D Deficiency and Replacement with Infectious Outcomes in Patients with Burn Injuries

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Introduction: Vitamin D (25OHD) deficiency has been associated with poor outcomes in intensive care populations. A recent single-center, burn study found a high incidence of 25OHD deficiency. A difference was noted in infectious complications, but was underpowered. The primary objective of this multi-center study was to determine if 25OHD deficiency is associated with infectious outcomes in adult burn patients.

Methods: Adult patients were eligible for inclusion in this 7 center, retrospective study if admitted January 1, 2016 - July 25, 2019 and had a 25OHD concentration drawn within the first 7 days of admission. Patients were excluded if admitted for a non-burn injury, had total body surface area (TBSA) burned of less than 5%, a readmission, pregnant, incarcerated, or made comfort care or expired within 48 hours of admission. Expecting a 3:1 enrollment, goal was at least 250 total patients to be appropriately powered (β = 0.2; α = 0.05) to detect a 33% difference in composite infectious outcome (bacteremia, pneumonia, urinary tract infection, wound infection, graft loss, or death) between patients with 25OHD deficiency (< 20 ng/mL) and control (≥ 20 ng/mL).

Generalized linear mixed modelling was used to control for center effect, % TBSA, age, and presence of inhalation injury and find the most predictive model.

Results: A total of 1147 patients were initially included. After exclusions, 234 (56.8%) in the deficient and 178 in the control group remained. Patients in the control group had their concentration drawn earlier (p < 0.001), were more likely to be male (p = 0.006), Caucasian (p < 0.001), lower body mass index (p = 0.009), lower % TBSA burn (p = 0.002), and taking a 25OHD supplement prior to admission (p < 0.001). Deficient patients were more likely to have an infectious outcome (52.1% vs 36.0%, p = 0.002), acute kidney injury requiring renal replacement therapy (p = 0.009), less ventilator free days in the first 28 days (p < 0.001), and more days requiring vasopressors (p = 0.008). After controlling for center, % TBSA, age, and inhalation injury the best model also included presence of deficiency (odds ratio = 2.425 [1.035 - 1.252]), days until 25OHD supplement initiation (1.139 [1.035 - 1.252]), and choice of cholecalciferol over ergocalciferol 2.112 [1.151 - 3.877]).
Conclusions: Dilution concerns were controlled by including %TBSA in the regression model. Even if low 25OHD concentrations were an acute reaction to burn injury and not representative of true deficiency, low concentrations and delay in supplementation were independently associated with increased risk of an infectious outcome.

Introduction: In burn patients, vitamin D deficiency has been associated with increased incidence of sepsis. The objective of this study was to assess the impact of vitamin D deficiency in adult burn patients on hospital length of stay (LOS).

Methods: This was a multi-center retrospective study of adult patients at 7 burn centers admitted between January 1, 2016 and July 25, 2019 who had a 25-hydroxyvitamin D (25OHD) concentration drawn within the first 7 days of injury. Patients were excluded if admitted for a non-burn injury, total body surface area (TBSA) burn less than 5%, pregnant, incarcerated, or made comfort care or expired within 48 hours of admission. The primary endpoint was to compare hospital LOS between burn patients with vitamin D deficiency (defined as 25OHD < 20 ng/mL) and sufficiency (25OHD ≥ 20 ng/mL). Secondary endpoints include in-hospital mortality, ventilator-free days of the first 28, renal replacement therapy (RRT), length of ICU stay, and days requiring vasopressors. Additional data collected included demographics, Charlson Comorbidity Index, injury characteristics, form of vitamin D received (ergocalciferol or cholecalciferol) and dosing during admission, timing of vitamin D initiation, and form of nutrition provided. Dichotomous variables were compared via Chi-square test. Continuous data were compared via student t-test or Mann-Whitney U test. Univariable linear regression was utilized to identify variables associated with LOS (p < 0.05) to analyze further. Cox Proportional Hazard Model was utilized to analyze association with LOS, while censoring for death, and controlling for TBSA, age, presence of inhalation injury, and potential for a center effect.

Results: Of 1,147 patients screened, 412 were included. Fifty-seven percent were vitamin D deficient. Patients with vitamin D deficiency had longer LOS (18.0 vs 12.0 days, p < 0.001), acute kidney injury (AKI) requiring RRT (7.3 vs 1.7%, p = 0.009), more days requiring vasopressors (mean 1.24 vs 0.58 days, p = 0.008), and fewer ventilator free days of the first 28 days (mean 22.9 vs 25.1, p < 0.001). Univariable analysis identified burn center, AKI, TBSA, inhalation injury, admission concentration, days until concentration drawn, days until initiating supplementation, and dose as significantly associated with LOS. After controlling for center,
TBSA, age, and inhalation injury, the best fit model included only deficiency and days until vitamin D initiation. 

Conclusions: Patients with thermal injuries and vitamin D deficiency on admission have increased length of stay and worsened clinical outcomes as compared to patients with sufficient vitamin D concentrations.


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Introduction: Acute respiratory distress syndrome (ARDS) remains a formidable sequela, complication, and mortality risk in patients with large burns with or without inhalation injury. Alveolar recruitment using higher positive end expiratory Pressures (PEEP) after the onset of ARDS has been tried with varying success. Subsequent studies have identified benefits for several rescue maneuvers in ARDS patients with refractory hypoxemia. A preventive strategy utilizing an early recruitment maneuver, however, has not, to our knowledge, been explored in ventilated burn patients. The purpose of this study was to evaluate the natural progression and clinical outcomes of ARDS severity (mild, moderate, and severe) using Berlin criteria in ventilated burn patients treated with an early high-PEEP ventilator strategy.

Methods: A single-center retrospective review of burn patients who were mechanically ventilated for more than 48 hours utilizing an early high-PEEP ventilator strategy was performed at our Level 1 trauma and regional burn center. ARDS severity was defined according to the Berlin criteria. Demographic data, as well as respiratory and clinical outcomes were evaluated.

Results: Eighty-three patients met inclusion criteria and were analyzed. According to the Berlin definition, 42.1% of patients met ARDS criteria on admission and nearly all patients (85.5%) developed ARDS within the first seven days: 28 (34%) mild, 32 (38.6%) moderate, and 11 (13.3%) severe ARDS. The mean percent total body surface area (%TBSA) was 24.6 ± 22.1, with 68.7% of patients diagnosed with inhalation injury. The highest incidence of ARDS was 57.8% on day 2 of admission. Most cases remained in the mild to moderate ARDS category with severe ARDS (2.4%) being less common by hospital day 7. Overall, 30-day in-hospital and inhalation injury mortality rates were 9.6% and 15.8%, respectively. No correlation was observed between plateau pressures (22.8), mean arterial pressures (84.4), or vasopressor requirements; and oxygen requirements down trended quickly over the first 24–48 hours.

Conclusions: In our study, prophylactic, immediate, high-PEEP in mechanically ventilated burn patients was associated with trends toward decreased severity and more rapid resolution of ARDS in the first week following burn injury. This correlated with lower 30-day in-hospital mortality in this population. This
Utilization of a Burn Sepsis Algorithm: A Five-Year Analysis
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Introduction: After the first 24 hours, the major cause of death in burn patients is multiple organ dysfunction/failure syndrome. It is preceded by an infection in 83% of burn patients, with reported septic mortality up to 65%. Since the early recognition and treatment of infection has been shown to decrease mortality from sepsis, we implemented a multidisciplinary algorithm designed to rapidly identify septic adult burn patients.

Methods: Adult (≥18 y) admissions between 7/1/2014 – 6/30/2019 were identified from our registry, and all initial sepsis screens were evaluated in the EMR. Patients were screened clinically at least twice daily and were considered a “positive” screen if MAP < 65 mmHg (SBP< 90 mmHg) or if 2 of the 3 occurred: Temp >102.2F; HR >120; RR >28 (or RR >+10% of ventilator set rate if set rate is >24 bpm). A positive screen prompted lab work to include CBC, BMP, procalcitonin (PCT), and lactic acid (LA), per protocol. If PCT >3.0 ng/ml or LA >2.0 mmol/L, or both thrombocytopenia and hyperglycemia were present, a “Burn Code Sepsis” was initiated and included cultures, a CXR, and empiric antibiotics. A patient was then formally considered “septic” (i.e. infected) if the cultures were positive or the CXR demonstrated an infectious process.

Results: There were 1,523 admissions during the 5-year period, and 228 initial positive screens. Of the 228 patients with positive screens, 159 (70%) were infected. There was a significant difference in PCT level between patients with and without infections, while no difference was noted for LA, WBC, platelets, temperature, glucose, age, %TBSA burned, or time to triggering a positive screen between the groups (Table). Defining PCT ≥3.0 ng/mL as being positive for sepsis demonstrated a 76% PPV and a 36% NPV for PCT alone. Our initial sepsis screening algorithm had a sensitivity of 64.8% and a specificity of 40.6% over the five-year period.

Conclusions: Recognition of sepsis remains difficult in burn patients. PCT and the use of a sepsis screening algorithm may have a role in the early detection of sepsis. Further research is warranted.

<table>
<thead>
<tr>
<th>Screen Positive</th>
<th>Overall (N = 228)</th>
<th>No Infection (N = 159)</th>
<th>Infection (N = 69)</th>
<th>P Value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean SD)</td>
<td>40.8 ± 15.1</td>
<td>47.9 ± 17.5</td>
<td>33.7 ± 15.3</td>
<td>0.03</td>
</tr>
<tr>
<td>Days to screening (median count IQR)</td>
<td>13(17,20)</td>
<td>12(12,18)</td>
<td>14(7,23)</td>
<td>0.06</td>
</tr>
<tr>
<td>Percent TBSA burned (mean SD)</td>
<td>34.7 ± 20.7</td>
<td>31.0 ± 18.0</td>
<td>35.6 ± 21.4</td>
<td>0.18</td>
</tr>
<tr>
<td>Lactic Acid (mean SD)</td>
<td>2.1 ± 1.2</td>
<td>1.9 ± 0.9</td>
<td>2.1 ± 1.3</td>
<td>0.17</td>
</tr>
<tr>
<td>Procalcitonin (mean SD)</td>
<td>13.9 ± 64.4</td>
<td>7.3 ± 12.2</td>
<td>16.5 ± 34.9</td>
<td>0.03</td>
</tr>
<tr>
<td>White Blood Cells (mean SD)</td>
<td>13.2 ± 7.5</td>
<td>12.8 ± 7.2</td>
<td>13.4 ± 7.5</td>
<td>0.04</td>
</tr>
<tr>
<td>Temperature (mean SD)</td>
<td>102.9 ± 2.7</td>
<td>102.7 ± 2.0</td>
<td>103.5 ± 2.9</td>
<td>0.05</td>
</tr>
<tr>
<td>Blood Glucose (mean SD)</td>
<td>140 ± 58.7</td>
<td>144 ± 41.0</td>
<td>148 ± 64.6</td>
<td>0.66</td>
</tr>
</tbody>
</table>

* p values are for comparisons between positive screen groups and are based on two-sample t-test

Use of Airway Pressure Relief Ventilation (APRV) in Burn Patients With and Without Inhalation Injury
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Introduction: Burn patients often require ventilator management because of large % TBSA injury, the presence of inhalation injury, and/or other factors. Airway pressure relief ventilation (APRV) offers several advantages over conventional ventilation modes including improved alveolar recruitment, better oxygenation and hemodynamics, preservation of spontaneous breathing, and possibly less ventilator-induced lung injury. This study reviews the use of APRV as the primary ventilator mode in burn patients with and without inhalation injury.

Methods: A retrospective chart review of patients admitted to the burn center and requiring APRV ventilation over a ten-year period was performed. Data collected included demographic data, burn injury data, ventilator settings, arterial blood gas data, and development of ventilator-associated pneumonia (VAP).

Results: There were 411 patients identified over the ten-year period. Mean age was 46 years, and mean % TBSA burned was 33. Seventy-three percent were male. One-half (51%) of patients had an inhalation injury. Mean hospital length of stay was 32 days with 22 mean ventilator days. Average number of surgeries was 4.4 per patient. Mean high pressure (P high) was 23 mm Hg, Mean FiO2 was 88% on post-injury day (PID) 1, 65% on day PID 2, and 45% thereafter. Mean P/F ratio was 333. Mean pH was 7.40, mean pCO2 was 40 mmHg, and mean HCO3 was 25 mm Hg. Forty-six percent of patients met criteria for diagnosis of VAP.

Conclusions: These data demonstrate that burn patients requiring mechanical ventilation can be safely and effectively managed with APRV. Oxygenation, carbon dioxide removal, normal acid-base status, and excellent P/F ratios were maintained with relatively low ventilator settings such as peak airway pressure and FiO2. Patients were able to breathe spontaneously when able and were easily liberated from the ventilator at the appropriate time.
Introduction: Bioelectric Impedance Analysis (BIA) is a rapid, non-invasive, and inexpensive technology based on electrical conductivity. BIA assesses body composition, fluid shifts, and phase angle, an electrical force vector where smaller values suggest cellular injury. Our objective was to use BIA to longitudinally track the clinical status of burn patients. We hypothesized that BIA would detect progressive decreases in muscle mass throughout the patient’s hospital course and that low phase angle values would correlate with severity of injury.

Methods: A cohort study of 10 patients from January 1, 2020 to March 13, 2020 was performed at an ABA-verified burn center. Patient and burn characteristics and laboratory data were collected. BIA measurements were performed daily for the first 10 days of admission and then twice weekly until discharge. The primary outcome was to detect changes in body composition. The secondary objectives were to detect differences between low and high-risk patients in terms of water composition and phase angle. Patients with APACHE II > 15, measured at burn unit admission, were considered high risk for burn injury related morbidity and mortality.

Results: BIA detected a statistically significant negative correlation between time spent hospitalized and leg lean mass (LM) (r²=0.56, P < 0.0001), right arm LM (r²=0.52, P < 0.0001) and left leg LM (r²=0.57, P < 0.0001), and positive correlation between body fat mass (BFM) and time spent hospitalized (r²=0.50, P < 0.0004). Water composition (volume of extracellular water (ECW) per total body water (TBW)) negatively correlated with low-risk patients: right arm (r²=0.51, P < 0.0001), left arm (0.71, P < 0.001), thorax (0.66, P < 0.0001), right leg (0.74, P < 0.0001), left leg (0.35, P=0.002). Full body phase angle increased with low-risk patients over their hospital course (r²=0.62, P < 0.0001), while phase angle decreased with high-risk patients (r²=0.71, P=0.0006). Full body phase angle differentiated high risk patients (P < 0.0001), and phase angle of thorax differentiated between patients with and without inhalation injury (P=0.0002).

Conclusions: Our study demonstrates that BIA measures changes in body composition and fluid shifts, identifies inhalation injury, and correlates with severity of injury in hospitalized burn patients. This pilot study included a limited number of participants with varying anatomic injuries presenting unique measurement challenges. Regardless, our preliminary data justifies a larger prospective study to confirm these results and correlate them with clinical outcomes.

Sustained Low Efficiency Dialysis (SLED) in Burn Patients with Acute Kidney Injury

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Introduction: Acute Kidney Injury (AKI) is common among patients with major burns and may require treatment with renal replacement therapy (RRT). Although continuous renal replacement therapy (CRRT) modalities are widely used and offer many advantages over traditional intermittent hemodialysis (IHD), CRRT is expensive, labour-intensive, and may not be available in some burn centers. Sustained Low Efficiency Dialysis (SLED) is a moderately efficient alternative to IHD, but its use in burn patients with AKI has not been described. The purpose of this study was to review our experience with SLED.

Methods: Retrospective review of adult burn patients with AKI treated by SLED between 07/2013 and 03/2020 at an adult regional ABA-verified burn center. Data was obtained from the electronic medical record including daily dialysis forms completed by the nephrology service. Values are shown as mean +/- SD or median (IQR) as appropriate.

Results: We evaluated 367 distinct SLED sessions provided to 33 patients [age 55.8 +/- 14 yrs., %TBSA burn 33 +/-19, % TBSA full thickness burn 10.5 (0, 35.8), and 54.5% with inhalation injury]. The serum creatinine (sCr) prior to the start of SLED was 2.96 (2.3, 4.17) mg/dL. SLED was initiated 5 (3, 10.8) days (range 0–24 d) post burn, and 7 (3.3, 12.8) sessions (range 1–44) with a duration of 4 (4.6) hours each were given per patient. Heparinization was required in 22 sessions (6%), and 46 sessions (12.5%) were aborted, most commonly due to clotting of the lines or circuit, and rarely (4%) due to hypotension. The net ultrafiltrate removal was 1.2 (0.7–2) L, with a dialysate flow rate of 350 (350, 500) mL/min. Among 208 sessions where patients were not on vasopressors (VPs) Pre-SLED, one or more VPs were required in 19 sessions (9%) during or at the termination of SLED. Among 116 sessions where patients were receiving norepinephrine (NEpI) infusions pre-SLED, the NEpI dose dropped from 7.3 +/- 4.2 gm/min to 6 +/- 4.5 gm/min (p=0.03). Pre and Post SLED values for blood pressure, creatinine, and potassium are shown in the table. The mortality rate was 36.4%, hospital length of stay was 42 (20.5, 61.5) days, and among surviving patients, 2 (9.5%) required dialysis post discharge.

Conclusions: SLED was effective and well tolerated. Hemodynamic instability was infrequently encountered.

<table>
<thead>
<tr>
<th>Systolic BP (mmHg)</th>
<th>Mean Arterial pressure (mmHg)</th>
<th>Creatinine (mg/dL)</th>
<th>Potassium (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre SLED</td>
<td>116 (105, 131)</td>
<td>74 (59, 91.8)</td>
<td>3.29 (2.38, 4.48)</td>
</tr>
<tr>
<td>Post SLED</td>
<td>122 (111, 137)</td>
<td>83 (56, 92)</td>
<td>3.88 (1.88, 3.69)</td>
</tr>
<tr>
<td>p value: pre vs post</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
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</table>

American Burn Association 53rd Annual Meeting
Long-Term Pulmonary Sequelae After Inhalation Injury: A Retrospective Cohort Study

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Introduction: Inhalation injury (INHI) has strong associations with increased rates of in-patient mortality and pneumonia. Data describing long-term health outcomes after inhalation injury are scarce and the true sequelae are largely unknown. The aim of the study is to review long-term pulmonary outcomes in inhalation injury patients. We hypothesize that INHI patients are at greater risk of developing long-term pulmonary sequelae.

Methods: We present a retrospective case-control of burn patients admitted to an ABA certified facility. We included burn patients with or without medically confirmed INHI who were admitted between 06/2016 to 11/2019 and were part of the regional Department of Health Services (DHS) system. The experimental group was patients with bronchoscopy confirmed INHI. The control groups were ventilated patients with confirmed non-inhalation injury (V) and non-ventilated patients with confirmed non-inhalation injury (NV). These were matched for age, TBSA, sex, previous comorbid pulmonary disease, and smoking status. Primary study outcomes were rates of post-discharge pulmonary sequelae, including ineffective airway clearance, infections, shortness of breath, and malignancy. Secondary outcomes included rates of post-discharge surgeries and readmission, post-discharge non-pulmonary sequelae, and post-discharge days to pulmonary/non-pulmonary sequelae.

Results: The study population included 33 INHI, 45 V, and 50 NV patients. There were no significant differences in age (P=.98), sex (P=.68), TBSA (P=.18), and smoking status (P=.92). Outpatient pulmonary sequelae were significantly higher for both INHI and V groups as compared to NV (21% and 17% vs 4%, P<.023, .043). The number of days from discharge to pulmonary sequelae was significantly shorter in the INHI group compared to the V group (162±139 vs 513±314 days, P=.024). Multinomial logistic regression for both INHI and V groups using the variables comorbid pulmonary disease, smoking status, and inpatient course and complications, indicated no effect on post-discharge pulmonary sequelae (all P >.05). All other measures were not significant when comparing INHI to V or NV (all P >.05).

Conclusions: Both INHI and V groups resulted in higher rates of outpatient pulmonary sequelae independent of inpatient course as compared to NV. While outpatient pulmonary sequelae were not significantly different between INHI and V, the INHI patients presented with complaints earlier. Thus one can conclude that ventilation alone is a significant contributing factor for the long-term pulmonary sequelae reported in this patient population.

The Risks of Sedation and Pain Control in the ICU: Can Increased Sedation Lead to Over-Resuscitation and More Hypotension?

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Introduction: Pain control and sedation of burn patients is a complex and necessary aspect of initial care and resuscitation. Each patient’s pain experience is unique. Balancing pain needs with obtundation and hemodynamic changes can be difficult, even for experienced clinicians. We hypothesize that in the first 48 hours of ICU admission, increased sedation in burned patients will be associated with increased resuscitation and hemodynamic instability.

Methods: A 6-year (2014–19) retrospective review of our hospital's burn database collected patients admitted to the ICU with greater than 20% TBSA burns. In the first 48 hours of admission, we compared total amounts of sedation/pain medications (morphine milligram equivalents (MME), propofol, dexmedetomidine, benzodiazepines) given with total resuscitation and hemodynamic data. A linear regression model was chosen to determine if higher amounts of sedation/pain medication could predict greater resuscitation and episodes of hypotension (MAP < 65).

Results: 208 patients were included with median age, %TBSA, and resuscitation of 43 years (0–99), 31% (20–93), and 3.3 ml/kg/%TBSA (0.13–19.05), respectively. The majority of our patients were white (80%) males (68%). Patients received a combination of MMEs (99% of patients), propofol (31%), dexmedetomidine (11%), and benzodiazepines (73%). Using a multivariable linear regression model, we found associations between total MMEs given and greater resuscitation (95% CI: 0.15–0.54, p=0.01) as well as number of hypotensive events (95% CI: 1.57–2.7, p< 0.001) in the first 48 hours of admission. No associations were noted with other sedative medications when comparing the number of hypotensive events and increased resuscitation.

Conclusions: While acute pain and sedation management is crucial in treating critically-ill burn patients, it often becomes routine. We find that pain management is not without physiological consequences and should be carefully monitored during resuscitation.
19 Nebulized Tobramycin is Associated with Decreased Pneumonia After Inhalation Injury

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Introduction: Management of inhalation injury is largely supportive and consists primarily of mechanical ventilation, bronchodilators, muscarinic receptor antagonists, and inhaled mucolytics and anticoagulants. Patients with inhalation injury are at high risk for pneumonia. Nebulized tobramycin is well supported in the use of chronic lung infections in patients with cystic fibrosis (CF). We hypothesize that after inhalation injury patients empirically treated with nebulized tobramycin (NT) have decreased incidence of pneumonia.

Methods: A protocol for a standardized 7-day course of nebulized treatments with bronchodilators, inhaled mucolytics combined with inhaled anticoagulants and Nebulized tobramycin was developed. Starting in May 2013, all patients that had a clinical diagnosis of inhalation documented by the attending physician were started on the 7-day treatment course. Patients with inhalation injury from 2009–2019 were retrospectively reviewed for treatment of inhalation injury. Univariate analysis and multiple logistic regression were performed using Stata.

Results: Of 90 patients with inhalation injury, median age was 52 (IQR:31–60) with 27% (n=23) women and median TBSA of 10%(IQR:0.7–35%). The median length of stay was 21 days (IQR:6–47). Median ventilator days were lower in patients treated with NT (8.5, IQR:4–21) compared to patients that did not receive NT (10, IQR:3–23) but was not significant (p=0.85). However, of those that received NT, the presence of pneumonia was significantly lower compared to patients not treated with NT (p=0.032). (Table 1) Patients who were not treated with NT developed pneumonia earlier (day 5, IQR:3–7) than patients treated with NT (day 10, IQR 6–16, p=0.02) After adjusting for grade of inhalation injury, patients who did not receive NT were 2.7 times as likely to get pneumonia compared to patients who received NT (p=0.037).

Conclusions: NT is a prophylactic strategy for pneumonia in patients with CF, well documented to be safe. It allows for concentrated antibacterial coverage localized to the area of infection without significant systemic absorption. After seeing ~60% incidence of pneumonia in inhalation patients, we developed a strategy that avoided systemic prophylactic treatment. Initial data shows empiric administration of NT in patients with inhalation injury may abrogate the development pneumonia. Additional research and clinical trials are needed to better understand the role of inhaled tobramycin in the management of inhalation injury.

Table 1: Presence of pneumonia in patients that did and did not receive nebulized tobramycin (NT)

<table>
<thead>
<tr>
<th></th>
<th>Did not receive NT</th>
<th>Received NT</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No pneumonia</td>
<td>14 (41%)</td>
<td>36 (64%)</td>
<td>50</td>
</tr>
<tr>
<td>Had pneumonia</td>
<td>20 (59%)</td>
<td>20 (35%)</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34</strong></td>
<td><strong>56</strong></td>
<td><strong>90</strong></td>
</tr>
<tr>
<td><em>p</em> = 0.032</td>
<td></td>
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</tbody>
</table>

20 Chronic Cardiovascular Dysfunction Following Lower Extremity Amputation in Burn Patients

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Introduction: Long-term chronic cardiovascular dysfunction is a well-reported outcome in patients who have suffered severe burns associated with diminished muscle mass and hypermetabolism. Devastating burn injuries sometimes warrant amputation to preserve life over limb. A lower extremity amputation can exacerbate the risk of burn-related sequelae due to prolonged recovery and reduced mobility. We queried a large multi-institutional national database to investigate whether lower extremity amputations in those with severe burns were associated with increased incidence of chronic myocardial dysfunction syndromes.

Methods: We accessed the TriNetX Global Health Research Network and queried ICD-10 codes for burn injuries (T20-25, T30-32) across 41 participating health care organizations. Comparative cohorts of patients who underwent lower extremity amputations and those who did not were identified. A matched case-control analysis of these cohorts accounting for age and gender matching was compared for the subsequent diagnosis of chronic cardiac dysfunction syndromes (150,22, 150,32, 150,42, 150,812).

Results: A total of 347,156 patients did not undergo lower extremity amputation, and their demographics showed a mean age of 38 years, 54% males, 60% white and 18% African American. In contrast, 1,535 patients underwent lower extremity amputation with a mean age was 59 years, 73% were male, 60% white and 24% African American. Burn patients who underwent amputations showed a comparative increased risk of 5.77% (p < 0.0001) for developing of chronic cardiac dysfunction compared to those who did not undergo amputations (RR 3.512, 95% CI: 2.39–5.16). One year following injury this comparative risk diminished to 3.45% (p < 0.0001; RR 3.14, 95% CI: 1.96–5.04). The difference in risk was not significant 3 years after burn injury (0.538%, p = 0.2163, RR 1.54, 95% CI: 0.77–3.09).

Conclusions: Patients who underwent amputations after severe burn are at increased risk of developing chronic cardiac dysfunction compared to those that did not undergo amputation; the significance appears to diminish with time. Further research is indicated to elucidate the mechanism for this relationship.
21 Navigating Controversial Therapies for Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis Syndrome Using Large Database Analysis

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Introduction: Stevens-Johnson Syndrome (SJS) and Toxic Epidermal Necrolysis Syndrome (TENS) are part of a spectrum of autoimmune conditions, which cause epidermal detachment and keratinocyte necrosis. Due to the rare incidence, a dramatic heterogeneity in treatment algorithms and prolonged discussion of controversial therapies has ensued. We queried a large national data network to better understand how these therapies are actually implemented and the relative impact on survival.

Methods: The TriNetX Global Health Research Network (41 healthcare organizations) was queried using ICD-10 codes (L51.1 - L51.3) to identify patients diagnosed with SJS or TENS from 2000 to 2020. A treatment frequency map was constructed to determine the most common treatment groupings, and cohorts were indexed based on the most frequent isolated and combined therapy algorithms: systemic steroids (SS), diphenhydramine (DH), cyclosporine (CS), intravenous immunoglobulin (IVIG) and tumor necrosis factor alpha inhibitors (TNFi). Cohorts were case matched for demographics against a restricted control group (RC; patients who did not receive any of the above-mentioned therapies) and an unrestricted control group (UC, all patients diagnosed with SJS or TENS) to evaluate mortality risk, survival probability, and to uncover Type II error.

Results: Cohorts were UC (6,196), RC (2,248), SS+DH (3,459), SS (1,269), SS+CS (1,554), DH (479), CS (52), IVIG (10) and TNFi (10). The treatment map showed 36.3% of patients did not receive any of the listed therapies. Of those that did 48.2% initially got SS, 24.3% got DH, 15.4% got SS+DH and 3% got SS+CS. Patients who received SS had a 8.51% mortality risk and 2.84% risk reduction compared to UC (p = 0.017). However, the Hazard Ratio (HR) was 0.80 (95% CI: 0.57, 1.23) showing no survival advantage. Compared to RC risk reduction decreased to 0.47% (p = 0.667). SS+DH showed a risk reduction of 1.13% compared to UC (p = 0.113; HR 0.89, 95% CI: 0.69, 1.16), but this advantage resolved when compared to RC. Similarly, SS+CS had a risk reduction of 2.12% compared to UC (p = 0.039; HR 0.80, 95% CI: 0.58, 1.09), which decreased to 0.07% (p = 0.947) when compared to RC. DH and CS had a significant risk reduction (p = 0.25 - 1.00) or survival advantage. IVIG and TNFi were underpowered for analysis.

Conclusions: The most common treatments for patients diagnosed with SJS or TENS are systemic steroids, diphenhydramine, or a combination of the two. Unfortunately, none of the above therapies confer a significant survival advantage. Furthermore, some therapies raised concern for Type II errors when the control group is not adjusted for alternative therapies.

22 Acute Kidney Injury in Burn Patients Following Combination Antibiotic Therapy: A Large Database Analysis

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Introduction: Burn patients are prone to infections, which often warrants broad-spectrum antibiotic coverage. Vancomycin is a common antibiotic used at burn centers and is administered alone, or in combination with other agents such as piperacillin-tazobactam (Pip/Tazo). A recent study showed that this combination therapy was associated with increased rates of acute kidney injury (AKI) in adult and pediatric burn patients when compared to vancomycin in combination with other antibiotics. However, other studies failed to demonstrate these findings. The degree of nephrotoxic effect of the combination therapy relative to its drug components has not been demonstrated in burn patients. Using a large national database encompassing 41 health care organizations, we sought to determine whether a combination of vancomycin and Pip/Tazo exacerbates AKI in burn patients.

Methods: Using the TriNetX Global Health Research Network, we identified the population of burn patients with ICD-10 codes T20-T25 and T30-T32 between 2000–2020. We then grouped this population into 4 cohorts based on the administration of broad-spectrum antibiotics they received after the burn incident: vancomycin, Pip/Tazo alone, combination, and neither vancomycin nor Pip/Tazo. All cohorts were balanced for age, gender, and race. We explored the distribution of these cohorts and conducted comparative outcome analysis to determine the relative risk of developing AKI using the ICD10 code N17.

Results: Comparative analysis showed burn patients who received vancomycin had a 4.81% increased associated risk with AKI compared to those who did not receive either vancomycin or Pip/Tazo (p = 0.001, RR =3.35, 95%CI= 2.63–4.26). Patients who received Pip/Tazo monotherapy had a 5.1% increased association with AKI compared to those who did not receive either drug (p = 0.001, RR =3.57, 95%CI: 2.33–5.45). The combination of vancomycin with Pip/Tazo increased the association with AKI by 9.49% compared to patients who did not receive either vancomycin or Pip/Tazo (p = 0.0001, RR=5.65, 95%CI: 4.40–7.26). Combination therapy also increased the risk of AKI when compared to the vancomycin monotherapy (5.01%, p< 0.00001, RR= 1.69, 95% CI: 1.42–2.00) and Pip/Tazo monotherapy (4.85%, p< 0.00002, RR= 1.62, 95% CI: 4.40–7.26).

Conclusions: The use of broad-spectrum antibiotics in burn patients is associated with a higher risk of AKI. The combination of these drugs affords an increased relative risk of AKI when compared to monotherapy with the respective component drugs. Whether this is associated with selection bias or drug-effect warrants further investigation.
Nutritional Intake and Weight Change in Severely Burned Patients

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Introduction: Nutrition is crucial for recovery from burn injuries, as severe weight (wt.) loss can lead to impaired immunity and wound healing, infections, skin graft failure, and mortality. Previous studies recommended avoiding more than 10% wt. loss, as this level resulted in increased infection rates. However, wt. loss is often not quantifiable during the critical illness phase, with severe edema masking non-fluid related body wt. changes. Energy (kcal) deficits can be used to estimate wt. loss until the edema has resolved, but previous studies in non-burn patients indicate that actual wt. loss is less than the commonly used 3500 kcal per pound of fat (7700 kcal per kg of fat). The objective of this performance improvement project was to evaluate nutritional intake and the resulting dry wt. change in severely burned patients.

Methods: This performance improvement project was approved by our regulatory compliance division. We performed a retrospective evaluation on patients with at least 20% total body surface area (TBSA) burns admitted for initial burn care to our intensive care unit over a 7-year period. Patients who died or who had major fascial excisions or limb amputations were excluded. Patients who did not achieve a recorded dry wt. after wound healing were not included in this analysis. Retrospective data were collected, including sex, age, burn size, kcal intake, kcal goal per the Milner equation using activity factor of 1.4, admission dry wt., dry wt. after wound healing (defined as less than 10% TBSA open wound), and days to dry wt. after wound healing. Descriptive statistics and linear regression were performed using JMP. Significance was set at p < 0.05.

Results: The 30 included patients had the following characteristics: 90% male, 30 ± 11 years old, 45% ± 15% TBSA burn. They received 2720 ± 1092 kcal/day, meeting 68% ± 24% kcal goal, and took approximately 53 ± 30 days from injury to achieve dry wt. after wound healing. These patients had wt. loss of 8 ± 8 kg from the kcal deficit of 69,819 ± 51,704 during this time period. The kcal deficit was significantly associated with wt. change [p < 0.001, R^2 = 0.49, wt. change in kg = (-0.000103 x kcal deficit) – 1]. This translates to one kg of body wt. loss resulting from 9709 kcal deficit.

Conclusions: This performance improvement project found that an energy deficit of approximately 9700 kcal in our patients equates to 1 kg of body mass loss (4400 kcal deficit equates to 1 pound of body mass loss). These findings are similar to wt. loss studies in other patient populations and contrary to the commonly used 3500 kcal per pound of fat (7700 kcal per kg of fat).
A Retrospective Review of Vitamin D Levels and Dosing in Burn Center Patients
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Valleywise Health Medical Center, Phoenix, Arizona; Arizona Burn Center Valleywise Health, Phoenix, Arizona; Valleywise Health, Phoenix, Arizona; Arizona Burn Center Valleywise Health, Phoenix, Arizona; Arizona Burn Center, Phoenix, Arizona; A. T. Still University, Tempe, Arizona; The Arizona Burn Center Valleywise Health, Phoenix, Arizona

Introduction: The potential consequences of vitamin D insufficiency/deficiency (I/D), include increases in ICU length of stay, organ dysfunction, infectious complications, and mortality. Burn patients, in particular, may be at increased risk of vitamin D I/D due to bleeding, systemic inflammatory response syndrome, increased utilization of vitamin D by injured tissues, compromised vascular integrity, fluid shifts, and leakage of vitamin D binding protein (VDBP) and albumin. The purpose of this study is to determine the incidence of vitamin D I/D and evaluate the institutional vitamin D dosing regimen.

Methods: A retrospective chart review was performed of all adult patients from January 1, 2018 through December 31, 2019 who received cholecalciferol and had at least one vitamin D hydroxy level during their hospitalization. Vitamin D level was drawn on admission, then weekly thereafter. Patients found to be I/D were initiated on high dose vitamin D supplementation and then adjusted based on the weekly levels. The therapeutic goal for vitamin D supplementation was set at 50 ng/ml.

Results: Three hundred and sixteen patients met criteria for review. Of those patients, 293 patients (93%) were vitamin D I/D. The magnitude of vitamin D deficiency was strongly positively correlated with %TBSA burn size (p< 0.001). Mean time to reach therapeutic vitamin D levels following initiation of supplementation was 29 days with an average weekly dose of 142,877 international units cholecalciferol. Many patients were discharged prior to reaching therapeutic levels. Time to reach therapeutic levels was also positively correlated with increasing burn size (p< 0.05).

Conclusions: Vitamin D I/D is present over 90% of burn patients and the degree of I/D was profound. Additionally, vitamin D I/D was not easily corrected, taking almost 3 weeks to reach therapeutic levels using an aggressive supplementation regimen. Further studies documenting the clinical consequences of vitamin D I/D and development of evidence-based supplementation dosing regimens are warranted.

Baseline Copper Levels are Associated with Worse Outcome in Burn Patients with Overweight and Obesity
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Introduction: While copper (Cu) has been shown to be beneficial in wound healing, high levels of circulating Cu are also associated with increased oxidative stress. Interestingly, elevated baseline Cu levels have been seen in obese patients, and theoretically, this is associated with higher baseline oxidative stress. Overweight (OW) and Obesity (OB) are common conditions in the US; therefore, a significant proportion of burn patients will be potentially affected. We examined the interactive effects of Cu and obesity on outcomes of burn patients; specifically, we hypothesized that higher baseline Cu levels in OW and OB burn patients are associated with worse clinical outcomes.

Methods: A retrospective review of patients with burns ≥20% TBSA between 2015–2019. Patients were grouped according to body mass index (BMI) (i.e., NW:18–24.9; OW:25–29.9; and OB: ≥ 30 kg/m2). Baseline characteristics were compared using ANOVA and χ2 tests. The interactions between baseline Cu and BMI groups on 1) lengths of ICU stay (ICUS), 2) overall hospital stay (LOS), and 3) the number of operative procedures, were examined in a series of multiple regression models in R.

Results: Data of 160 patients met eligibility (NW: OW: OB = 53: 38: 69). BMI groups did not differ significantly on demographics, TBSA, degree of burn, inhalational injury, or mortality. Regression models revealed that NW patients with high baseline Cu levels had shorter ICUS (p< 0.001) and LOS (p<0.003) and also had fewer operations (p = 0.001). While OW and OB were protective at low Cu levels, patients with OW or OB who had high baseline Cu levels had longer ICUS (p< 0.001 and p=0.033), LOS (p=0.001 and p=0.063), and a greater number of operations (p< 0.001 and p=0.066) (Table 1).

Conclusions: High baseline Cu seems to be beneficial for NW burn patients, yet associated with adverse outcomes in burn patients with OW and OB. While further evidence is needed to confirm this notion, caution is advised when supplementing Cu for burn patients with OW and OB.
Introduction: Many patients treated on a burn unit require tube feeding as their primary caloric source or as supplemental feeding due to their injuries. Burn patients specifically require higher caloric intake due to the hypermetabolic state of burn injuries. Inadequate nutritional support contributes to longer ICU stays and higher mortality. Clogged feeding tubes reduce nutrition provided due to temporary discontinuation of feeding. The objective of this study was to identify risk factors for the incidence of tube clogging.

Methods: This was a single-center retrospective chart review of all patients admitted to an American Burn Association-verified Burn Unit between August 2017 and October 2019 who received tube feeds during their admission. Data collected included baseline demographics, clinical outcomes, and details about tube feed formulations, number of clogs, and details leading up to the clog. Baseline demographics were compared using descriptive statistics. Nominal data was compared using Chi-square test. Continuous data was analyzed using student’s t-test or Mann-Whitney U test.

Results: A total of 170 patients were included; admission diagnoses included burn (97), soft tissue infections (29), SJS/TEN (11), and others (33). At least one clogged feeding tube was experienced by 51 patients and some experienced up to seven separate clogs. SJS/TEN patients were less likely to experience a clog (9.2 vs 0%, p = 0.035) and frostbite patients were more likely to experience a clog (0 vs 5.9%, p = 0.026). Burn mechanism did not affect incidence of tube feed clog, but patients with larger total body surface area (TBSA) burned were more likely to have a clog (15.55 vs 25.03%, p = 0.004). It was a median of 12 days until the first clog occurred (IQR 7.8–17.3). Two tube feed formulas demonstrated an increased likelihood of clog: a renal formulation (16.8 vs 33.3%, p = 0.017) and a polymeric concentrated product (5.0 vs 17.6%, p = 0.008). Both products have a high viscosity. Patients who experienced a clog had a longer length of stay (21.5 vs 44.0 days, p = 0.001).

Conclusions: This study identified several risk factors associated with higher incidence of clogged feeding tube in the burn unit including tube feed formulation and viscosity, admission diagnosis, and larger TBSA in burn patients. This study also confirms that clogged feeding tubes, and the resultant insufficient nutritional support, may contribute to an increased length of stay.

Table 1: Regression model with Cu interaction terms.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>B</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu x Normal Weight</td>
<td>0.91</td>
<td>0.35</td>
<td>0.001</td>
</tr>
<tr>
<td>Cu x Overweight</td>
<td>0.86</td>
<td>0.41</td>
<td>0.002</td>
</tr>
<tr>
<td>Cu x Obesity</td>
<td>0.78</td>
<td>0.37</td>
<td>0.002</td>
</tr>
<tr>
<td>Cu</td>
<td>1.13</td>
<td>0.30</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Cu: Baseline serum copper level; NW: Normal weight; OW: Overweight; OB: Obesity

26 Clogged Feeding Tubes: Why Does It Matter?

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Oral Supplementation for Burn Patients: Would YOU Eat That?

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Introduction: The metabolic demands of burn injury often require that patients consume a high-calorie diet. For patients taking nutrition solely by the oral route, this can be challenging, and supplementation is necessary. The burn team is sometimes frustrated at patients’ inability or perceived unwillingness to consume the daily prescribed supplementation. The purpose of this study was to expose the burn team to the various nutritional supplements offered to patients, and to gain a better understanding of the palatability those supplements.

Methods: Nine volunteers from the burn team participated in this blinded study: an attending surgeon; surgical residents (2); students (1); therapists (2); and nurses (3). Samples of 9 different nutritional supplements were placed in numbered cups, with the contents known only to the dietitians. The supplements consisted of: “milkshake” consistency drinks (#1, 4, 6, 7, 9); gelatin (#2); frozen custard (#3); clear thin liquid (#5); and pudding (#8). Each participant received one cup of each supplement and was asked to rate the contents on a scale of 1 to 10, with 10 being tastiest. Mean, trimmed mean, and median taste scores were noted. Data were analyzed by t-test and by regression to assess for differences based on protein content.

Results: The highest mean and trimmed mean scores (7.3 and 7.4) were given to product #8. Product #1 had slightly lower scores (6.4 and 6.1). Product #9 received the lowest mean score (2.2); the trimmed mean was even lower (1.7). Median scores for the products upheld these results, and most of the remainder of the products received median scores of 4 or 5. T-test analysis showed significant differences in preference for products 1 and 8 versus the rest of the products (with means of 2.2 to 5.3). Regression analysis suggests that taste scores tend to be higher for products with a lower percentage of calories from protein, while the higher protein products fare less well in taste (a decline of roughly 0.47 in mean taste score for every 10-percentage point increase in percentage of calories from protein).

Conclusions: A blinded taste test of commonly offered supplements revealed that most products are, at best, moderately acceptable (median score 4–5). This suggests two potential changes in the approach to oral supplementation. First, the burn team should be sympathetic to the challenges that patients face with oral supplements, particularly the high-protein versions. Second, the burn team may need to be innovative. Chilling the drinks, offering different flavors, mixing flavors, or mixing with other liquids may help patients to take oral supplements more enthusiastically. Sampling these oral supplements has helped our team to understand better what we ask our patients to do to achieve their nutritional goals.
Timing of Enteral Nutrition Initiation in Severely Burned Patients

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Introduction: Early initiation of enteral nutrition (EN) for severely burned patients (pts) has been found to be associated with decreased catabolism, decreased wound infections, lower sepsis rates, shorter intensive care unit (ICU) days and hospital days, and improved mortality. The American Society for Parenteral and Enteral Nutrition (ASPEN) recommends initiating EN within 4–6 hrs of injury for critically ill adult burn pts; however, they also recommend waiting for hemodynamic stability to be achieved before starting EN in all critically ill pts. The objectives of this performance improvement project (PIP) were to evaluate the timing of EN initiation and reasons for delays in initiating EN in our critically ill burn pts.

Methods: We performed a retrospective evaluation on pts admitted to our ICU in 2019 with at least 20% TBSA burns. Exclusion criteria were death within 72 hrs of admission, oral nutrition, and admission over 1 calendar day after injury. This PIP was approved by our regulatory compliance division. We clinically defined hemodynamic stability as lactate levels less than 3 mmol/L with vasopressor requirements of less than 10 mcg/min norepinephrine. Demographic data were collected along with timing of EN and reasons for delays in EN initiation.

Results: EN was initiated 28 ± 17 hrs after admission for the 19 included pts with the following characteristics: 44 ± 16 years old, 38 ± 16% TBSA burn, all required mechanical ventilation on admission. These pts had 16 ± 10 mechanical ventilator days and 42% mortality. The shortest time to EN initiation was 9 hrs after admission. EN was delayed for initial hemodynamic instability for 10 ± 17 hrs after admission. Other delays in EN initiation after initially achieving hemodynamic stability included time to feeding tube placement (1 ± 2 hrs) and x-ray confirmation (4 ± 9 hrs), and time to EN orders (8 ± 10 hrs). EN was initiated 6 ± 6 hrs after the preceding events occurred. Some of the delays in placement of EN orders and for EN initiation after the above criteria were met included procedures (2 ± 2 hrs), becoming hemodynamically unstable again (5 ± 7 hrs), and placement of a small bore, post-pyloric feeding tube when an orogastric or nasogastric feeding tube was already available for use (2 ± 4 hrs). We were not able to retrospectively identify reasons for delays during 5 ± 6 hrs per patient.

Conclusions: As a result of this PIP, we found EN was not initiated in any of our critically ill burn pts within the timeline recommended by ASPEN/SCCM. The primary reasons for delays included hemodynamic instability, feeding tube placement and confirmation, adding a post-pyloric feeding tube, and procedures.

Introduction: Laser therapy has emerged as a valuable treatment option for hypertrophic burn scars over the past decade. Improvements in scar symptoms have been found using the ablative fractional carbon dioxide laser (AFCL) as well as the pulsed dye laser (PDL). However, research regarding the use of laser therapy among pediatric burn patients remains limited. Thus, the aim of this study was to investigate the effectiveness of using laser therapy to improve hypertrophic burn scars in a pediatric population using a comprehensive set of subjective and objective scar assessment tools.

Methods: A single-center, prospective observational study was carried out at a tertiary pediatric hospital. Twenty participants with hypertrophic burn scars that had not received previous laser treatment were included. Laser procedures were administered at approximately two-month intervals and each participant attended five study visits over the course of one year. A comprehensive set of scar assessment tools including the Vancouver Scar Scale, the Patient and Observer Scar Assessment Scale, conventional ultrasound, ultrasound elastography, and a multi-parameter skin analysis device were used to evaluate scar properties at each study visit.

Results: Seventy-one laser procedures were carried out with most participants receiving treatment with both the AFCL and the PDL at the same session (83%). All participants underwent at least three laser procedures with no complications noted. From baseline to study completion, statistically significant improvements in all scar measures, both subjective and objective, were observed (p < 0.05). More specifically, improvements in overall scoring and in specific scar properties including thickness (p < 0.05), stiffness (p < 0.05), and color (p < 0.05) were found.

Conclusions: To our knowledge, this is the most comprehensive study to date to evaluate the effect of laser treatment on hypertrophic burn scars in a pediatric population. Our findings suggest that laser therapy is a highly beneficial treatment for burn-injured children that should be integrated into current scar treatment practices. In addition to obtaining strong evidence to support the use of laser therapy, we utilized rigorous scar assessment and laser treatment protocols that can be easily adopted by other clinicians.
A phase 3 open-label, controlled, randomized trial evaluating the efficacy and safety of a bioengineered allogeneic cellularized construct in patients with deep partial-thickness thermal burns

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Introduction: Autograft (AG) is the standard of care for treatment of severe burns. While AG provides effective wound closure (WC), the procedure creates a donor site wound prone to pain and scarring. In a phase 1b trial, no deep partial-thickness (DPT) wound treated with a bioengineered allogeneic cellularized construct (BACC) required AG by Day 28 and WC at the BACC site was achieved in 93% of patients by Month (M) 3. This phase 3 study (NCT03005106) evaluated the efficacy and safety of this BACC in patients with DPT burns. While AG provides effective wound closure (WC), the procedure creates a donor site wound prone to pain and scarring. In a phase 1b trial, no deep partial-thickness (DPT) wound treated with a bioengineered allogeneic cellularized construct (BACC) required AG by Day 28 and WC at the BACC site was achieved in 93% of patients by Month (M) 3. This phase 3 study (NCT03005106) evaluated the efficacy and safety of this BACC in patients with DPT burns.

Methods: Enrolled patients were aged ≥18 years with 3–49% TBSA thermal burns on the torso or extremities. In each patient, two DPT areas (≤2,000 cm² total) deemed comparable following excision were randomized to treatment with either cryopreserved BACC or AG. Coprimary endpoints were 1) the difference in percent area of BACC treatment site and AG treatment site autografted at M3 and 2) the proportion of patients achieving durable WC of the BACC treatment site without AG at M3. Ranked secondary endpoints were: 1) the difference between BACC and AG donor sites in average donor site pain intensity through Day 14; 2) the difference between BACC and AG donor site cosmesis at M3; and 3) the difference between BACC and AG treatment site cosmesis at M12. Safety assessments were performed in all patients through M12.

Results: Seventy-one patients were enrolled. By M3, there was a 96% reduction in mean percent area of BACC treatment sites that required AG, compared with AG treatment sites (4.3% vs 102.1%, respectively; P < .0001). BACC treatment resulted in durable WC at M3 without AG in 92% (95% CI: 85.6, 98.8; 59/64) of patients for whom data was available. By M3, mean donor site Patient and ObserverScar Assessment Scale (POSAS) observer total score (±SD) was significantly lower (more like normal skin) for BACC donor sites compared with AG donor sites (6.3 ± 7.71 vs 16.3 ± 7.71; P < .0001). At M12, mean POSAS observer total score (±SD) was 15.6 (± 8.34) for BACC treatment sites compared with 16.3 (± 9.41) for AG treatment sites (P = .4268). The most common BACC-related adverse event (AE) was pruritus, which occurred in 11 (15%) patients. All BACC-related AEs were mild or moderate in severity.

Conclusions: This phase 3 study achieved both coprimary endpoints, including significant autograft sparing and durable WC in DPT burns. Both donor site pain and donor site cosmesis were favorable outcomes of significantly reduced use of AG in BACC-treated patients. M12 POSAS for BACC did not differ significantly from AG. This BACC may offer a new treatment for severe burns to reduce or eliminate the need for AG.

Applicability of Research to Practice: This BACC has shown clinical benefit in patients with DPT thermal burns, potentially mitigating donor site morbidity.

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Introduction: The use of silicone gel sheeting (SGS) has long been observed clinically as an effective modality in reducing hypertrophic scar (HTS) formation. Although the use of SGS is widely accepted, the exact mechanism is not fully understood. Prevailing theory suggests silicone suppresses collagen production in immature active scar. Collagen production is enhanced as blood flow increases in areas of scar hyperemia. Reduction of blood perfusion to the immature scar may act as a potential mechanism in limiting excessive scar proliferation.

Methods: Laser Doppler Imaging (LDI) was used to assess 2 areas in 2 subjects (85% TBSA w/ CEA and native skin control): A control site and SGS testing site were traced on the skin of each subject and 5 LDI scans were performed on both subjects: 1) initial without SGS; 2) initial with SGS applied; 3) 4-hours post-SGS application with SGS on; 4) 4-hours post-SGS application immediately after removal; 5) 15-minutes post-SGS removal. The control and testing site for both subjects were then analyzed using the LDI software and the average perfusion units (PU) over the region of interest (ROI1: testing site; ROI2: control site) areas were calculated for each scan.

Results: Perfusion within both ROI had a marked increase in perfusion for HTS scans after 4-hours when compared to the initial scan. However, after initial SGS application to ROI1, the mean PU decreased by 23.1% while the perfusion to ROI2 remained relatively constant (-5.8%). Subsequently, the ROI2 increased in mean PU by 23.4% 4-hours after the initial scan while the ROI1 showed a blunted response in perfusion in comparison increasing by only 2.3%.

Conclusions: Perfusion for both NS and HTS were notably decreased when SGS was applied compared to the matched ROI without SGS. In addition, prolonged SGS application created a greater difference in perfusion between silicone (less perfusion) and non-silicone sites (greater perfusion) for both NS and HTS when compared to initial SGS application demonstrating a greater effect on perfusion the longer SGS was worn.

Introduction: Hypertrophic scarring after burn injury can be extremely painful, cause profound itching, and affect the way patients view themselves and how the outside world perceives them. We have utilized laser therapy as a modality for scar modulation for our patients since 2013. In 2014, we initiated and completed a prospective IRB approved study to evaluate the outcome of scars treated with fractional CO2 laser therapy (FLT) utilizing objective and subjective tools. Recently, we have completed a prospective study evaluating the use of pulse dye laser (PDL) therapy and the impact on post-burn pruritis. In reviewing the outcomes from these two studies, we have developed an evidence-based laser therapy algorithm for burn scar management.

Methods: The FLT study entailed a series of three CO2 laser treatments minimally 4-6 weeks apart with scar measurements and POSAS form completion performed prior to each laser treatment and four weeks after the last FLT. Scar measurements that included color, pliability, and scar thickness; and completion of the POSAS form were obtained prior to each laser therapy session and four weeks after the third laser treatment. The measurements of color, pliability, and scar thickness were measured with the Colorimeter, Cutometer, and ultrasound. The PDL study utilized the 5-D Itch scale to evaluate post-burn pruritis. A baseline measurement was obtained prior to any laser treatments. Each patient underwent two PDL sessions and a 5-D itch scale was completed four to six weeks after the second PDL session. The baseline measurement was then compared to the final 5-D itch scale measurement.

Results: Data from the FLT study is in Table 1 and shows that there were statistically significant improvements in the Patient and Observer POSAS scores, patient rated itch score, scar thickness, and measured skin density. Changes to patient rated scar pain, scar color, and pliability were noted but were not of statistical significance. Data from the PDL study is in Table 2 and shows a statistically significant decrease in the treated patients’ post-burn pruritis.

Conclusions: In reviewing the outcomes of these two studies, we have developed an algorithm based on our studies. All of our patients undergoing laser therapy receive two PDL sessions that are four to six weeks apart followed by 3 FLT sessions. The use of both PDL and FLT decreases post-burn pruritis, decreases scar thickness, decreases pain, and increases patient satisfaction as shown in our research.
Introduction: Dyschromic hypertrophic scar (HTS) with areas of hyper- and hypo-pigmentation is a common sequela of burn injury. The mechanism behind the development of dyschromia has not been elucidated. In this study, we provide a histological analysis of these scars with a focus on rete ridge presence. Rete ridges occur in epithelial tissues such as oral mucosa and skin and can be described as undulating “pegs” that are interdigitated with dermal papillae. Rete ridges enhance adhesion of the epidermis to the dermis. We hypothesize that rete ridge presence is important for normal skin physiology, and their absence or presence may hold mechanistic significance in post-burn HTS dyschromia.

Methods: Subjects with post-burn dyschromic HTS were consented and enrolled (n=27). Punch biopsies of hyper-, hypo-, and normally pigmented scar and skin were collected and stored in formalin. Biopsies were paraffin embedded, sectioned, stained with H&E, and imaged. The number of rete ridges were investigated by calculating a rete ridge ratio from the length of the basement membrane and the length of the epidermis.

Results: The patient population was predominantly female (55.5%), black (70.4%), and had Fitzpatrick skin Type V (51.9%). The injuries were primarily as a result of flame (37%) and scald (33.3%) and resulted in a median TBSA burn of 7%. The median age of the scar at the time of sample acquisition was 12.2 months. The rete ridge ratio of normally pigmented, un-injured skin was above 1 (1.31 ± 0.04), indicating that normal skin’s basement membrane is longer than its epidermal length due to the presence of rete ridges. HTSs resulting from burn wounds that healed without split thickness autografts were first investigated. The number of rete ridges was higher in normal skin compared to HTS that was either hypo- or hyperpigmented (1.31 ± 0.04 vs. 1.13 ± 0.05 and 1.14 ± 0.04 vs. p< 0.05). This difference was similar despite pigmentation phenotype. When hyperpigmented scars resulting from wounds that were treated with split thickness autografts (Hyper+) were investigated, rete ridge number was significantly higher than in Hyper- (1.89 ± 0.23, p< 0.01). Patient age showed a weak correlation (R=-0.33) with rete ridge ratio where older patients had lower rete ridge ratios in normal, un-injured skin. Hyper+ showed a weak correlation between rete ridge ratio and age of scar (R=0.38).

Conclusions: Post-burn HTS that is dyschromic has fewer rete ridges than normal skin. This finding may explain the decreased epidermal barrier function that is associated with HTS.

Introduction: Our group has previously reported our experience with autologous skin cell suspension (ASCS) in the treatment of all subjects with hand burns regardless of the total body surface area (TBSA) involved. In order to better address the confounder of TBSA on burn outcomes, we sought to analyze our experience in a cohort of subjects whose TBSA totaled 20% or less. We hypothesized that the use of ASCS in conjunction with a 2:1 meshed autograft would provide comparable outcomes to hand burns treated with smaller meshed autograft alone.

Methods: A retrospective review was conducted for deep 2nd and 3rd degree hand burns treated with split thickness autograft (STAG) at our urban verified burn center between April 2018 to September 2020. Exclusion criteria was a TBSA greater than 20%. The cohorts were those subjects treated with ASCS in combination with STAG (ASCS+) versus those treated with STAG alone (ASCS-). All ASCS+ subjects were treated with 2:1 meshed STAG and ASCS overspray while all ASCS- subjects had 1:1 or piecrust mesh only. Outcomes included demographics, proportion returning to work (RTW), length of time for RTW, and time to wound closure. Mann-Whitney U test was used for comparisons of continuous variables, and Fishers Exact test for categorical variables. Values are reported as median and interquartile range.

Results: Fifty-one subjects fit the study criteria (ASCS+ n=31, ASCS- n=20). The ASCS+ group was significantly older than the ASCS- cohort (44 yrs. [32, 54] vs 32 [27.5, 37], p=0.009) with larger %TBSA burns (15% [9.5, 20] vs 9% [1, 14], p < 0.0001), and larger size hand burns (190 cm2 [120, 349.5] vs 126 cm2 [73.5, 182], p=0.015). Comparable results were seen between ASCS+ and ASCS-, respectively, for time to wound closure (9 days [7, 13] vs 11.5 [6.75, 14], p=0.63), proportion RTW (61% vs 70%, p=0.56), and days for RTW among those returning (35 [28.5, 57] vs 33 [20.25, 59], p=0.52). The ASCS+ group had two graft infections with no reoperations, while ASCS- had one infection with one reoperation. No subjects in either group had a dermal substitute placed.

Conclusions: Despite being significantly older, having larger hand wounds, and larger overall wounds within the parameters of the study criteria, patients with 20% TBSA burns or smaller whose hand burns were treated with 2:1 mesh and ASCS overspray had comparable time to wound closure and return to work as subjects treated with 1:1 or pie-crust meshed STAG. Our group plans to follow this work with scar assessments for a more granular picture of pliability and reconstructive needs.
36 Using Pressure Mapping to Understand and Prevent Hospital-Acquired Pressure Injuries in the Burn ICU

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Introduction: Real-time pressure mapping devices may help prevent hospital-acquired pressure injury (HAPI) in Burn ICU (BICU) patients who are at a high baseline risk for HAPIs. While prior studies have demonstrated the utility of pressure monitoring devices in preventing pressure injuries, there has been little investigation into using pressure mapping data to better understand HAPI development, and to determine specific predictors of HAPIs. Such data could help risk stratify patients upon admission to the BICU and result in improved patient care as well as cost savings. This study retrospectively investigated the utility of pressure mapping data in predicting/preventing pressure injury among BICU patients, and estimated HAPI-related cost savings associated with the implementation of pressure monitoring.

Methods: This was a retrospective chart review of real-time pressure mapping in the BICU. Incidence of HAPIs and costs of HAPI-related care were determined through clinical record review, before and after implementation of pressure mapping. Multivariable-adjusted logistic regression was used to determine predictors of HAPIs, in the context of pressure mapping recordings.

Results: In total, 122 burn ICU patients met inclusion criteria during the study period, of whom 57 (47%) were studied prior to implementation of pressure mapping, and 65 (53%) were studied after implementation. The HAPI rate was 18% prior to implementation of pressure monitoring, which declined to 8% after implementation (chi square: p=0.010). HAPIs were more likely to be less severe in the post-implementation cohort (p < 0.0001). Upon multivariable-adjusted regression accounting for known predictors of HAPIs in burn patients (BMI, length of stay, co-morbidities, age, total body surface area burned, mobility), having had at least 12 hours of sustained pressure loading in one area significantly increased odds of developing a pressure injury in that area (odds ratio 1.3, 95%CI 1.0–1.5, p=0.04). When comparing patients who developed HAPIs to those who did not, pressure mapping demonstrated that patients who developed HAPIs were significantly more likely to have had unsuccessful repositioning efforts prior to HAPI development, defined as persistent high pressure in the at-risk area (60% versus 17%, respectively; p=0.02). Finally, implementation of pressure mapping resulted in significant cost savings ($2,063 prior to implementation, versus $1,082 after implementation, p=0.008).

Conclusions: The use of real-time pressure mapping decreased incidence of HAPIs in the burn ICU patients and resulted in significant cost savings.

37 Analysis of the Utility of CO2 and Pulse-Dye Lasers in the Treatment of Hypertrophic Burn Scars

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Introduction: Despite advances in burn care, hypertrophic burn scars (HTBS) remain a significant source of morbidity. Treatment often involves use of CO2 lasers to reduce thickness and pulse-dye lasers (PDL) to reduce erythema. Despite frequent utilization, little quantitative data exists. This study seeks to objectively determine the effects of these laser treatments on burn scars.

Methods: Patients found to have HTBS undergoing laser treatments were approached for enrollment. Following enrollment, an area of HTBS outside of the treatment area was divided into 4 equal 3x3cm squares which were randomized to receive either CO2, PDL, CO2+PDL, or no treatment. Patients underwent a total of 3 treatments, 4–6 weeks apart, and were seen for follow-up over 3–6 months. Scar assessments occurred at each visit prior to treatment and consisted of digital photographs, ultrasound assessment for scar thickness, colorimetry, and the Patient and Observer Scar Assessment Score (POSAS).

Results: Twenty-five patients were enrolled at our institution. To date, 12 (48%) have completed all 3 treatments and the remainder are still in their follow-up period. Median initial scar thickness (ST) was 0.3cm. Mean time since injury was 9 months. Overall, there was a significant decrease in ST over time (p=0.0246) but not between treatment groups. There were no significant changes seen in melanin, erythema, or POSAS scores (p=0.9030, 0.6470, and 0.1495, respectively). When separated by ST before initiation of treatment, thin scars (< 3cm) appeared to be overall less erythematos in groups treated with PDL and CO2+PDL and untreated groups (p=0.0358, 0.0027, 0.0118, respectively) as compared to thick scars (≥3cm). Thin scars treated with PDL and CO2+PDL were also less pigmented than thick scars (p=0.0127, 0.0213, respectively). Erythema significantly decreased between the last treatment and the final visit for PDL and CO2+PDL groups (p< 0.0001). Older scars (≥9 months prior to treatment) tended to have a greater reduction in thickness as compared to newer scars but the difference was not significant to date.

Conclusions: Laser therapy is often employed in the treatment of HTBS. However, few studies have determined their objective benefits. Based on a preliminary analysis of our data, we have shown an overall decrease in scar thickness, less pigmentation, and less erythema in thin scars treated with PDL or CO2+PDL. Further analysis will be performed after additional follow-up information is collected.
**Cost-effectiveness of Autologous Cell Harvesting Device for the Treatment of Burns Requiring Hospitalization: An Economic Evaluation Using Real World Data**

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**Introduction:** Value is a prominent issue in healthcare measured by the clinical outcomes of good medical practices relative to the literal or figurative costs of care. As a result, cost effectiveness has become an essential measure when assessing new technologies in burn care. To help providers evaluate cost-effectiveness, the BEACON model was developed in 2018 using National Burn Repository (NBR) data. While the NBR data has tremendous value portraying a cumulative picture of burn care, it lacks resolution for new innovations such as autologous skin cell suspension (ASCS). In BEACON, ASCS was shown to reduce costs associated with the current treatment of severe burns, where this cost-saving was attributed to reductions in length of stay (LOS), the number of operations, the donor site size, and associated wound care. Our study examines the efficacy of the BEACON model by performing a multicenter real-world data (RWD) analysis of primary cost-savings measures of reduced LOS for patients treated with ASCS vs. standard of care (SOC).

**Methods:** De-identified electronic medical record data was collected over a 20-month period (1/2019 to 8/2020) from 43 burn centers in 14 states. Patients with burn injuries treated with ASCS were matched by age, gender, TBSA, and comorbidities to patients treated by current SOC treatment. Injury severity was calculated as categorical data with intervals: <10%, 10–19%, 20–29%, 30–39%, and 40–49% TBSA. Co-morbidities were also assessed to facilitate a 1:1 comparison of patients across the two cohorts. Cost analysis was determined prior peer-reviewed literature in burn care.

**Results:** A total of 2,438 patients were reviewed, and 162 were used in the matched cohort analysis (n=81 in each cohort). In these patients, 68% had <20% TBSA. When comparing patients matched on co-morbidities, burn %TBSA/extent, age, and gender, ASCS patients had a shorter LOS by 4.1 days. At an assumed cost of $6,795 per day, these differences in LOS produced savings of over $28,000 in hospital bed costs alone per ASCS patient versus SOC. LOS was the same or shorter for ASCS patients in 63% of cases with an average reduction of 4.1 days resulting in an overall savings of $2,269,530 for ASCS-treated patients compared to SOC.

**Conclusions:** Our study is the largest RWD cost-effectiveness analysis of ASCS vs SOC. This analysis confirms the BEACON model with savings primarily originating from reducing LOS, even for small burns with 68% of patients having burns less than 20% TBSA.

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**Managing Burn Wounds with Silvadene**

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**Introduction:** Topical delivery of antibacterial agents is typically incorporated and is an essential component of burn wound therapy. The goal is to prevent infection and promote the healing process. Poorly treated wounds can result in scarring or severely in sepsis and multi-organ dysfunction. Topical SSD cream has been the gold-standard for initial local care in partial thickness or full thickness burns. Due to immediate burst release of the drug into the exposed areas, application is relatively frequent (usually twice daily). However, it remains unknown whether twice-daily SSD dressings are superior to once-daily.

**Methods:** We maintained a twice-daily dressing change standard of care until 01/01/2019. Patients admitted after that date had their dressing changed once-daily. Our goal is to review outcomes for 75 patients before the change-of-practice and 75 patients after. The main outcomes recorded are wound infection rates, hospital-acquire complications (non-wound related), pain scores, daily narcotic requirements, average amount of SSD used, and length-of-stay.

**Results:** Preliminary results of the 75 pre-change-of-practice and 75 post-change-of-practice patients showed slightly better outcomes in the post-change group. Wound-infection rates were the same for both groups (pre=5.33%, post=5.33%), average daily pain-levens for the pre-change group were slightly higher but the difference was negligible and not statistically significant (pre=5.76, post=5.69). The pre-change group had a higher average daily narcotic dosage (pre=6.61mg, post=6.38mg), hospital-acquired complication rates were higher pre-change (pre=10.67%, post=6.67%), and length-of-stay was longer in the pre-change group (pre=10.81, post=9.25). The average amount of SSD jars used per patient was higher as well (pre=6.30, post=2.85). Statistical analysis of the distribution of burn type, age, and burn depth showed no discrepancy and a generalized decreased length-of-stay with once-daily SSD dressing change.

**Conclusions:** Preliminary results show that once-daily dressing changes of SSD in burn wounds have no negative
impact on wound outcomes. However, it is associated with a decreased length-of-stay, decreased pain levels, and less hospital-acquired complications. A decreased length-of-stay means reduced medical expenses for the patient and the hospital. In addition, less hospital-acquired complications result in better patient recovery. Since the difference in wound outcomes is negligible and statistically insignificant, changing the standard-of-care to once-daily could prove beneficial.

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40 Wildfire Burn Victims: A Unique Population
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Introduction: In the past ten years, wildfires have burned an average of 6.8 million acres annually. The frequency of wildfires is expected to increase with climate change. Wildfire burn victims have not been previously well characterized in the literature. As we prepare for more wildfires it is necessary to target populations at risk for sustaining burns with prevention efforts and to prepare hospital systems to meet these patients’ needs.

Methods: A retrospective review of patients admitted to a burn center between 2016 and 2019 was performed. Patients who were admitted after sustaining a burn attributable to wildfires were identified from the burn center database. Controls were matched to wildfire burn patients by age, gender and total body surface area of burn. The primary outcome was mortality. Secondary outcomes included number of operations, length of stay (LOS), intensive care unit (ICU) LOS, development of wound infections and pneumonia, wound culture microbiology.

Results: A total of 16 patients who had sustained burns in wildfires were identified and matched with 32 controls. There was no difference in mortality (19% wildfire vs. 9% non, p=0.386), LOS (18 days wildfire vs. 15 days non-wildfire, p=0.406), ICU LOS (17 days wildfire vs. 11 days non-wildfire, p=0.991) and number of skin grafts (1 wildfire vs. 0.5 non-wildfire, p=0.519). Patients who had sustained burns in a wildfire trended towards higher rates of pneumonia (31% wildfire vs. 13% non-wildfire, p=0.117), and higher rates of wound infection (31% wildfire vs. 19% non-wildfire, p=0.361). On evaluation of wound cultures for the 5 wildfire patients and the 7 non-wildfire patients who developed wound infections, more patients who sustained burns in wildfires had gram positive bacteria cultured from their wounds (100% wildfire vs. 29% non-wildfire, p=0.027). Patients who had sustained burns in wildfires trended towards increased likelihood of readmission (23% wildfire vs. 3% non-wildfire, p=0.080).

Conclusions: Patients who sustain burns in wildfires are likely at increased risk of readmission, of developing pneumonia and of developing gram-positive wound infections. Interventions for these patients should focus on pneumonia prevention and assistance with wound care after discharge.
Enhancing Burn Medical Care During a Disaster Using a Novel Augmented-Reality Application

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Introduction: In disaster or mass casualty situations, access to remote burn care experts, communication, or resources may be limited. Furthermore, burn injuries are complex and require substantial training and knowledge beyond basic clinical care. Development and use of decision support (DS) technologies may provide a solution for addressing this need. Devices capable of delivering burn management recommendations can enhance the provider’s ability to make decisions and perform interventions in complex care settings. When coupled with merging augmented reality (AR) technologies these tools may provide additional capabilities to enhance medical decision-making, visualization, and workflow when managing burns. For this project, we developed a novel AR-based application with enhanced integrated clinical practice guidelines (CPGs) to manage large burn injuries for use in different environments, such as disasters.

Methods: We identified an AR system that met our requirements to include portability, infrared camera, gesture and voice control, hands-free control, head-mounted display, and customized application development abilities. Our goal was to adapt burn CPGs to make use of AR concepts as part of an AR-enabled burn clinical decision support system supporting four sub-applications to assist users with specific interventional tasks relevant to burn care. We integrated relevant CPGs and a media library with photos and videos as additional references.

Results: We successfully developed a clinical decision support tool that integrates burn CPGs with enhanced capabilities utilizing AR technology. The main interface allows input of patient demographics and injuries with step-by-step guidelines that follow typical burn management care and workflow. There are four sub-applications to assist with these tasks, which include: 1) semi-automated burn wound mapping to calculate total body surface area; 2) hourly burn fluid titration and recommendations for resuscitation; 3) medication calculator for accurate dosing in preparation for procedures and 4) escharotomy instructor with holographic overlays.

Conclusions: We developed a novel AR-based clinical decision support tool for management of burn injuries. Development included adaptation of CPGs into a format to guide the user through burn management using AR concepts. The application will be tested in a prospective research study to determine the effectiveness, timeliness, and performance of subjects using this AR-software compared to standard of care. We fully expect that the tool will reduce cognitive workload and errors, ensuring safety and proper adherence to guidelines.

COVID-19 Slowdown? Not in Our Burn Center!

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Introduction: There has been a great concern that the COVID-19 pandemic has interfered with burn care. The feeling has been that resources have been shifted to treating the COVID patients and that “shelter-in-place” requirements have reduced the risks for burn injury. The ABA and other organizations have sent biweekly surveys in order to determine how the pandemic has interfered with burn care. Despite these concerns, we seemed very busy.

Methods: The inpatient data was collected in our adult and pediatric burn centers between January 1, 2020 and August 31, 2020.

Results: During the COVID-19 pandemic there was an increase in burn admissions in both adult and pediatric centers. At the same time there were 1270 COVID-19 adult admissions and 4 COVID-positive admissions at the pediatric center. In the adult center, there was increase from 414 total admissions from fiscal year 2019 (7/2018-6/2019) of 414 to 495 for fiscal year 2020 (7/2019-6/2020). The average daily census also increased from 18.33 to 18.36 during the same period. The monthly number of burn admissions increased from 38.5/month for the last six months of 2019 to 44/month for the first six months of 2020. The admission rate continued in July (41) and August (47). In the first 8 months of 2020, there were 356 admissions with a mean TBSA of 11.3%. There were many large burns admitted in late summer. The mean TBSA of the 12 bed ICU on September 11, 2020 was 60.6% (range 25–85%). In the pediatric unit, there were 174 admissions through July 2020, a 6% increase from the preceding same period. There was a 6% decrease in burn reconstruction.

Conclusions: Despite a significant burden of COVID-19 patients, burn admissions also increased at the same time. There was no evidence that “shelter-in-place” requirements changed the risk for burn injuries. Resources for critical care needs should not be siphoned away from burn centers during pandemics. Risky behaviors leading to burns do not go away despite new health crises.
Introduction: The net effect of the COVID-19 pandemic on this northeastern, urban healthcare system during March, April and May 2020 was the redirection of virtually all resources to the care of the affected population. Conversion of the majority of the hospital’s assets, including staff and infrastructure, to COVID care created a large reduction in resources for other clinical problems. The burn service was among those few essential disciplines that continued to receive acutely affected individuals during the crisis. The preservation of the burn center’s ability to continue its mission within the walls of a COVID hospital is the subject of this review.

Methods: All of the hospital’s ICU rooms, including all those on the burn unit, post anesthesia care units, some step-down units, and over 90% of the operating rooms (ORs) converted to COVID care ICUs. These vital actions by hospital administration enabled an increase in ICU beds from 114 to 270. Staff were redeployed to cover the massive influx of critically ill COVID patients.

Burn inpatients during the transition were categorized by severity and age for disposition consideration. Of the 17 inpatients, 4 pediatric patients discharged home and 1 transferred to our associated children’s hospital; 7 adults discharged home, 2 transferred to our associated inpatient psychiatric hospital, 1 to inpatient rehab, and 2 transferred to a neighboring orthopedic hospital converted into an adult acute care hospital.

The commitment to keep the burn center operational for both children and adults was facilitated by protecting the burn ICU hydrotherapy room, a large patient care space in the center of the burn ICU. Children, initially admitted and cared for in the hydrotherapy room until stable, transferred to our network Children’s hospital for continued care. Critical adult burns were admitted to the inpatient ICU with the COVID patients, acute burns were housed on the few remaining medical surgical units. Burn care was performed in the patients’ rooms to keep the hydrotherapy room “clean.”

Results: During the 3-month period described the burn service admitted and cared for 92 adult and 25 pediatric patients while maintaining a full ICU census. Although 3 admitted burn patients were COVID +, no burn patients in the ICU became COVID + during their stay.

Conclusions: The commitment to protect the burn hydrotherapy space for burn triage and care from the top level of administration was critical and notable given the widespread conversion of the subspecialty ICUs and most other patient care areas to COVID care units. Strict adherence to infection prevention guidelines and protection of the hydrotherapy room allowed burn patients to receive timely and appropriate care during a pandemic.

Introduction: The COVID-19 pandemic has had widespread effects on healthcare and society at large. There are limited data on the impact of the pandemic on the long-term recovery of the burn survivor. This study aims to compare physical and psychosocial outcomes of the burn survivor population before and during the COVID-19 pandemic.

Methods: Data from the Burn Model System National Database (2015-present) were analyzed. Data were divided into pre- and during-pandemic groups (before and after March 1st, 2020). Outcomes were compared at four cross-sectional time points: 6, 12, 24, and 60 months after burn injury. The following patient reported outcome measures were examined: SF-12 Health Survey, PROMIS-29, Post-Traumatic Growth Indicator, Community Integration Questionnaire, Patient Civilian Checklist, Satisfaction with Life Scale, Burn Specific Health Scale, NeuroQOL Stigma, 4-D Itch, and CAGE Questionnaire (drug/alcohol misuse). Given the cross-sectional design, potential differences in clinical and demographic characteristics were examined for each group at each time point. Adjusted mean outcome scores at each time point were compared between groups using a two stage multi-variable regression model with propensity score matching. For each time point, subjects from each group were matched. The propensity score was calculated using the following matching variables: gender, age, race, ethnicity, etiology, length of stay, and burn size. The mean score difference of outcomes within each matched sample was examined.

Results: Sample sizes varied by time point with a range from 420 at 6 months to 94 at 60 months. The during-COVID group comprised 10% of the total sample size. There were no significant differences in demographic and clinical characteristics between the groups at any time point. There were no significant differences between the groups in adjusted mean outcome scores across the different time points.

Conclusions: This preliminary examination showed no differences in myriad long-term outcomes at multiple time points after injury among burn survivors before and during the start of the COVID-19 pandemic. The results may suggest an element of resilience, however given the sample size and cross-sectional limitations further investigation is required to better understand the impact of COVID-19 on the burn population.
Introduction: A nuclear disaster would generate an unprecedented volume of thermal burn patients from the explosion and subsequent mass fires (Figure 1). Prediction models characterizing outcomes for these patients may better equip healthcare providers and other responders to manage large scale nuclear events. Logistic regression models have traditionally been employed to develop prediction scores for mortality of all burn patients. However, other healthcare disciplines have increasingly transitioned to machine learning (ML) models, which are automatically generated and continually improved, potentially increasing predictive accuracy. Preliminary research suggests ML models can predict burn patient mortality more accurately than commonly used prediction scores. The purpose of this study is to examine the efficacy of various ML methods in assessing thermal burn patient mortality and length of stay in burn centers.

Methods: This retrospective study identified patients with fire/flame burn etiologies in the National Burn Repository between the years 2009 – 2018. Patients were randomly partitioned into a 67%/33% split for training and validation. A random forest model (RF) and an artificial neural network (ANN) were then constructed for each outcome, mortality and length of stay. These models were then compared to logistic regression models and previously developed prediction tools with similar outcomes using a combination of classification and regression metrics.

Results: During the study period, 82,404 burn patients with a thermal etiology were identified in the analysis. The ANN models will likely tend to overfit the data, which can be resolved by ending the model training early or adding additional regularization parameters. Further exploration of the advantages and limitations of these models is forthcoming as metric analyses become available.

Conclusions: In this proof-of-concept study, we anticipate that at least one ML model will predict the targeted outcomes of thermal burn patient mortality and length of stay as judged by the fidelity with which it matches the logistic regression analysis. These advancements can then help disaster preparedness programs consider resource limitations during catastrophic incidents resulting in burn injuries.
Increased Concomitant Burn and Trauma Injuries Follows an Increase in Overall Trauma Volume: A Descriptive Analysis

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McGovern Medical School at UT Health, Houston, Texas

Introduction: Concomitant traumatic injury in the burn patient complicates care coordination and increases morbidity and mortality. The incidence of concomitant injury, however, is uncommon and reported to range from 5–7%. In May 2020, our level 1 trauma center began seeing 40% more patients per month that the 12 months prior. We sought to determine the incidence of concomitant injury in burn patients during this time of increased trauma volume and to examine the associated traumatic injuries in this group.

Methods: The burn registry at a single ABA-verified burn center was examined from 5/20–9/20. Patients with concomitant burn and traumatic injury were examined with respect to: %TBSA burn, mechanism of injury, operative interventions, associated traumatic injuries, and length of hospital stay. Continuous data was presented as mean (standard deviation).

Results: Eighty-nine burn patients were admitted during this period, of whom 24 (26.9%) had concomitant traumatic injuries. The cohort was young and mostly male; the mean TBSA was 16% (Table 1). The most common mechanism of injury was motor vehicle collision (12 or 50%), followed by fall after high voltage electrical injury (6 or 25%) and motorcycle collisions (5 or 21%).

The most common associated injuries were: pulmonary contusions 29.1% (7/24); long bone fractures 25% (6/24); pelvic/acetabular fractures 20.8% (5/24); femur fractures 16.6% (4/24); and solid organ injury: 16.6% (4/24).

Twenty patients (83.3%) required burn or trauma operative intervention during hospital stay. Of the 20 patients who required operative intervention, 85% underwent burn surgery and 55% underwent trauma surgery (solid organ or orthopedic). Forty percent of these patients required operation for both burn and traumatic injury. In looking specifically at the electric injury group, all six patients required operative intervention for burn injuries, and four required extremity fasciotomy. Patients with electrical injury had a significantly longer hospital stay relative to their TBSA (p< 0.04).

Conclusions: Concomitant trauma and burn injuries are infrequent yet present a major clinical challenge. Our recent increase in overall trauma volume was paralleled by an increase in patients with concomitant burn injuries. The associated traumatic injuries require a multi-disciplinary approach to minimize morbidity and restore function.

<table>
<thead>
<tr>
<th>Table 1. Demographics of combined trauma/burn patients</th>
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<tbody>
<tr>
<td><strong>Total Combined Burn/Trauma (n=24)</strong></td>
</tr>
<tr>
<td><strong>Average Age (yrs)</strong></td>
</tr>
<tr>
<td>--MVC</td>
</tr>
<tr>
<td>--MCC</td>
</tr>
<tr>
<td>-- Fall/Electric</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td><strong>% TBSA (n=24 combined Trauma/burn)</strong></td>
</tr>
<tr>
<td>% TBSA burn MVC</td>
</tr>
<tr>
<td>% TBSA burn MCC</td>
</tr>
<tr>
<td>% TBSA burn Fall/Electric</td>
</tr>
<tr>
<td>% TBSA burn Fall/Electric</td>
</tr>
<tr>
<td><strong>Mechanism</strong></td>
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<tr>
<td>--MVC</td>
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<tr>
<td>--Fall/Electric</td>
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<tr>
<td>--MCC</td>
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COVID-19 Impact on Burn Care: A Summary of Weekly Bed Counts and Surge Capacity

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Introduction: The COVID-19 pandemic has raised global awareness of healthcare resource limitations. Specifically, the pandemic has demonstrated that burn disaster planning should involve non-burn disasters that threaten staff, supplies, or space. The ABA facilitated bed counts with the assistance of regional disaster coordinators from April through August of 2020. Our analysis examines the impact of the pandemic on burn surge and bed capacity in the U.S.

Methods: Bed availability was obtained by the ABA regional disaster coordinators through an initiative by the Organization and Delivery of Burn Care Committee. Bed availability was defined as immediately available burn beds and categorized as adult, pediatric, or flexible. Surge capacity was defined as the maximum number of patients that a burn center could admit in a surge situation. Data was deidentified by the central office with descriptive statistics to determine bed availability and surge capacity trends regionally and nationally.

Results: Bed counts were performed 6 times from 04/17/2020 through 08/14/2020. Response rates from the 137 North American burn centers varied from 86–96%. At least 6 burn centers (5%) were either closed or converted for COVID patients during the initial two bed counts. The total number of adult or pediatric burn beds was 2,082. Total bed availability decreased from 845 at the first survey down to 572 beds at the last survey. Surge capacity baseline was 1,668 and decreased from 1,132 beds in the initial survey down to 833 beds in the final survey.

Conclusions: Our study demonstrates a significant impact on burn bed availability due to the COVID-19 pandemic with a 37% reduction in available burn beds from April to August and a 26% reduction in surge capacity. This study demonstrates a substantial reduction in bed availability during the pandemic with additional analysis in process to examine regional trends.

Higher Admission Frailty Scores Predict Increased Mortality, Morbidity and Healthcare Utilization in the Elderly Burn Population

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Introduction: The Rockwood Clinical Frailty Scale is a validated rapid assessment of frailty phenotype, predictor of mortality and other clinical outcomes in the geriatric population, even when applied retrospectively. Using data from a large tertiary care burn center, we assessed the association between admission frailty in an elderly burn population and outcomes.

Methods: Retrospective analysis of burn patients ≥ 65 years, admitted to a tertiary care referral burn center from 2015–2019 (n= 652). Patients were assigned to Rockwood frailty subgroups, low (1–3), moderate (4–6), or high (7–9), based on comprehensive medical, social work, physical and occupational therapy assessments. Patients who did not have complete assessments to allow for appropriate frailty scoring were excluded. Hospital-associated infections (HAIs) were identified through the institutional epidemiology database and healthcare utilization data were extracted from burn registry and medical records. Cox proportional hazards regression was used to estimate associations between admission frailty and 30-day inpatient mortality.

Results: Our study included 644 patients (low: 262, moderate: 345, and high: 37 frailty subgroups). Frailty was associated with higher percent TBSA (median TBSA: low 2.0%; moderate 3.0%; high 3.0%; p=0.01) and older age at admission (p=0.0004). The 30-day cumulative incidence of mortality was 2.3%, 7.0%, and 24.3% among the low, moderate, and high frailty strata, respectively. After adjustment for age, TBSA and inhalation, high frailty was associated with increased 30-day mortality (HR 5.73; 95% CI 1.86, 17.62). Moderate frailty appeared to increase 30-day mortality, although estimates were imprecise (HR 2.19; 95% CI 0.87–5.50).

Morbidity and healthcare utilization results are reported in Table 1. Higher frailty was associated with any ICU stay during the hospitalization, need for mechanical ventilation, and higher median hospital cost/day. HAIs were infrequent in all frailty subgroups. The proportion of patients discharged to hospice, rehab, long and short-term care facilities was highest in the high frailty subgroup. Those in the moderate and low subgroups were more likely to be discharged home or home with services.

Conclusions: Higher admission frailty is associated with an increased 30-day mortality regardless of age group. Higher frailty correlates with increased morbidity and healthcare utilization.
Comparing Intravenous & Subcutaneous Insulin Regimens for Management of Hyperglycemia in Adult Burn Patients

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Eskenazi Health, Indianapolis, Indiana

Introduction: Burn patients are at an increased risk of hyperglycemia due to metabolic, anabolic, and treatment-related factors. Studies in burn patients have targeted goal blood glucose (BG) values ranging from 80–140 mg/dL. Our study aimed to evaluate current management of hyperglycemia in burn patients and to develop a treatment protocol in this population.

Methods: A retrospective study of patients admitted between 10/2016 - 8/2019 was conducted. Eligible patients were at least 18 years old, admitted within 48 hours following injury, and admitted for either thermal, chemical, or electrical burn, frostbite, or inhalation injury. The primary outcome was glycemic control, defined as percent of time spent within our predefined BG goal range of 90–130 mg/dL using a time-weighted BG (TWBG) level. Insulin regimens were compared to determine the most effective modality for achieving this goal. Additional secondary outcomes included consequences of hypoglycemia, complications of poor glycemic control, length of stay, and in-hospital mortality.

Results: A total of 68 patients were evaluated, and 48 met inclusion criteria. Majority of patients were male (73%), with a mean (SD) age 60 (16) years, median (IQR) TBSA 10% (4,19), and median (IQR) baseline HbA1c 6.6% (5.6,8.2). Twenty-four (50%) patients did not have a history of diabetes. Patients spent a median (IQR) 38% (20,61) of days in goal range. Twelve patients (25%) had a TWBG level between 90–130 mg/dL. Overall, the median (IQR) TWBG level for all 48 patients was 140 mg/dL (132,160). Majority of patients were either on an insulin infusion (60%) or basal + sliding scale insulin (SSI) (51%). Patients that were on insulin infusions were controlled for a median (IQR) 75% (50,83) of days compared to patients treated using basal + SSI 20% (0,40) of days (p< 0.01). Other regimens are included in the table below. No patients were hypoglycemic (BG less than 70 mg/dL) based on TWBG.

Conclusions: The majority of patients in this study were not within goal BG range during their hospitalization. Patients were primarily managed by an insulin infusion or basal + SSI. However, the most appropriate regimen appears to be an insulin infusion or basal + bolus + SSI.

### Table 1. Morbidity and healthcare resource utilization outcomes.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Overall</th>
<th>Insulin Infusion</th>
<th>Basal + SSI</th>
<th>Insulin Infusion vs Basal + SSI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comorbidities, median (IQR)</td>
<td>39 (16,37)</td>
<td>33 (16,35)</td>
<td>45 (16,54)</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Age at entry, median (IQR)</td>
<td>28 (4,72)</td>
<td>29 (4,72)</td>
<td>27 (4,72)</td>
<td>0.05</td>
<td></td>
</tr>
</tbody>
</table>

### Figure 1. Rockwood Frailty Score at admission and 30-day inpatient mortality.

#### Table 2.

<table>
<thead>
<tr>
<th>Group (Frailty 4)</th>
<th>Adjusted Kaplan-Meier Survival Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frailty 4</td>
<td>0.82 (0.69, 0.96)</td>
</tr>
<tr>
<td>Frailty 5</td>
<td>0.72 (0.62, 0.82)</td>
</tr>
</tbody>
</table>

#### References:

Introduction: Enoxaparin, a low molecular weight heparin, has been proven to safely and effectively prevent venous thromboembolism (VTE) in acutely ill patients. Burn patients may be particularly vulnerable to the occurrence of a VTE due to prolonged immobility, frequent operating room procedures, and low flow states. Treatment of acute VTE is associated with a direct medical cost of $12000-$15000 and subsequent complications increase costs to $18000 to $23000 per case. Current institutional protocol for initiation of enoxaparin in all burn adult patients is 40 mg administered subcutaneously every 12 hours. Anti-Xa levels are used to monitor anticoagulation prophylaxis, with 0.3–0.5 U/mL recognized as the prophylactic range. Doses are subsequently modified in 10 mg increments to achieve goal prophylaxis anti-Xa levels. The purpose of this study was to evaluate current practice (CP) and assess if the implementation of a published enoxaparin dosing algorithm could minimize delay in achieving anticoagulation prophylaxis.

Methods: A retrospective chart review was performed of 94 adult burn patients. The doses and time required to reach goal prophylaxis anti-Xa levels using current practice (CP) were compared to the predicted algorithm dose (AD). The number of dose adjustments and the number of days needed for adjustments for CP were documented. Charges related to laboratory determinations and medication administration were calculated.

Results: Of the 94 patients reviewed, the average age was 47 years, the majority were male (74%), mean actual weight 92 kilograms and mean TBSA 15.7%. The most common mechanism of injury was flash/flame (63%) with 18% suffering an inhalation injury. On average, using CP it took 9.3 days to get to goal prophylaxis anti-Xa levels, with a mean of 2.86 anti-Xa lab tests needed and an average prophylactic dose of 55.5 mg. A total of 360 labs draws were performed and 74% were timed correctly. The CP average starting dose was lower than the AD 40 mg versus 45 mg (p < .0001). If the algorithm had been used the number of dosing adjustments would have been 25% less. The algorithm underestimated the starting dose in only 2.1% of the population. The average charges until goal was met for enoxaparin were $2,933 and $787 for anti-Xa levels.

Conclusions: This study demonstrates increased clinical efficacy and cost-effectiveness for an algorithm driven enoxaparin dosing regimen for burn patients. Prospective study with larger patient numbers is warranted.

Introduction: Previous studies have found that burned-injured patients who use illicit substances, such as methamphetamines, have worse outcomes and longer hospital lengths of stay when compared to those who do not use illicit drugs. It is our unit’s stated practice to perform a urine drug screen on all patients admitted with a burn injury. We hypothesize that, while we intend to test all patients, we fall short of this goal. The purpose of this study is to examine our urine drug screening practices.

Methods: Following IRB approval, a retrospective chart review was conducted using electronic medical records of all adult patients admitted to the burn center from 2016–2018. Data collected included information on the burn injury, drug screening, and demographics. Due to the fact that many patients receive opioids and benzodiazepines for pain and anxiety related to their burn injury, these were not considered positive if present on drug screen without gas chromatography to confirm use. Data analysis was conducted using chi-square, t-test, and logistic regression models.

Results: A total of 1134 patients (mean age 45.9 ± 17.3 years, 855 males (75.4%), mean burn size (TBSA) 12.1±15.5%) were analyzed. Of the 1134 patients admitted, 65% had a urine drug screen performed. Of those who were not screened, 12.1% had a test ordered but not performed while 87.8% had no test ordered. Globally, amphetamines/methamphetamines were the most commonly detected substances in 262 patients (23.1%) followed by cocaine with 14 patients (0.2%). Those with larger burns were more likely to be tested with the mean burn size of those tested being 15.0% while the mean size of those not tested was 6.6%, p< 0.0001. When looking at the effect of age on drug screening, those at the extremes of age (< 20 years (37.5%), 61–70 years (38.9%), 71–80 years (51.5%) and >80 years (76.9%)) were more likely to not be tested (p< 0.0001). All other age groups had a rate of not testing between 30.3% and 33.6%. Additionally, overall men were more likely to be tested than women (68.3% vs. 54.8%, p< 0.0001). On multivariate logistic regression, age (OR 0.99 (0.98–0.99), p< 0.0001), burn size (OR 1.07 (1.05–1.08), p< 0.0001), and female gender (OR 0.61 (0.45–0.81), p=0.0008) were independently associated with a patient receiving a urine drug screen.

Conclusions: Although our intention is to perform a urine drug screen on all patients admitted with burn injury, we fall short of this goal. A significant number of patients do not get tested and these tend to be older patients, those with smaller burns, and women. Given that drugs of abuse can alter patient outcomes we need to be more rigorous in our efforts to obtain tests on all patients.
Impact of National Marijuana Legalization on Delirium Rates and Opioid Use in Acute Burns

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University of Toronto, Toronto, Ontario; University of Toronto, Toronto, Ontario; Sunnybrook Health Sciences Centre, Toronto, Ontario; Sunnybrook Health Sciences Centre, Toronto, Ontario

Introduction: Cannabis use has been associated with larger total burn size areas, longer hospital stays, and an increased number of operations. Legalization of marijuana in Colorado has led to marked increases in burn injuries. Tetrahydrocannabinol (‘THC’) use has been shown to increase psychosis, anxiety, and depression, however, it is unknown how this has impacted rates of ICU related delirium in the burn context. Further, observational studies have shown that marijuana use has decreased opioid-related overdoses, but it is unknown how chronic marijuana use affects opioid consumption in the ICU. Thus, it is unknown how national marijuana legalization has impacted ICU rates of delirium and opioid use. As such, the objectives of this study are to describe trends of marijuana legalization on burns and determine if the amount of delirium and opioid use while in hospital has increased after national marijuana legalization.

Methods: We conducted a retrospective cohort study of 514 patients admitted to an ABA-verified centre one year prior to national marijuana legalization and one-year afterwards. Inclusion criteria consisted of an acute burn injury admission. Data included demographics, toxicology screening information, hospital rates of delirium, and pain medication use. Statistical analysis consisted of student’s t-test, one-way ANOVA, Kruskal-Wallis, Mann-Whitney U, Fisher’s exact, and $\chi^2$ test. P value of < 0.05 was considered statistically significant.

Results: Out of 514 patients, 422 were included; 203 prior to legalization (‘PL’) and 219 afterwards (‘AL’). Cohorts were similar regarding age, gender, inhalation injury, and smoking history, TBSA, length of stay, police custody, major psychiatric illness, alcoholism, and drug dependence were significantly higher in the AL cohort. Positive cannabinoid screens were similar in each cohort (13.3 versus 13.7%), however in both cohorts a large proportion of admissions did not have a toxicology screen completed (58.4–63.5%). Delirium rates (‘PL’=0.5%, ‘AL’=4.1%; $p=0.02$) and opioid use (‘PL’=48%; ‘AL’=52%; $X^2(1, N=422) = 5.7, p=0.02$) were significantly higher in the AL cohort.

Conclusions: National legalization of marijuana is associated with increased in-hospital delirium rates and opioid consumption in the acute burn context. Every effort should be made to ensure toxicology screens are completed on admission with the appropriate use of both opioid and adjunct pain medication regimens. In addition, for those not eligible for a toxicology screen due to delayed arrival time to the burn centre, an in-depth discussion should be completed to elicit drug history.
Modified Frailty Index is an Independent Predictor of Death in the Burn Population: A Secondary Analysis of the Transfusion Requirement in Burn Care Evaluation (TRIBE) Study
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Introduction: Previous studies in the burn population have noted frailty as an independent predictor of inpatient and outpatient mortality. The Modified Frailty Index (MFI) uses comorbidities tracked by the American College of Surgeons National Surgical Quality Improvement Program to help to predict morbidity and mortality in patients. The purpose of this study was to determine whether or not the MFI-5 and MFI-11 would predict mortality in the burn population.

Methods: A secondary analysis of the prospective, randomized, multicenter Transfusion Requirement in Burn Care Evaluation (TRIBE) study was conducted. Statistical analysis with chi-square for categorical variables and student’s t-test for continuous variables were conducted. Frailty was determined using the MFI-5 (functionally dependent, diabetes mellitus, chronic obstructive pulmonary disease, congestive heart failure, hypertension) and MFI-11 (using the aforementioned 5, as well as myocardial infarction, hypertension, delirium, transient ischemic attack/cerebrovascular accident (without deficits), cerebrovascular accident (with deficits), peripheral vascular disease) from comorbidities included in the Burn Registry. Patients were considered frail if they had an MFI > 1 on either scale. Multivariate regression was used to compare mortality between those who were and those who were not considered frail based on this index.

Results: A total of 347 patients with a mean age of 43±17 years, 73 women and 274 men, were analyzed. Mean total body surface area burn (TBSA) was 38±18%, and 23% had inhalation injury. As continuous variables, MFI-5 (OR 1.86; 95% CI 1.11–3.11; p-value 0.02) and MFI-11 (OR 1.83; 95% CI 1.18–2.8; p-value 0.007) were independent predictors of mortality. In addition, TBSA total, age, and female gender were all independent predictors of mortality. Having a MFI-11 > 1 was considered an independent predictor of mortality (OR 2.91; 95% CI 1.11–7.7; p-value 0.03); whereas, having a MFI-5 > 1 was not considered an independent predictor of mortality (OR 2.6; 95% CI 0.95–7; p-value 0.06).

Conclusions: A MFI-11 > 1 in the burn population was an independent predictor of mortality, as were total TBSA, age, and female gender. Given these findings, further study on the predictive value of MFI-11 in major burn injury is warranted.

Designing and Implementing an Obese Lund and Browder: A Pilot Study
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University of California Irvine Medical Center, Huntington Beach, California; University of California Irvine Medical Center, Orange, California; University of California Irvine Medical Center, Orange, California; University of California Irvine, Orange, California; University of California Irvine Medical Center, Columbus, Ohio

Introduction: Accurate determination of the total body surface area (TBSA) burned is an essential element for the clinical management of burn care. The Lund and Browder (LB) is a tool that allows practitioners to calculate the TBSA burned, which is used to determine fluid needs, nutritional requirements, and graft site availability. Studies have shown that individuals with a body mass index (BMI) greater than 30 have an increase in surface area in the trunk and lower extremities, making the applicability of the traditional LB less accurate. The objective of this study was to develop and implement an electronic obese LB and compare it to the traditional LB.

Methods: Using the paper by Williams et al. as a guide, an obese LB was constructed for each body type: android, gynecoid and mixed (Table 1). Based on the patients BMI, the hospital’s Electronic Medical Record (EMR) would direct staff to the appropriate LB. All providers were formally trained on the obese LB, body types and changes in body surface area measurements. A retrospective chart review of adult patients admitted from January 2020 to September 2020 with a BMI≥30 was conducted. The BMI, body type, and location of burn was analyzed for each patient. The TBSA burned was recalculated for each patient using the traditional LB and compared to the obese LB completed at admission.

Results: A total of nineteen patients had a BMI≥30 and an admission obese LB completed. The TBSA burned ranged from 0.25–78.5%. The difference in TBSA burned calculated by the traditional and obese LB was 4.2±8.8 % (Figure 1). In patients with burns to the trunk or lower extremities (n=7) a difference of 12±10.5% was observed.

Conclusions: Limited research exists demonstrating the use of a standardized obese LB in clinical practice. No patient complications were identified with the use of the developed obese LB. Evaluation of the data revealed that the traditional LB often underestimated the TBSA burned in obese patients with burns to the trunk and/or lower extremities. This could lead to under-resuscitation and complications related to hypovolemia. In addition, expectations on patient survival and outcomes become inaccurate. As obesity grows in prevalence having a LB that recognizes the difference in surface area observed in the trunk and lower extremities can improve patient outcomes. Further research with a larger sample size is needed to gain a greater understanding of the clinical impact of an obese LB. We have shown that accurate determination of the burn area in obese patients can be done in a standardized fashion within the EMR.
The Impact of a Nurse Morbidity and Mortality Meeting

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Introduction: Physicians have long held Morbidity and Mortality (M&M) conferences to discuss complications and deaths. The format for these conferences lays out the case, discusses care performed, and generates discussion on areas of opportunity. Physician M&M usually focuses on teaching and the presenter may not be the caregiver. There is not much literature on the use of this teaching methodology in nursing. Due to the strong culture of safety on the unit, it was determined that using a similar format for nursing on the Burn Unit could prove beneficial for discussion of complications, deaths, errors, and good catches.

Methods: Nurse M&M is held monthly for one hour. The nurses are given the opportunity to present the individual case or give personal testimony as to the situation from their point of view. The cases are all presented in the same format. The initial slides cover background, history of present illness, and where the report came from. Next is all of the pertinent review from the electronic charting system and any discussions had with those involved in the case. The presenter then opens the floor for discussion. If there was a variation in practice, the policy or procedure that relates to the error is reviewed. Topics for Nurse M&M are gathered through many different venues. The hospital uses an online reporting system for electronic submission of adverse events, variations in care, and good catches. The entire multidisciplinary team have all individually reported something they wanted discussed at Nurse M&M. If clarification is needed on a case, the question is punt back to the appropriate decision maker and followed up to the staff.

Results: Nurse M&M is the most highly attended, non-mandatory, meeting held on the unit. The nursing staff was surveyed to determine their perceptions on how the addition of Nurse M&M had effected them. The results were overwhelmingly positive. All nurses surveyed rated the statement, “I feel that Nurse M&M has had a positive outcome on the unit’s collective practice”, as agree or strongly agree. Over time, the notes taken have evolved into a basic table of what was discussed and if there were action items created off of a case. The staff have come to the point where they will self-report events before they are entered into the online system.

Conclusions: In conclusion, the Burn Unit nursing staff are highly engaged Nurse M&M. The staff are open to discussing errors in a way that fosters educational growth and critical thinking development. Even if the case being discussed is because of a personal error, more often than not, the person responsible will discuss why they made the decision they did and facilitate the discussion with their peers as to what could have been done differently. The bedside nurses’ commitment to being present, engaged, and open minded are strong signs of the healthy work environment present on the unit.
**Correlative VIII - Outpatient Care**

**C-158**

57  **Safety and Cost Effectiveness of Outpatient Surgery in Acute Burn Care**

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**Introduction:** Outpatient burn surgery is increasingly utilized for delivery of acute burn care. Reports of its safety and efficacy are limited. The purpose of our study was to evaluate the safety and cost reduction associated with outpatient burn surgery and to describe our centre’s experience.

**Methods:** This was a single centre, retrospective cohort study of consecutive patients who underwent outpatient acute burn surgery requiring split thickness skin graft or dermal regenerative template from January 2010 - December 2018. Patients with insufficient follow up to evaluate operative site healing were excluded. Patient demographics, comorbidities, burn etiologies, operative data and postoperative care were reviewed. The primary outcome is complication involving major graft loss requiring reoperation.

**Results:** 165 patients and 173 procedures met the inclusion criteria. The average age was 44 years and 60.6% (100/165) were male. The number of annual outpatient procedures increased 48% from 23 to 34 cases over the 9-year period. The mean grafted total body surface area was 1.0 ± 0.9%. Rate of major graft loss requiring reoperation was 5.2% (9/172). Greater than 95% graft take was achieved in 80.9% of patients. Age, sex, co-morbidities, total body surface area, and procedure types were not significantly associated with postoperative complication rate. Outpatient burn surgery model was estimated to save CA$7,875 per patient from inpatient costs. This extrapolates to a total of over CA$1.36 million in savings over the 9-year study period.

**Conclusions:** Acute burn care at our centre is increasingly being delivered through an outpatient day surgery model. Our demonstration of its safety and considerable cost savings is compelling for further utilization. Our experience found the adoption of improved dressing care, appropriate patient selection, increased patient education, adequate pain control, and regimented outpatient multidisciplinary care to be fundamental for effective outpatient surgical burn care.

58  **Rate and Predictors of Outpatient Follow-Up Compliance of Pediatric Burn Patients During the COVID-19 Pandemic**

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**Introduction:** The effect of the COVID-19 pandemic has led to increased isolation of families at home and potentially decreased access to the healthcare system. We therefore evaluated the effect of COVID-19 on rates of compliance with recommended post-injury follow-up. We hypothesized that this isolation may lead to detrimental effects on adherence to proper follow-up for children with burn injuries.

**Methods:** We queried the registry at an ABA-verified Level 1 pediatric burn center for patients aged 0–14 years who were treated and released from March 30 to July 31, 2020, which represents the height of the pandemic. As a control, we searched the registry for patients treated during the same time frame from 2016 to 2019. Patient and clinical factors were compared between the COVID and pre-COVID cohorts. Predictors of follow-up were compared using chi-squared and Kruskal-Wallis tests. Multivariable logistic regression was used to evaluate for predictors of compliance with follow-up.

**Results:** A total of 401 patients were seen and discharged from the pediatric ED for burn injuries. The COVID cohort consisted of 58 (14.5%) of these patients. Burn characteristics and demographic patterns did not differ between the COVID and pre-COVID cohorts. Demographics, including age, gender, race, and ethnicity did not differ between patients with 2-week follow-up and those without. The rate of compliance was not affected (62.4% prior to COVID vs. 55.2% during, p=0.29). As expected, burn size, burn depth, and mechanism of injury all significantly predicted compliance with 2-week follow up (table 1). After adjusting for these variables, there was still no difference in the odds of appropriate follow up (OR 0.6, 95% CI 0.3 - 1.1; p=0.12).

**Conclusions:** Despite concerns about decreased access to healthcare during the pandemic, the experience at our Level 1 pediatric burn center, including rates of follow-up for those managed as outpatients, appears unchanged.
Impact of A Mature Burn Telemedicine Program On Inpatient, Outpatient, and Aftercare Programs During COVID19.

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Introduction: In 2014, a multidisciplinary burn telemedicine program was developed in order to increase access of burn specialists and improve care. This proved to be beneficial in the face of the pandemic through utilization of existing programs and development of new processes.

Methods: The basis of this burn telemedicine program utilizes a partnership approach. Visit types include inpatient and outpatient consultation, with visits occurring in in-patient settings, emergency departments, out-patient clinics, and in patient’s homes. During the COVID 19 pandemic, a weekly meeting was held with telemedicine program and clinic leadership, program coordinators, and our burn surgeon to triage patients to telemedicine or inpatient visit types. This often required the nursing staff to contact the patients to obtain more information about the injury and help them to securely upload photographs. The telemedicine visits were primarily video visits occurring either in clinic settings or the patient’s home. The burn psychotherapist and occupational therapists also utilized telemedicine for patient care. In addition, aftercare support groups, which originally were held twice each month onsite, transitioned to video and increased to three times. Telemedicine is also being utilized for school re-entry programming and the annual burn camps. The program is also tracking reimbursement for telemedicine activities.

Results: The pandemic resulted in a significant increase of telemedicine visits as compared to in person clinic visits often occurring directly into the patient’s homes. A greater number of burn patients were seen overall than previous to this process. Attached graphs show the comparison of in person visits compared to telemedicine visits during this time frame. Additional data will be presented showing the breakdown of visit location, provider (psychotherapist versus surgeon for example), and usage with aftercare programming.

Conclusions: This telemedicine program with established processes and partnerships, allowed transitioning alternative care due to the pandemic to be less stressful event. Benefits to patient care included the ability of the multidisciplinary burn team to see more patients safely via video especially in their own homes and allowed continuation and expansion of aftercare support. Challenges experienced included needing additional staff to ensure patients were triaged appropriately, scheduling of visits, and technology training for patients and families, and to ensure that patients were receiving medications and dressings as needed. The increased volume of patients seen could be attributed to more frequent visits and an increased volume of burn injuries.
A Retrospective Review of Factors Influencing Post-Hospital Discharge Follow-up in Patients with Burn Injuries

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Introduction: Approximately 486,000 burn injuries, requiring hospitalization and/or outpatient care occur annually. Physical and psychosocial problems may develop at any time during recovery and it is important that care continue after discharge to maximize outcomes. Often, patients discharge themselves from clinic for unknown reasons. The purpose of this study was to identify factors related to self-discharge.

Methods: A retrospective chart review of patients admitted to the burn center and outpatient follow up visits in 2018 was performed. Patients were grouped by lost to follow up (LTF) versus completed patients (COM). The LTF were further stratified by distance from clinic (≤ 50 miles vs. > 50 miles). COM were categorized as those who were discharged from clinic as PRN follow up visits.

Results: A total of 211 patients were scheduled for outpatient visits, mean age was 36.4 years and 74% were male. Most were Caucasian (41%) and Hispanic (31%). The most frequent payor sources were Medicaid (58%)/Medicare (17%). Mean TBSA was 5.8%, the most common mechanisms were Flame/Flash and Scald (30% each). Mean length of stay was 10.3 days, mean number of surgeries was 1.5. The majority of patients were discharged Home (71%). The mean number of outpatient visits was 3.57. A total of 165 (78%) were lost to follow-up. LTF patients had a smaller TBSA (4.69%) compared to COM (9.62%). Comparison between LTF and COM, showed no significant difference in age, race, distance from clinic, or disposition. However, larger TBSA (p=0.0009), longer length of stay (p=0.01), more surgeries (p=0.0105), patients with ongoing scar management (p=0.00001), and patients with Workman’s Comp (p=0.048) were more likely to complete outpatient follow up. Patients with closed wounds (p=0.0001), substance abuse (p=0.0168), mental illness (p=0.0403), smokers (p=0.0192) were less likely to complete outpatient follow up as directed. The number of complications was also higher (p=0.0433) in the LTF group. When LTF were stratified by distance, Native Americans were significantly more likely to live > 50 miles from the clinic (p < 0.0001).

Conclusions: A large percentage of patients discharged themselves from clinic. Factors associated with self-discharge include healed wounds, no scarring issues, smoking, substance abuse and mental illness. Given the geographic distribution of races and ethnicities in our state, it is unsurprising that Native Americans live distant to our clinic. This provides an opportunity to expand our outreach efforts and incorporate the use of technology to improve access to care for this population.
61 Real-time Burn Outpatient Virtual Visits in the Home During the Era of COVID-19

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Introduction: The majority of burn injured patients travel long distances to receive burn care from regional burn centers, creating a burden on families and impairing outcomes. Recent federal policies in response to the COVID-19 pandemic have relaxed some of the barriers to virtual visits in the non-health care setting. We sought to review the experience of a comprehensive burn program in managing burn patients with a virtual platform.

Methods: A clinical quality database was maintained to evaluate virtual videoconference and in-person clinic visits for a comprehensive adult and pediatric burn program during the COVID-19 pandemic (March 2020 to August 2020). Virtual visits utilized a telemedicine platform that employs real-time audio and video communication. Demographic, burn severity, and visit quality data were recorded. Zip code data was also collected and then used to calculate the following estimated savings for the patient and their family: total miles, travel hours, driving costs, and wages.

Results: A total of 145 patients were included in this study with 96 (66.2%) male and 49 (33.7%) female. 91 (62.8%) were pediatric patients with a mean age of 6.2 ± 0.5 years and 54 (37.2%) were adult patients with a mean age of 40.4 ± 2.5 years. There were 320 total burn outpatient follow-up visits with 199 pediatric visits (40 virtual and 159 in-person) and 121 adult visits (24 virtual and 97 in-person). The majority of patients (73.1%) were treated as in-person visits while 6.9% had purely virtual visits, and 20.0% of patients had both virtual and in-person visits. The following savings were associated with virtual visits: 8562.6 total miles (average 133.8 ± 42.4), $6789.29 total driving cost (average $106.08 ± 33.61), 161.5 total travel hours (average 133.8 ± 42.4), and $4758.42 total wages lost to travel (average $106.08 ± 33.61). Estimation were only reported in 14% of total visits (2.5% of pediatric virtual visits and 33.3% of adult virtual visits).

Conclusions: Outpatient virtual visits for burn care are a new frontier, driven by improvements in technology and reduced barriers to reimbursement. This study demonstrates that virtual visits are associated with major financial and temporal benefits for patients and their families. Technical issues remain an important barrier, particularly in the adult population. A clear understanding of this and other barriers may improve implementation of this new healthcare delivery paradigm.

Savings from 64 Virtual Visits

62 The Essential Need of Having Dedicated Clinical Social Workers in Both the Burn Outpatient and Inpatient Setting

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Introduction: By providing holistic support to the entire patient, a licensed clinical social worker (LCSW) plays an essential role on a Burn Center multidisciplinary team. A majority of our burn population exhibit difficulties in navigating the complex array of psychosocial issues in regard to basic needs such as employment, food, housing, and transportation. While these needs can be addressed with inpatients, our patients who follow-up in Burn Clinic face additional challenges. A need was identified to have a dedicated LCSW in the outpatient setting.

Methods: As with the continued growth of inpatient admissions in our burn center, our burn clinic encountered an even higher number of new patients. With limited bandwidth, our burn LCSW was seeing both inpatient and clinic patients. Recognizing the need for additional support, the hospital’s care management department approved a full-time outpatient Burn Clinic LCSW position. Their role will include trauma screens, mental health, and psychosocial support to patients in clinic rather than providing reactive support to the most acute patients.

Results: In FY2019, our Burn Center admitted 501 patients across a seven-state region. Our Burn Clinic saw 1132 patients with 1932 clinic visit encounters. In addition to seeing all admitted patients, our inpatient LCSW also saw 13.7% (n=155) of the clinic patients and had 175 documented encounters. Furthermore, 16.6% (n=188) of these clinic patients had a form of Medicaid Health Insurance.

Conclusions: The capacity to provide access and resources to our patients has been limited to the time of one LCSW. By hiring a dedicated Burn Clinic LCSW, we will be able to increase our patients’ abilities to navigate barriers, while limiting unnecessary hospital resources with Emergency Department visits and readmissions. The clinic LCSW will assist by finding primary care physicians, transportation and housing needs, applying for disability, and accessing community resources such as our SOAR support group.
Introduction: Burn patients are a vulnerable population at risk for poor follow up after injury. With few burn centers throughout the country, there is often limited access to specialized care. We investigated barriers to patient compliance with recommended outpatient burn care at a single ABA-verified burn center after presentation at referring Emergency Departments (ED).

Methods: A retrospective review was performed on patients who presented at two EDs located 60–75 miles from our burn center over a two-year period. Recommendation for follow up was made by a burn surgeon at our regional burn center after telephone consultation. Medical record review was performed to determine what specific follow up occurred. Data on patient demographics, burn size/location/etiology were also recorded.

Results: Out of 135 consults from the two EDs, a total of 60 patients were recommended for outpatient follow up (vs. transfer, local management, or no follow up). Median age was 35 years [IQR 27–38] and most patients were male (n=40, 66%). Most patients had burns measuring < 1% total body surface area (TBSA) (n=43, 72%). Half scheduled a follow up appointment (n=31, 52%) and fewer came to that appointment (n=26, 43%). Median time from initial presentation to burn clinic follow up was 2 days (range 1–8 days). Of patients who did not attend recommended follow up, 24% (n=8/34) presented for additional visits to the ED or another local provider. Patients who did not follow up were more likely to be male (79% vs. 50%, p=0.03), lack insurance (27% vs. 4%, p=0.05), be homeless/institutionalized (18% vs. 0%, p=0.03) and have facial burns as compared to other body regions (32% vs. 8%, p=0.05). Patients who followed up were more likely to have scald burns versus flash/flame/contact burns (69% vs. 18%, p< 0.001) and were more likely to have been injured at home/work as opposed to outdoors/other location (100% vs. 38% p< 0.001). Age, marital status, race/ethnicity, having a primary care physician, %TBSA, and other comorbidities were not associated with follow up. Although reasons for not following up were rarely noted in the medical record, anecdotal reasons included lack of transportation (n=4), incarceration (n=3), and feeling that burns were healing (n=1).

Conclusions: Less than half of patients followed up at the regional burn center as recommended, while nearly a quarter followed up at local EDs/clinics. Barriers to follow up include patient gender, insurance, and resources (transportation).

Introduction: Temperature sensitivity is a common problem after burn injury. However, the impact of temperature sensitivity on health-related quality of life (QoL) is unknown. We aimed to describe characteristics associated with temperature sensitivity and determine its association with patient reported QoL. We hypothesized that temperature sensitivity negatively impacts both mental and physical health.

Methods: We reviewed a multicenter burn database for participants who had been asked about hot or cold temperature sensitivity 6, 12 and 24 months after injury. Outcomes of interest included the Satisfaction with Life Scale (SWLS) score and Veterans RAND 12 (VR-12) physical (PCS) & mental health summary (MCS) scores. Chi square and Kruskal-Wallis tests determined differences in patient and injury characteristics. Generalized linear regression models included burn size (%TBSA), graft size (%TBSA), location of burn, pruritis intensity, amputation status, study site, and review of systems questions at each follow-up visit as covariates to determine the impact of temperature sensitivity on QoL.

Results: The cohort was comprised of 637 participants. Prevalence of temperature sensitivity at each follow-up period ranged from 48%-54%. Those who experienced temperature sensitivity had larger burns, required more grafting, and had higher intensity of pruritus at discharge. Temperature sensitivity was associated with lower SWLS scores and lower VR-12 PCS and MCS at each follow-up period. After controlling for confounding variables, temperature sensitivity remained a significant independent predictor of lower SWLS scores (OR -3.2, 95% CI -5.4, -1.1) and VR-12 MCS (OR -4.4, 95% CI -7.4, -1.4) at 6 months follow-up.

Conclusions: Temperature sensitivity is a highly prevalent symptom after burn injury and an independent predictor of worse satisfaction with life and worse mental health recovery.
Introduction:

Opioids are key to pain management in burns but have increased side effects like falls and delirium in the elderly. However, comorbidities prevalent in this population (e.g., chronic kidney disease) limit use of non-opioid adjuncts, making pain control for these patients a difficult balance. Little data exists regarding pain control practices in elderly burn patients. We aim to retrospectively characterize pain management strategies (including opioids and non-opioid adjuncts) in this patient population.

Methods:

This is a retrospective cohort of patients age ≥65 with burns <20% total body surface area (TBSA) admitted to the burn stepdown unit from 2014 to 2019. The primary outcome was to quantify opioid use inpatient and at discharge in morphine milligram equivalents (MME). Secondary outcomes included percent of patients receiving opioids and adjunct analgesics at these timepoints. Mean MME inpatient vs. discharge were compared using paired t-test. Percent of patients receiving opioids and non-opioid adjuncts were compared using McNemar’s test.

Results:

One hundred elderly patients (mean age 73.9, SD 6.7) with mean TBSA of 5.6% (SD 4.5) were included. Fifty-two percent required autografting; the remainder received porcine or non-operative therapy. Mean daily inpatient MME was 18.0 (SD 20.8) and mean discharge MME was 28.0 (SD 20.5) (p=0.001), equivalent to 12mg and 18.5mg of oral oxycodone. Inpatient, 72% of patients received opioids vs. 83% at discharge (p=0.041). Acetaminophen was the most commonly prescribed non-opioid adjunct inpatient and at discharge; other adjuncts like non-steroidal anti-inflammatories (NSAIDs) and gabapentin drugs were infrequently used.

Conclusions:

Elderly burn patients are discharged with more opioids than utilized while inpatient. Aside from acetaminophen, non-opioid adjuncts used commonly in younger patients such as NSAIDs and gabapentin medications are under-utilized, presumably due to concern for comorbidities.
Prescribing Patterns of Opioids and Adjunctive Analgesics for Patients with Burn Injuries

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Introduction: Large quantities of analgesics are prescribed to control pain among patients with burn injuries and may lead to chronic use and dependency. This study aimed to determine whether patients are overprescribed analgesics at discharge and to identify factors that influence prescribing patterns.

Methods: A retrospective review of patient charts (n = 199) between July 1, 2015 - 2018 were reviewed from a registry at a single burn center. Opioid, neuropathic pain agent (NPAs), acetaminophen, and ibuprofen quantities given before and at discharge were compared. Linear mixed regression models were used to identify factors that increased the amount of analgesics prescribed among burn care providers.

Results: On average, patients were prescribed significantly more analgesics at discharge compared to what was consumed pre-discharge (p < 0.0001). Specifically, on average, providers did not overprescribe the daily dose of analgesics, but overprescribed the duration of pain medications required. For every increase in percent TBSA, 14 MEQ more opioids, 203 mg more NPAs, 843 mg more acetaminophen, and 126 mg more ibuprofen were prescribed (p < 0.05). Surgery was a predictor for higher opioid and NPA prescriptions (p = 0.03), while length of stay was associated with fewer NPAs prescribed (p = 0.04). Fewer ibuprofen were given to patients with a history of substance misuse (p = 0.01).

Conclusions: The quantity of analgesics prescribed at discharge varied widely and often prescribed for long durations of time. Standardized prescribing guidelines should be developed to optimize how analgesics are prescribed at discharge.

Identifying Risk Factors that Increase Analgesic Requirements at Discharge Among Patients with Burn Injuries

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Introduction: Opioids and neuropathic pain agents (NPAs) like gabapentin and pregabalin are commonly prescribed in large doses to achieve adequate pain control among patients with burn injuries. This patient population is therefore at greater risk of becoming dependent and misusing analgesics following their injuries. Factors that increase the risk of chronic use of opioids or NPAs among this patient population has not yet been characterized. The purpose of this study was to identify factors that increase the amount of analgesics required by patients with acute burn injuries at the time of discharge.

Methods: Patient charts from July 1, 2015 - 2018 were reviewed retrospectively to determine opioid and neuropathic pain agent (NPAs) requirements 24 hours before discharge (n = 199). Regression models were performed to determine whether the following risk factors increased analgesic requirements at discharge: surgical intervention; age; gender; TBSA; history of psychiatric disorder; and history of substance misuse.

Results: Patients with a history of substance misuse or who were managed surgically required higher doses of opioids at discharge compared to those without a history of misuse or those who were managed conservatively (p = 0.01 and 0.02, respectively). Similarly, patients who had undergone surgery required more NPAs compared to those who did not have surgical debridement of their injuries (p < 0.001). For every percent increase in TBSA, patients required 14 mg more NPAs (p = 0.01). In contrast, older patients and those with a longer hospital stay required fewer amounts of NPAs before they were discharged from hospital. For every increase in years of age, patients required on average 7 mg less NPAs (p = 0.006), and for each additional day in a patient’s length of stay, patients required 6 mg less NPAs (p = 0.009).

Conclusions: Predictors of high analgesic requirements at discharge include patients with a history of substance misuse, those who underwent surgical debridement of their burn injuries, and patients with higher TBSA. Characterizing patient risk factors that increase analgesic requirements may help burn care providers tailor how much narcotics and NPAs to prescribe each patient at discharge.
**Introduction:** Opioids are the predominant analgesic for pediatric burn patients. Burned children are frequently critically ill and require prolonged hospitalization with multiple surgical interventions. Pain associated with burns is severe, and failure to appropriately manage burn pain acutely can lead to long-term negative consequences for these children. Prolonged opioid use, however, can lead to tolerance. While tolerance is anecdotally observed to develop at different rates in individual patients, the impact of genetic variability on the rate of development of tolerance is not known. This prospective study assesses the impact of genetic variability on opiate requirement in burned children.

**Methods:** A pilot study of pediatric burn patients was performed. Whole exome sequencing was used to evaluate genes involved in the metabolism and response to opioids. Oral morphine equivalents by weight (OME/kg) were calculated by day. Tolerance was determined by evaluating the rate of decline of OME/kg following the final major surgical procedure. Patients in the lowest third for rate of decline of opioid use were compared to other patients.

**Results:** Nine pediatric burn patients with median total body surface area of burn of 22% (IQR 12–36) and median age 7 years (IQR 5–13) were analyzed. Significant variability in the rate of decline of OME was observed, ranging from a decline 0.0971 OMEs/kg/day to an incline of 0.0057 OME/kg/day. Patients with a rate of decline in the lower third had a high frequency of missense mutations with predicted functional impact in the mu opioid receptor: 67% had a variant predicted to have functional impact, compared to 50% of patients in the upper two thirds. Two patients overall had missense mutations with predicted functional impact in the delta opioid receptor, with one having more rapidly developed tolerance.

**Conclusions:** The rate at which pediatric burn patients develop tolerance is variable. Variants in the mu opioid receptor may contribute to the rate at which patients develop tolerance. The function of many variants identified in this study is unknown, and their contribution to the development of tolerance requires further studies. Large scale studies to evaluate the rate of variants in the population and their relationship to tolerance development are critical to formulate personalized pain management for burned children.
Introduction: Despite the persistence and debilitating symptoms among inflicted children and their families, little is known about children’s itching behavior as perceived and described by parents. This study examined the parental description of young children’s itching behavior corresponding to the itch intensity rating, which can inform the future development of itch measurements for young children.

Methods: This analysis was part of a larger descriptive study that examined parental behavioral and psychological responses to children's itch following the child's unintentional burn injury. Parents of young children with deep second or third-degree burns were recruited. Parents were asked to rate the child's itching intensity under four situations during the 7-day time frame using a 0–10 numerical rating scale (0 indicates no itch, and 10 indicates the worst itch possible). Parents were subsequently interviewed to describe the child’s observed behavior that reflected the itch intensity rating. The four itch situations were the current itch, the worst intense itch, the least intense itch, and the itch by a mosquito bite. Qualitative data were analyzed using inductive content analysis methods.

Results: Twenty parents of children 34 (±11.5) months old participated in the study. The average length of time since the child’s burn accident was 6.4 (±3.1) months. The mean ratings of the current itch, the worst intense itch, the least intense itch, and the itch by a mosquito bite were 3.45 (±2.4), 8.35 (±2.3), 1.5 (±1.7), and 4 (±1.2), respectively. Two themes that described a child's itching behavior were identified: the level of a child's needs for parental comfort and the frequency and disturbance (to activity and sleep) of scratching behavior.

Conclusions: Results suggest that the parent’s description of a child’s needs for parental comfort and scratching behaviors may serve as objective indicators of itching intensity. Interpreting itching intensive based on a child's needs for parental comfort offered a creative way to evaluate itch considering the developmental perspective in young children. Future development of itch measures for children under 5 years of age shall consider these two important aspects.

Introduction: Effective management of chronic burn-induced neuropathy manifesting as pain and/or pruritus presents an ongoing challenge for clinicians. Standards of care are based on limited evidence and vary widely, especially for non-surgical neuropathies that are not associated with a specific nerve distribution. This study aims to quantify and qualify evidence for non-surgical treatments of chronic burn-induced neuropathy to define their efficacy.

Methods: PRISMA and Cochrane guidelines were implemented for review structure. PubMed, Science Direct, Embase, Cochrane Library, and Web of Science databases were searched for relevant studies. Inclusion criteria were patients age 18 years and older, with neuropathy lasting >6 months following burn injury. Studies for inclusion were comparative intervention studies for treatments of chronic burn-induced neuropathies. Mean differences (MD) between interventions eligible for meta-analysis were analyzed for neuropathy outcomes.

Results: Seventeen randomized controlled trials (RCTs) were identified for inclusion with a mean post-burn follow-up of 20.8±39.3 months. Nine studies reported pain and sixteen reported pruritus using patient reported visual analogue scales for 601 and 975 patients, respectively. Pain interventions included transcranial direct current stimulation (tDCS), extracorporeal shockwave therapy (EWSST), massage therapy, carbon dioxide (CO2) laser, silicone gel, and pressure therapy. Pruritus interventions included tDCS, EWSST, massage, herbal cream, doxepin cream, enzymatic moisturizer, CO2 laser, silicone gel, and pressure therapy. CO2 laser showed no improvement over standard care for the treatment of pain or pruritus associated with hypertrophic scarring (pain: MD 0.26, 95%CI -0.04, 0.57; p=0.09; pruritus: MD -0.07, 95%CI -0.44, 0.30; p=0.72). EWSST showed no statistically significant improvement over standard care for the treatment of pruritus (MD -2.69, 95%CI -5.42, 0.04; p=0.05). Massage therapy was associated with significantly greater improvements in pruritus than standard care (MD -1.64, 95%CI -2.10, -1.09; p< 0.00001). Doxepin cream was not associated with greater improvements in pruritus than placebo or antihistamines (MD -0.84, 95%CI -3.61, 1.94; p=0.56).

Conclusions: Creative efforts have revealed massage therapy as a potential non-surgical intervention for treating chronic burn-induced neuropathy. Additional RCTs with innovative non-surgical interventions will provide further insights for this challenging condition.
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Seattle University, Seattle, Washington

Introduction: Postburn itch is one of the disturbing symptoms that persist throughout the burn wound healing period. Parents often assume the responsibility to respond to their child’s symptoms; consequently, their responses to their child’s symptoms contributed to the child’s symptom experience and long-term outcomes. To date, literature examining parental behaviors in response to symptoms has been limited to children with pain. This study examined parents’ behavioral responses to itching in young children with burns.

Methods: This analysis was part of a larger descriptive study that examined parental behavioral and psychological responses to children’s itch following the child’s unintentional burn injury. Parents of young children with deep second or third-degree burns were recruited. Semi-structured interviews were conducted with parents to learn about parental behavioral responses to the child’s itching. The Adult Responses to Children’s Symptoms (ARCS) scale was used to evaluate parental responses as part of the interview. The ARCS scale consists of 29 items that allow parents to self-report their responses to children’s itch. However, four items were excluded: three items were not appropriate to the study sample; one item related to sleep because children’s sleep pattern has been dramatically disturbed. We used the inductive content analysis that adapted from Grounded Theory to analyze the data.

Results: Twenty parents of children 34 (±11.5) months with moderate to severe burns 11.2% (±8.7%) total burn surface area (TBSA) participated in the interview. The mean length of time since burn injury was 6.4 (±3.1) months. Persevering through Devastation was the core construct that captured the lived experience of parental itching management. Parental behavioral responses to their child’s itch involved shifting their child’s attention, touching the scar, and tending to the itching scar. Data triangulation revealed that the ARCS scale captured parent behaviors in response to their child’s itch that was not reported in the interview.

Conclusions: Parents were devastated when they struggled on their own to relieve their child’s incessant itching during the prolonged wound healing stage. They cared for children with perseverance in the face of traumatic burn event; however, some parents responded to their child’s distress and call for comfort with anger or reactive behavior.

Correlative X - Prevention/Epidemiology/Public Health
C-160

High Cost and Resource Utilization of Frostbite Readmissions
Frederick W. Endorf, MD, Rachel M. Nygaard, PhD
Hennepin Healthcare, Minneapolis, Minnesota; Hennepin Healthcare, Minneapolis, Minnesota

Introduction: Frostbite is a high morbidity, high-cost injury that can lead to digit or limb necrosis requiring amputation. Our primary aim is to describe the rate of readmission following frostbite injury. Our secondary aims are to describe the overall burden of care, cost, and characteristics of repeat hospitalizations of frostbite-injured people.

Methods: Index hospitalizations and readmissions were identified in the 2016 and 2017 Nationwide Readmission Database. Weighted incidence and characteristics of readmissions associated with frostbite injury were calculated and adjusted for by using survey weight, sampling clusters, and stratum. Multivariable logistic regression was clustered by hospital and additionally adjusted for severe frostbite injury, gender, year, payor group, severity, and comorbidity index.

Results: The unplanned readmission rate following frostbite injury was 35.4% (95% CI 32.2 – 38.6%). In the two-year cohort, 1,065 index hospitalizations resulted in 1,907 total hospitalizations following frostbite injury. Most patients were male (80.3%), lived in metropolitan/urban areas (82.3%), and nearly half were insured with Medicaid (46.4%). Of the 842 readmissions, 53.7% were associated with complications typically associated with frostbite injury. Overall, 29% of frostbite injuries resulted in at least one amputation. The average total cost and total LOS of readmissions was $236,872 and 34.7 days. Drug or alcohol abuse, homelessness, Medicaid insurance, and discharge AMA were independent predictors of unplanned readmission. Factors associated with multiple readmissions include discharge AMA and Medicare Insurance, but not drug or alcohol abuse or homelessness.

Conclusions: This is the first study examining readmissions following frostbite injury on a national level. Drug or alcohol abuse, homelessness, Medicaid insurance, and discharge AMA were independent predictors of unplanned readmission, while only AMA discharge and Medicare insurance were associated with multiple readmissions.
Epidemiology and Outcomes of Cooking and Cookstove-related Burn Injuries: A World Health Organization (WHO) Global Burn Registry (GBR) Report

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Introduction: Cooking- and cookstove-related burns (CSBs) comprise a large proportion of burn injuries globally. A cookstove is any apparatus that provides heat and is used for cooking (e.g., three-stone fire, traditional or improved cookstove). There are limited data on patterns of cooking behaviors and CSBs to inform prevention initiatives and advocacy. We aimed to describe the epidemiology, risk factors and outcomes of cooking-related burns and CSBs, specifically.

Methods: Patients with cooking and non-cooking related burns from 2018 to 2020 were identified in the World Health Organization (WHO) Global Burn Registry (GBR). Patient demographics, cooking arrangement, injury characteristics [mechanism, total body surface area (TBSA), revised Baux score] and outcomes were described. Differences in proportions and medians were compared. Bivariate regression was performed to identify risk factors associated with occurrence of CSB.

Results: GBR contained data of 6,965 burn-injured patients from 17 countries; 88% were from middle-income countries. One quarter of burn injuries (1,723 burns) were cooking-related. More than half of cooking-related burns (55%) occurred in females. Median age for cooking-related burns was 11 years (IQR 2–35). Of cooking-related burns, 22% were cookstove-related burns (CSBs; 311 burns). The most common mechanism in CSB was flame (87%), whereas the most common mechanism in other cooking burns was scald (62%). Patients with CSBs were more often female (65% vs 53%; p< 0.001) and much older than patients with other cooking burns (32 years, IQR 22–47 vs 5 years, IQR 2–30). CSBs were significantly larger in TBSA size (30%, IQR 15–45% vs 15%, IQR 10–25%; p< 0.001), had higher revised Baux scores (70, IQR 46–95 vs 28, IQR 10–25; p< 0.001) and more often resulted in death (41 vs 11%; p< 0.001) than other cooking burns (Table1). Patients with CSBs were more likely to be burned by fires (OR 4.74; 95% CI 2.99–7.54) and explosions (OR 2.91, 95% CI 2.03–4.18) than other cooking injuries. Kerosene had the highest odds of CSB than all other cooking fuels (OR 2.37, 95% CI 1.52–3.69).

Conclusions: Cooking-related burns are common and have different epidemiology than CSBs, specifically (e.g., more often female, older, larger burn size, higher mortality). CSBs were more likely caused by structural factors (e.g., explosion, fire) than behavioral factors (e.g., accidental movements) when compared to other cooking burns.

Figure 1

Injuries and Outcomes in Cookstove-related Burns (CSB) vs. Other Cooking Burns

Table 1

<table>
<thead>
<tr>
<th>Outcome</th>
<th>CSB</th>
<th>Other Cooking Burns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associated Mortality (%)</td>
<td>41</td>
<td>11</td>
</tr>
<tr>
<td>Death (%)</td>
<td>15.7</td>
<td>10.5</td>
</tr>
<tr>
<td>TBSA Median (%)</td>
<td>30%</td>
<td>15%</td>
</tr>
<tr>
<td>Revised Baux Score Median (%)</td>
<td>70</td>
<td>28</td>
</tr>
<tr>
<td>Mechanism (%)</td>
<td>Flame (87%)</td>
<td>Scald (62%)</td>
</tr>
<tr>
<td>Total Patients</td>
<td>311</td>
<td>1,454</td>
</tr>
</tbody>
</table>

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Geographic Location-Allocation Modeling to Optimize National Burn Care Delivery and Disaster Planning

Kevin Li, BS, MS, Kajal Mehta, MD MPH, Ada Wright, Joohee Lee, MPH, CPQH, Tam N. Pham, MD, FACS, Kiran K. Nakarmi, MBBS, MS, MCh, Barclay T. Stewart, MD, PhD, MPH

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Introduction: The study country has a disproportionately high burn incidence rate compared to other low- and middle-income countries. Preventable death and disability are common due to poor population-level spatial access to organized burn care, including no organized system of ground or aeromedical transport. Currently, severe burns are referred to a single facility nationwide, often with suboptimal stabilization and/or significant care delay. Therefore, we aimed to identify existing candidate hospitals that would optimize population-level access to acute burn care if burn stabilization capabilities were strengthened in each hospital.

Methods: The 175 general hospitals that referred patients to the single national burn referral center between 2016–2020 were designated as candidate hospitals. Demand points for location-allocation modelling were derived from a 2020 estimated population density grid for the country (total population 30,184,338). Road network and national speed limit data were extracted from publicly available geodata to inform travel distance and time. Six models were developed (Models A-F) using cost-distance and network analyses to identify the 3 vs 5 candidate hospitals that would optimize population-level access if their initial burn stabilization capabilities were strengthened. Three travel time thresholds (≤2, 6, and 12 hours) were used for both sets of models.

Results: Currently, 6,151,298 people (20.3% of the national population) have access to organized burn care within 2 hours of travel, 11,240,957 (37.2%) within 6 hours and 21,925,928 (72.6%) within 12 hours [Table 1]. If acute burn stabilization capabilities were strengthened, Models A-C of 3 chosen hospitals would increase population-level spatial access if their initial burn stabilization capabilities were strengthened. Three travel time thresholds (≤2, 6, and 12 hours) were used for both sets of models.

Conclusions: This exercise demonstrates two sets of models for increasing population-level access to acute burn stabilization in the study country. If acute burn stabilization capabilities were strengthened in the identified hospitals, approximately 90% of the national population would have access to burn care within 6 travel-hours in both the 3 and 5 hospital scenarios. Although the models with 5 strengthened hospitals reduce mean travel time, the percent of population with improved travel time access is only marginally higher.
Introduction: Burn injuries contribute a considerable burden of disease in variable-resource settings, often resulting in mortality. Despite contributing a substantial burden, outcomes from burn injuries in rural Africa are rarely described. The objective of this study was to examine factors associated with mortality from burn injury in rural Africa.

Methods: A retrospective chart review was conducted for all patients with burn injury from January 1, 2014 to December 31, 2017 at a 300-bed faith-based, teaching hospital in eastern Africa. Bivariate analysis was used to compare patients who survived the hospital stay with those who did not. Using total body surface area (TBSA), the LD50 (Lethal Dose 50, burn size with a lethality of 50% of patients), and the modified-Baux score were calculated. Due to small sample size, lasso inference techniques for logistic regression were utilized to avoid overfitting a model and to determine relevant risk factors for mortality, by evaluating burn severity, age, sex, location of residence, payer status, time from injury to arrival, distance from hospital, presence of full thickness burns, inhalational injury, and referral status.

Results: A total 171 burn injury patients were reviewed for this study; two were excluded due to missing data. Among 169 patients, 14.8% (n=25) experienced mortality prior to hospital discharge. Fifty patients suffered an adverse event (29.6%) including: 17 wound infections, 10 urinary tract infections, 10 with sepsis, and 25 with respiratory complications. The LD50 for TBSA was 42%. The LD50 for the modified-Baux score was 81. Non-survivors had higher average TBSA (31.0±5.0% vs 11.5±0.8%; p< 0.01), more inhalational injury (44% vs 2.8%, p< 0.01), full-thickness burns (56.5% vs 23.9%, p< 0.01), and complications (88% vs 19.4%, p< 0.01). Odds of mortality increased 1.06 times for every percent increase in TBSA burn (95%CI: 1.02, 1.11; p< 0.01) and 13.9 times with inhalational injury (95%CI: 3.4, 56.4; p< 0.01).

Conclusions: Mortality from burn injury represents a substantial portion of patients at a hospital in rural Africa. Factors of larger TBSA and inhalational injury represent the greatest risk.

Insurance Status Plays a Role in Burn Patient Disposition Following Burn Injury

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Introduction: According to the Emergency Medical Treatment and Labor Act (EMTALA), patient insurance status has no role in stabilization and treatment of patients brought into the emergency department. However, uninsured patients with burn injuries are more likely than insured patients to face early hospital discharge, and less likely to receive care in skilled facilities for post-hospital rehabilitation. Following trauma, insured patients are more likely to have longer hospital lengths of stay (LOS) compared to uninsured patients, resulting in a loss of clinical equipoise. The purpose of this study was to evaluate whether insurance status affects morbidity, mortality, LOS, and post-discharge care for patients with burn injuries. We hypothesized that insured patients would experience fewer complications but would more frequently be referred to skilled facilities for extended post-discharge care.

Methods: We retrospectively queried our prospectively collected burn database for all patients suffering from burn trauma and admitted to our burn facility from July 2015-December 2015. Patients under the age of 18 years and those without documented insurance status were excluded. Our primary outcome was any complication. Secondary outcomes included LOS, ICU days, mortality, and disposition. Chi-square and multivariate logistic regression analyses were performed using Stata.

Results: A total of 451 patients were included (74% male, median age 51 years, TBSA 20% ± 1.1, 27% were uninsured). Univariate analysis showed that uninsured patients were less likely to have complications following burn injury, as well as less likely to have any comorbidities (28.5% vs. 40.6%, p=0.02; 55.3% vs. 72.3%, p=0.001, respectively). After controlling for confounding variables (Baux score, comorbidities, gender, and smoking) we found there was no association between complications and insurance status (OR 1.45, 95% CI 0.91–2.33). Using the same regression model, we secondarily found that there was a significant association between disposition after hospital admission and insurance status (OR 1.94, 95% CI 1.04–3.62) as well as an association between mortality and insurance status (OR 0.35, 95% CI 0.17–0.72).

Conclusions: At our institution, insurance status for burn patients was not associated with differences in length of stay or complications. Despite this, insured patients were more likely to be discharged to skilled facilities and less likely to die from burn injury. Disparate outcomes between insured and uninsured burn patients remain a significant concern, and more studies are needed to understand underlying etiologies.
Introduction: Thermal burns as a result of contact with a hot surface are a frequent cause of injury. A unique subset of contact burns are those sustained as a result of exposure to a hot surface during summer days in geographic areas with excessive ambient temperatures. Under these conditions, external surface temperatures can reach 180 degrees Fahrenheit, and deep cutaneous burns can happen with only a brief contact. Often exposure occurs in patients with impairments that prevent them from removing themselves from such contact in an expeditious fashion leading to severe injury. The purpose of this study was to review and analyze patients admitted to a southwest burn center with burns caused by contact with a hot external surface during the summertime months.

Methods: This was a retrospective chart review of patients admitted to our regional burn center over a 6-year period, whose burns were sustained from contact with the ground during the months of June, July, and August. Patients were stratified into two groups those whose injuries occurred from 2015 – 2019 and those that occurred in 2020. Climate data was collected from the National Oceanic and Atmospheric Administration website.

Results: The mean high daily temperature for June, July, and August 2020 was 108.5°F compared to 106.3°F for June, July and August of the preceding five years 2015 to 2020 (p < 0.0001). The number of days during this 3-month period with high temperatures exceeding 110°F was 48 for 2015 – 2019 compared to 106.3°F for 2015–2019 (p < 0.0001). Correspondingly, there were 104 inpatient admissions for contact burns during this 3-month period in 2020 compared to a mean of 70 patients each year for 2015 to 2020, a 49% increase. There was no difference in age, gender, % TBSA burned, length of stay, or comorbidities in the two groups of patients. There were differences noted in the ethnicity compositions between the two groups. While alcohol use was not different between the two groups, the admission blood alcohol level was significantly greater in the 2020 group versus the 2015–2019 group (p=0.0477). Additionally, the 2020 group demonstrated significantly greater illicit drug use than the 2015 to 2019 group (p=0.0098).

Conclusions: This study shows that increasing summertime temperatures in the southwest USA results in a corresponding increase in the number of patients with hot surface contact burns, and this increase is also associated with significantly great drug and alcohol abuse.
Silvadene was the most common topical agent used in the initial management of thermal injuries, followed by Bacitracin and Xeroform. 63% (n=80) of patients did not require surgery, while 36% (n=46) required surgical excision, and 15% (n=20) required split-thickness skin grafting. Multiple surgeries were uncommon. 22% of patients required one operation, 12% required two operations, and 2% required 3 operations.

**Conclusions:** Our data recognizes use of ENDS as a growing public health problem with potential to cause thermal injury and secondary trauma. Most injuries occur during use, however many result from spontaneous combustion while the device is not being used. Treatment of ENDS-related injuries is institution-dependent. Most patients are treated on an inpatient basis however the majority of patients treated on outpatient basis have good outcomes.

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### Table: Characteristics of Burn Injuries in Infants

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>groupI</th>
<th>groupII</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>33 (13.64)</td>
<td></td>
</tr>
<tr>
<td>TBSA%, mean (SD)</td>
<td>3.85% (2.65%)</td>
<td>3.8% (2.65%)</td>
</tr>
<tr>
<td>2° Degree, n (%)</td>
<td>85 (66.93%)</td>
<td></td>
</tr>
<tr>
<td>3° Degree, n (%)</td>
<td>46 (36.22%)</td>
<td></td>
</tr>
<tr>
<td>Burn injury, n (%)</td>
<td>327 (100%)</td>
<td></td>
</tr>
<tr>
<td>Blister injury, n (%)</td>
<td>83 (63.78%)</td>
<td></td>
</tr>
<tr>
<td>Flame burn, n (%)</td>
<td>89 (70.7%)</td>
<td></td>
</tr>
<tr>
<td>Contact burn, n (%)</td>
<td>70 (55.12%)</td>
<td></td>
</tr>
<tr>
<td>Electrical burn, n (%)</td>
<td>1 (0.79%)</td>
<td></td>
</tr>
<tr>
<td>Hospitalized, n (%)</td>
<td>92 (72.44%)</td>
<td></td>
</tr>
<tr>
<td>Hospital LOS (median, IQR)</td>
<td>6 (2-10)</td>
<td></td>
</tr>
<tr>
<td>Surgery, n (%)</td>
<td>46 (36.2%)</td>
<td></td>
</tr>
<tr>
<td>Topical Antimicrobials, n (%)</td>
<td>118 (92.9%)</td>
<td></td>
</tr>
<tr>
<td>Enzyme Debridement, n (%)</td>
<td>20 (15.7%)</td>
<td></td>
</tr>
</tbody>
</table>

**Introduction:** Infants are prone to unintentional minor burns. Caregivers play a key role in prevention and first aid. So, updating communal burn-prevention education programs according to time-related social changes is of importance. Aim of the present study was to analyze features of minor burns in infants who were referred to our burn center in the last 15 years.

**Methods:** Subjects were 973 infants (1-24 months) with minor burns who were treated at our burn center between 2005 and 2019. Subjects were divided into two subgroups; groupI: referrals between 2005 and 2014 (n=465) and groupII: referrals between 2015 and 2019 (n=508). Data collected for each case were age; sex; burn-cause; extent of burns; affected major body-sites; environment in which injury occurred; first-aid method used by the caregiver; referral history (time interval between injury and referral (TIIR) and other hospitals before arriving at our center). Socioeconomic status was investigated with social-security status; home-types and methods of home-heating.

**Results:** Median age was 1±0.2 both in groupI and in groupII; male/female ratio was 0.96/1 in groupI and it was 1.07/1 in groupII. Mean TBSA burned was 2.7±0.12% (min:0.1, max:18) in groupI and it was 2.2±0.11% (min:0.1, max:18) in groupII. Most common burn-cause was scalds in both groups (groupI: n=351; 75.5%, groupII: n=405; 79.8%) (p > 0.05). Chemical burns slightly increased, flame burns decreased in groupII (p < 0.05). Hands continued to be the most common affected major body-site (n=334; 34.5%) (p > 0.05). Home was the most common environment in which injury occurred (groupI: n=428; 92%, groupII: n=487; 95.9%) (p > 0.05). Tap water was the favorite first-aid method (groupI: n=366; 78.9%; groupII: n=411; 80.9%) (p > 0.05). But tendency to herbal and/or unreasoning first-aid methods increased in groupII (groupI: n=10; 2.2%, groupII: n=47; 9.3%) (p > 0.05). Tap water was the favorite first-aid method (groupI: n=366; 78.9%; groupII: n=411; 80.9%) (p > 0.05). But tendency to herbal and/or unreasoning first-aid methods increased in groupII (groupI: n=10; 2.2%, groupII: n=47; 9.3%) (p > 0.05). TIR was under 3 days for 820 cases (84.3%) (p > 0.05). Rates of unmediated referral to our burn-center were higher in groupII (groupI: n=221; 47.5%, groupII: n=303; 59.7%) (p > 0.05). Most infants were in civil social-security-system, with an increased number of private-insurance in groupII (groupI: n=12; 2.5%, groupII: n=29; 4.3%) (p < 0.05). Most lived at centrally heated homes (n=926; 95.2%), and number of infants who lived at stove-heated homes decreased in group II (groupI: n=31; 6.7%, groupII: n=16; 3.1%) (p < 0.05).

**Conclusions:** Our results revealed that socioeconomic status has improved, direct referrals to burn center increased in the last 5 years. Unfortunately usage of herbal and unreasoning first aid methods also increased in the same period. Future communal education programs for caregivers should emphatically continue to focus on precautions against threats at homes and correct first-aid methods should be urged.
Further work is needed to understand whether the increased groups, but ICU admissions are down in the 2020 cohort. We hypothesize this is due to patients’ avoiding the hospital due to burns injury to hospital admission in the 2020 cohort. We did not experience the COVID-19 pandemic. There is an increased lag time from hospitalization, in the 2020 cohort. We hypothesize this is due to patients’ avoiding the hospital due to fear of contracting COVID-19. TBSA >20%, work-related injuries, or suspected abuse related injuries. Of note, the mean days from injury to admission, there were no differences in age, gender, pediatric admission, hospital course, and discharge at a major metropolitan burn center.

Methods: This was a retrospective cohort study of admissions to our burn center. Our institution’s medical record was reviewed from 1/1–8/31 for years 2020, 2019, & 2018. We included all thermal, chemical, and electrical burn inpatient admissions over these time periods. Non-burn wound admissions and vulnerable patient populations were excluded. Our population included 1,358 patients. These patients were grouped by year 2020 (n=425), 2019 (n=470), and 2018 (n=463). The medical record was queried for admission, hospital course, and discharge variables. SAS 9.4 statistical software was used to compare the pre-pandemic 2018/2019 groups against the 2020 group. Group means were compared using two-sample two-tailed t-tests, and categorical variables were compared using Chi-Square analysis.

Results: In 2020 the burn center had 425 admissions compared to 470 and 463 in 2019 and 2018 respectively. On admission, there were no differences in age, gender, pediatric admissions, burn etiology, total body surface area (TBSA), TBSA >20%, work-related injuries, or suspected abuse related injuries. Of note, the mean days from injury to admission for the groups were (2020 2.5±4.9 vs 2019 1.4±4.3, p=0.001, vs 2018 1.5±4.3, p=0.0017). Groups were similar in respect to burns requiring surgery and mean OR visits. 2019 and 2018 had increased ICU admissions compared to the 2020 cohort (ICU: 2020 60 (14%) vs 2019 91-(19.4%), p=0.041, vs 2018 108 (23.3%, p=0.033). Inpatient mortality was lower in the 2020 cohort compared to the pre-pandemic cohorts (2020 2 (0.6%) vs 2019 9 (2.5%), p=0.04, vs 2018 14 (4.2%) p=0.0017).

Conclusions: Volume at our burn center remains high during the pandemic. There is an increased lag time from burn injury to hospital admission in the 2020 cohort. We hypothesize this is due to patients’ avoiding the hospital due to fear of contracting COVID-19. TBSA is similar across groups, but ICU admissions are down in the 2020 cohort. Further work is needed to understand whether the increased lag time has affected outcomes and whether the decreased ICU admissions are due to yearly variation or the pandemic.

Introduction: The current and long-term impact of the coronavirus disease 2019 (COVID-19) global pandemic on our healthcare system is still unknown. When healthcare resources were being diverted to only the most critical of needs, emergent surgical and burn care remained essential. Currently, no data exist on the impact of a global pandemic on a burn center. Our aim for this study was to understand how the COVID-19 pandemic affected admissions, hospital course, and discharges at a major metropolitan burn center.

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Conclusions: Volume at our burn center remains high during the pandemic. There is an increased lag time from burn injury to hospital admission in the 2020 cohort. We hypothesize this is due to patients’ avoiding the hospital due to fear of contracting COVID-19. TBSA is similar across groups, but ICU admissions are down in the 2020 cohort. Further work is needed to understand whether the increased lag time has affected outcomes and whether the decreased ICU admissions are due to yearly variation or the pandemic.

Introduction: The current and long-term impact of the coronavirus disease 2019 (COVID-19) global pandemic on our healthcare system is still unknown. When healthcare resources were being diverted to only the most critical of needs, emergent surgical and burn care remained essential. Currently, no data exist on the impact of a global pandemic on a burn center. Our aim for this study was to understand how the COVID-19 pandemic affected admissions, hospital course, and discharges at a major metropolitan burn center.

Methods: This was a retrospective cohort study of admissions to our burn center. Our institution’s medical record was reviewed from 1/1–8/31 for years 2020, 2019, & 2018. We included all thermal, chemical, and electrical burn inpatient admissions over these time periods. Non-burn wound admissions and vulnerable patient populations were excluded. Our population included 1,358 patients. These patients were grouped by year 2020 (n=425), 2019 (n=470), and 2018 (n=463). The medical record was queried for admission, hospital course, and discharge variables. SAS 9.4 statistical software was used to compare the pre-pandemic 2018/2019 groups against the 2020 group. Group means were compared using two-sample two-tailed t-tests, and categorical variables were compared using Chi-Square analysis.

Results: In 2020 the burn center had 425 admissions compared to 470 and 463 in 2019 and 2018 respectively. On admission, there were no differences in age, gender, pediatric admissions, burn etiology, total body surface area (TBSA), TBSA >20%, work-related injuries, or suspected abuse related injuries. Of note, the mean days from injury to admission for the groups were (2020 2.5±4.9 vs 2019 1.4±4.3, p=0.001, vs 2018 1.5±4.3, p=0.0017). Groups were similar in respect to burns requiring surgery and mean OR visits. 2019 and 2018 had increased ICU admissions compared to the 2020 cohort (ICU: 2020 60 (14%) vs 2019 91-(19.4%), p=0.041, vs 2018 108 (23.3%, p=0.033). Inpatient mortality was lower in the 2020 cohort compared to the pre-pandemic cohorts (2020 2 (0.6%) vs 2019 9 (2.5%), p=0.04, vs 2018 14 (4.2%) p=0.0017).
Introduction: Over 1 million burns occur in Sub-Saharan Africa (SSA) each year leading to significant morbidity and mortality. Financial constraints, social stigma, political strife, inaccessible healthcare facilities, limited perioperative resources, and low workforce capacity results in steep barriers to obtaining timely and effective burn care. This study set out to better define the burn burden as well as the age and gender-related disparities within SSA, to identify specific sub-regions and countries that would benefit most from targeted interventions to enhance burn care.

Methods: Data for all 46 SSA countries were acquired from the 2017 Global Burden of Disease (GBD17) database of the Global Health Data Exchange. Information regarding fire, heat, and hot substance-related injuries was derived from 17,792 data sources to estimate burn-related incidence, deaths, and Disability Adjusted Life Years (DALYs) by year, sex, age, and location from 1990 to 2017. Summative statistics were created for burn incidence, deaths, DALYs, and mortality ratio (deaths: incidence; %). Spatial mapping was performed to identify burn burden for specific regions and countries.

Results: An estimated 28,127,199 burns occurred in SSA from 1990–2017. On average, SSA accounted for 16% of worldwide burns, 21% of burn deaths, and 25% of DALYs. Furthermore, the mortality rate was 2.2 times the global average and remained nearly double the entire 27-year period. While all SSA regions had higher incidence, deaths, and DALYs compared to the global cohort, the Southern SSA region consistently had the highest incidence (211 cases per 100,000), deaths (7 per 100,000), and DALYs (355 years per 100,000) throughout the time period, with Lesotho, Swaziland, and Zimbabwe having the highest rates. In contrast to gender similarities globally for burn indicators, all regions within SSA showed higher incidence rates (144 vs 136 cases per 100,000), deaths (5.4 vs 4.7 deaths per 100,000), and DALYs (289 vs 272 years per 100,000) for men than women when age standardized.

Conclusions: With an estimated 1.4 million burn injuries in 2017, SSA accounted for over 15% of all worldwide burns and 20% of global burn deaths. Although all trended rates improved over the years for each country, they were consistently worse and slower to improve in all regions of SSA compared to the rest of the world. While both Central and Southern SSA regions had the greatest burn burden, burns in Central SSA more significantly impacted those under 5 years whereas Southern SSA saw the greatest burden on the 15–49-year age group.
**Introduction:** Identifying modifiable risk factors for pediatric scald burn injury prevention efforts is an important function for burn registries. Geographic information systems (GIS) analysis can provide additional census tract data about patient home and injury location. We hypothesize that (GIS) analysis of burn registry data using census tract data could identify geographic areas and additional risk factors for pediatric scald burn injury prevention efforts.

**Methods:** The burn registry of a U.S. regional burn center was used retrospectively to identify burn admissions, ages 0–17, within the county from 1/1/2018 to 7/31/2020. Data collected included demographics, vitals, burn type and body surface area burned (BSA%), hospital charges, length of stay, complications, and mortality. GIS geocoding of patient home addresses with census tract data including poverty level, languages spoken at home and highest educational level was performed. Burn incident hot spot analysis to identify statistically significant burn incident clusters was done using the Getis Ord Gi* statistic.

**Results:** There were 1057 burn initial admissions during the study period, 152 (14.3%) patients were children 17 and younger with scald injury who were county residents. The average age was 4.0 ± 4.0 years, and 59.9% were male. Mean scald injury BSA was 4.9% ± 5.7, 14/152 admissions (9.2%) had a burn ≥10% BSA. There were no in-hospital deaths. 120/728 county census tracts were identified as high risk with higher rates of child scald injury admissions than the countywide mean of 1.27 cases/1000 children. Regression analysis of high-risk census tracts were more likely to have increased poverty levels (O.R. 3.30, 95% C.I.: 1.1–9.7, p<0.031) and lower educational attainment (O.R. 1.10, 95% C.I.: 1.0–1.18, p<0.047). Non-white race, unemployment level, living with grandparents and speaking Spanish at home were non-significant risk factors. GIS analysis identified geographic hot spots for child scald injury admissions (p<0.001).

**Conclusions:** GIS analysis of county burn registry data identified census tracts with increased poverty and lower educational attainment levels to have an increased risk of pediatric scald injury admission. Burn prevention efforts should be focused on these high-risk areas.
Introduction: The shelter-in-place mandate to mitigate the effects from the 2019 severe acute respiratory syndrome coronavirus 2 was associated with an increase in admissions of school-aged children to our burn center but a decrease in adult admissions. It was unclear how many admissions were from suspected abuse. Our objective was to determine the social impact of the shelter-in-place mandate on the number of burn admissions secondary to suspected abuse during the COVID pandemic compared to previous years.

Methods: Patients were identified using Institutional Burn Center registry and linked to the clinical and administrative data. All patients admitted from January 1, 2016 to July 31, 2020 with suspected abuse were eligible for inclusion. Demographics, patient and burn characteristics were evaluated. Statistical analysis was performed with Student’s t-test, and chi-squared test.

Results: There were 7177 patients included in the study. Prior to 2020, each year the percentage of cases with suspected abuse decreased compared to previous years (19% decrease in 2017, 23% decrease in 2018, 30% decrease in 2019). Compared 2019, the number of patients admitted with suspected abuse during the COVID pandemic increased 257%, p=0.00046. There were no significant differences in race, ethnicity, sex, burn mechanism, or burn size in those admitted with abuse-related injuries. The average age of patients with abuse-related injuries in 2020 was 13 years old, compared to an average age of 28 years old for the period from 2016–2019 (p<0.003).

Conclusions: There is a significant increase in number of patients admitted for suspected abuse. Shelter-in-place mandate limited viral transmission of COVID-19 but led to unfathomable increases in abuse cases at our institution.

Introduction: Individual- and community-level socioeconomic disparities impact overall health and injury incidence, severity, and outcomes. However, the impact of community-level socioeconomic disparities on recovery after burn injury is unknown. We aimed to characterize the association between community-level socioeconomic disparities and health-related quality of life (HRQL) after burn injury. These findings might inform rehabilitation service delivery and policy making at administrative levels.

Methods: Participants with the NIDILRR Burn Model System who were ≥14 years with a zip code were included. Sociodemographic and injury characteristics and 12-item Short Form Health Survey (SF-12) and Veterans RAND (VR-12) physical (PCS) and mental (MCS) component summary scores 6 months after injury were extracted. Data were deterministically linked by zip code to the Distressed Communities Index (DCI), which combines seven census-derived metrics into a single indicator of economic well-being that ranges from 0 (lowest distress) to 100 (highest distress). Multilevel linear regression models estimated the association between DCI and HRQL.

Results: The 342 participants were mostly male (239, 69%) had a median age of 48 years (IQR 33–57) and sustained a median burn size of 10% TBSA (IQR 3–28%). More than one-third of participants (117, 34%) lived in a neighborhood within the two most distressed quintiles. After adjusting for age, race/ethnicity, and pre-injury HRQL, increasing neighborhood distress was negatively associated with PCS (β-0.05, SE 0.02, p=0.01). Age and pre-injury PCS were also significantly associated with 6-month PCS. There was no association between neighborhood distress and 6-month MCS. However, pre-injury MCS was significantly associated with 6-month MCS (0.56, SE 0.07, p<0.001).

Conclusions: Neighborhood distress is associated with lower PCS after burn injury but is not associated with MCS. Regardless of neighborhood distress, pre-injury HRQL is significantly associated with both PCS and MCS during recovery.
Introduction: Associations, institutions, and providers have made enormous efforts to educate the United States public on burn injury in the hopes of preventing burns. However, there are no reports to-date describing the level of public burn knowledge in the U.S. This study characterized the public knowledge of burn prevention and preparedness in the US. It also aimed to assess if our interactive quiz is an appropriate educational tool.

Methods: QualtricsTM surveys designed to test knowledge and educate about burns were crowdsourced to laypersons via Amazon MTurk. Demographics were self-reported. In section 1, respondents were presented six questions asking about causes and care for burns, in a quiz style with explanations provided immediately. In section 2, respondents self-reported personal experiences with burns, burn education, and knowledge of verified burn centers. In section 3, they reported attitudes towards burn care. Survey responses were analyzed using two-tailed Student’s t tests and chi square analyses.

Results: We received 402 completed survey responses, and 331 total were included for analysis; studies were excluded if they were completed in < 5 minutes or had incorrect attention check questions. The mean age was 39.4 ± 12.08, and 51% male.

1. Knowledge: The average quiz score was 51% ± 8; while 65% of respondents knew to run scald burns under cool water, only 41% knew the optimal time of more than 20 minutes. The majority of respondents (92%) reported the quiz improved their burn knowledge. Also, while majority (63%) of respondents had heard of verified burn centers, only 44% knew where the closest one was.

2. Experiences: 72% of respondents had personally experienced a burn, of which 62% were treated in the emergency room. 57% of respondents had witnessed a burn injury occur, of which 92% applied first aid using cool running water (26%), ice (18%), burn gel (17%), and gauze (11%). Only 61% of respondents have participated in burn precautions at home. 56% of respondents have received formal burn training, such as from CPR class (21.4%) and recent first aid training (32.9%). Informal sources include from friends and family (66%), personal burn experience (63%), or social media (47.4%).

3. Attitudes: The majority of respondents agreed there should be more public education on risks/prevention (85%) and treatment of burns (78.6%). Only 63% believe acute burn care should be covered by insurance.

Conclusions: Our study demonstrates that despite personal experiences with burns and formalized courses, there remain gaps in public burn knowledge in the US. Further studies are required to characterize more detailed knowledge gaps and intervention strategies.
Introduction: Knowledge of substance use history is important for treating patients with burn injuries due to increased risk of mortality, complications, and poor outcomes. Yet, there has been little research on how admitting medical providers make the determination of who to test for alcohol or drug use. Burn severity, etiology, and circumstances surrounding the burns are important factors that should be considered when determining who should be tested. The race of the victim should not. This study analyzed data from the National Burn Repository for years 2008–2017 to ascertain if there were associations between race and decisions to do alcohol and drug testing upon burn center admission, controlling for other demographics, burn severity, and circumstances surrounding burn injuries.

Methods: This study was a secondary analysis of 37,355 cases from the National Burn Data Repository (American Burn Association). The dependent variables were whether a burn victim was tested for alcohol or drug use. These were dichotomous dependent variables, so a binary logit regression analysis was used. Missing data were handled with full information maximum likelihood. The independent variables were age, gender, whether physical abuse was reported, mental health comorbidity, marital status, severity of burns, whether the injury was work related, injury circumstances, and etiology of injury. Race was the independent variable of focus. The hypothesis was that race was associated with whether a burn victim was tested for drug or alcohol use.

Results: Controlling for independent variables, race was associated with whether a victim was tested for alcohol use, $X^2(5) = 71.3, p < .0001$; race was also associated with whether a burn victim was tested for drug use, $X^2(5) = 66.5, p < .0001$. Odds ratios for comparing the likelihoods of victims of different racial categories being tested ranged from .69 to 2.3 for alcohol testing, and from .79 to 2.4 for drug testing. These results were consistent with racial bias in decisions to test burn victims for alcohol and/or drug use.

Conclusions: Because there is little written about criteria for alcohol or drug testing on admission for critical burn injuries, it is unclear what prompts admitting health care providers to test. Our study found several racial groups had differential likelihoods of being tested upon admission to a burn center. Using Critical Race theory as a framework, these findings suggest racial bias may have influenced decisions to test for substance use in reported burn admissions. There is a need to establish a protocol for alcohol and drug use testing upon burn center admission that is equitable across all populations.
Discrepancies in Mortality Metrics Between National Datasets

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Introduction: The National Burn Repository (NBR) is the recognized standard for data collection models within the academic burn community. Despite its robust capabilities, the NBR poses challenges to access and exploration that can be intimidating to some researchers. As a result, user-friendly alternative databases have grown in popularity. We compared the NBR to two commercially available large datasets using the well-recognized relationship between age and total body surface area (TBSA) on mortality as our metric to assess correlation.

Methods: We accessed the TriNetX Global Health Research Network and queried the Diamond network (medical clearinghouses) and Research network (41 healthcare organizations (HCO)) for all-cause mortality within 3 years following burn injuries that occurring between 2000 – 2020 using ICD-10 codes (T31-32). We explored the distribution of TBSA and age across these cohorts and compared the variance in the distribution to the 2008–2017 NBR report using one proportion z-tests for each age-TBSA matched subgroup. We also compared demographics and lethal area for 50% mortality (LA50).

Results: The Diamond network identified 336,965 entries with an all-cause mortality rate of 3.21% and an LA50 of < 10%. Demographics showed 50% male, 81% unknown race and a mean age of 39. In 2016 - 2017, 56,430 entries were reported. The Research network identified 114,778 entries with a mortality rate of 2.54% and an LA50 of < 10%. Demographics showed 61% male, 58% white, 24% unknown and 16% black with a mean age of 37. In 2016 - 2017, 14,164 entries were reported. In comparison, the NBR database reported 185,239 entries with a mortality rate of 2.96% and an LA50 of >70%. Demographics showed 67% male, 59% white and 3.6% unknown with a mean age between 20–29. In 2016 - 2017, 42,402 entries were reported. Comparison of mean mortality between age-TBSA matched subgroups in the Diamond and the Research networks relative to NBR showed correlation among pediatric populations but lacked significance.

Conclusions: The Diamond and Research networks are large datasets, which appear to be statistically different from the NBR dataset and are derived from different populations (insured patients, academic healthcare organization and accredited academic burn centers). The exact overlap between datasets is unknown, but demographics suggest that they are very different populations. The Figure depicts the relationship between age and TBSA on mortality for each database. Each database is large enough to achieve statistically significant conclusions, but caution should be used when contrasting conclusions between datasets due to the significant degree of divergence.
Current Practices and Beliefs Regarding Screening Burn Patients for Acute Stress Disorder and Post-Traumatic Stress Disorder: A Survey of the American Burn Association

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Introduction: The prevalence of Acute Stress Disorder (ASD) after burn injury may be up to 30% and the prevalence of Post-Traumatic Stress Disorder (PTSD) is as much as 40% at six months post-burn injury. The American Burn Association (ABA) published a consensus statement in 2013 recommending screening for ASD and PTSD in all patients with a burn injury. To our knowledge, the current practices of screening for ASD and PTSD in patients with burns is not known. This study aims to describe the current screening practices and provider beliefs regarding screening for stress disorders in burn patients in the US.

Methods: Interviews with psychologists and clinicians from our regional burn and injury center were utilized to generate a 31-question survey to assess burn center screening practices and provider beliefs regarding screening for ASD/PTSD. The Survey was approved by the ABA and distributed to its US membership in July 2020. Percentages of responses were generated, and chi-square tests were used to compare answers by profession type.

Results: There were 121 respondents out of 1500 recipients. The respondents were surgeons (27%), psychologists (6%), therapists or social workers (16%), nurses (31%), and advanced practice providers (13%). About half of the respondents (47%) worked at institutions that admit over 300 adult burn patients a year and had over 10 years of experience (52%). Seventy-five respondents (62%) indicated their institution formally screens for ASD and/or PTSD, 35 do not formally screen, and 11 respondents were unsure. Of the 35 centers that did not screen, the most common reason was a lack of mental healthcare providers (46%), lack of funding (26%) and lack of time (20%). The timing of screening, person administering the screening, and method of screening varied greatly across centers for pediatric and adult patients. Most respondents thought screening pediatric (83%) and adult (87%) patients with burns for ASD/PTSD was important, and 87% thought it should be standard of care. However, only 32% of respondents were comfortable screening pediatric patients and 62% were comfortable screening adults.

Conclusions: Whereas screening for ASD and PTSD is recommended for patients with burns, our study indicates that, despite general consensus that it should be, screening is not a current standard of care. Lack of mental health providers, funding, and time are contributing factors. Among those institutions that screen, a uniform screening protocol does not exist for pediatric or adult patients.

Introduction: Burn camps provide a safe haven for child burn survivors to socialize and participate in recreational activities away from the unwanted stares from the public. But when a worldwide pandemic forced one of the world’s largest burn camps to forgo an in-person camp and pivot to a virtual camp, would the virtual burn camp prove as effective as an in-person burn camp?

Methods: In a 4-year retrospective review of camper evaluations within 2017–2020, we aimed to assess if the campers’ evaluation responses of virtual camp were consistent with their responses from past in-person camp evaluations. Camper self-evaluation forms were reviewed to record camper responses to questions regarding their opinions on camp. Camp rosters were reviewed to determine which campers attended virtual Burn Camp in 2020 as well as in-person Burn Camp among the years 2017–2019, and matched sample comparisons were reviewed (2020 vs. 2017; 2020 vs. 2018 and 2020 vs. 2019). Categorical variables were summarized as frequency and percentage, and continuous variables were described as median and range. To assess if the responses to each question were consistent between 2020 vs. 2017, 2018 and 2019, McNemar’s test was used. Statistical significance was declared based on a p value< 0.05.

Results: Within 2017–2020, there were 444 camper evaluations submitted. In 2020, there were 137 registered campers. Sample size of this study was small due to a low response rate to evaluation form requests from virtual Burn Camp participants. There were 31 individual completed evaluations forms (23% response rate). Among 31 campers, 20, 22 and 20 campers attended 2017, 2018, and 2019 in-person Burn Camp, respectively. Participants’ demographic characteristics are summarized in Table 1. Comparisons between 2020 vs. 2017, 2018 and 2019, in general, the campers’ responses were consistent. However, for Question #8 (Did you learn anything new from the other burn survivors at this event?) in 2020, more people (n=8) answered Not/A little while they answered Yes/Mostly in 2019 (p=0.046). Participants’ responses to Question#8 are summarized in Tables 2 and 3.

Conclusions: Virtual Burn Camp was generally as effective as in-person Burn Camp in almost all areas of assessment, except for the ability for burn-injured children to learn from other burn-injured children. The virtual Burn Camp model provided some interaction between counselors and campers, but did not allow for much interaction between campers, resulting in a greater response of “A Little” or “Not at All” to the question “Did you learn anything new from the other burn survivors at this event?”
Introduction: Burn camps have served burn-injured youth in the U.S. for over 35 years. Camp is a rehabilitation program that has been recognized as an important part of young survivors’ recovery. The 2020 global pandemic made an in-person camp impossible, so volunteers rallied to provide a virtual experience. Registered campers received a “Camp in a Box” filled with activities, art supplies, a camp tee-shirt, and snacks to enjoy at Virtual Burn Camp (VBC). Participants connected with campers and counselors online. This study sought to determine how youth viewed VBC compared to in-person camp, how the pandemic was affecting their emotional status and whether VBC helped them.

Methods: The study asked participants to rate survey items regarding levels of comfort, connection, and support at VBC vs. in-person camp on a 4-point scale from 1. NO! 2. no 3. yes 4. YES! Multiple choice questions such as “My favorite thing about virtual camp,” and “Things I missed most about regular burn camp” - choose 2. General stress & anxiety levels related to Covid-19 were assessed, as well as if VBC helped to reduce their anxiety/stress levels.

Results: Pediatric burn survivors (n=77) participating in 2 virtual camps, demographic’s included mean age 13.8 years, male (n=39%), female (n=61%), visible scars (74%) vs. (10%) hidden scars with the majority representing racial/ethnic minorities (65%) vs. white (35%). Campers reported feeling more connected at in-person camp (84%) vs. VBC (38%). Feeling supported was higher at regular burn camp (84%), but the majority (76%) also claimed feeling supported at VBC. Camper’s favorite things about VBC were Camp in a Box (66%), Being Part of the Burn Community (51%), and Seeing Counselors (47%). Things missed most about regular burn camp were seeing Friends (83%) and Counselors (61%). Respondents reported high Covid-19 related stress/anxiety levels (66%) and (88%) said that VBC reduced their anxiety/stress. Top benefits included feeling Happy (48%) and Thankful (32%).

Conclusions: Pediatric burn survivors place a high value on their burn community involvement. Though not the preferred camp method, the VBC earned high marks for camper’s improved emotional status and for reducing their Covid-19 stress and anxiety levels. The program succeeded in helping Virtual Campers feel supported and provided an important venue for connecting them with their burn-injured peers and camp counselors.
Introduction: Reporting by proxy is necessary when patients are not able to report their own experience, such as young children or those too sick to respond. PROMIS pediatric proxy-report item banks are a set of generic measures that facilitate comparisons across populations and studies. Our objectives were to (1) examine agreement in pediatric burn survivors between child self- and caregiver proxy-report on multiple PROMIS domains and (2) examine factors associated with differences between self- and proxy-reports.

Methods: Data were collected from children 8–17 years with moderate to severe burn injury and their respective caregivers between 6 months and 15 years after injury. The PROMIS-25 and Anger v1.0 short form were completed by pediatric burn participants. Caregivers completed either custom (depression, pain interference) or standard (Physical Function (PF) 8a, Peer 7a, Anger 5a) PROMIS proxy short forms. Self- and proxy-report scores were compared using Wilcoxon sign rank test, Cohen's effect size, and intraclass correlation coefficients (ICC(2,1)) and by agreement across severity of symptoms based on recommended cutoffs. Regression analyses examined child- (self-report score, age, gender, and ethnicity) and proxy-related (relationship to child) factors associated with score differences.

Results: A total of 274 child-caregiver pairs completed the PROMIS measures. Mean child age was 13.0 (SD=3) years. Caregivers reported significantly worse scores than the child on PF, pain, and anger (all p<0.01). Cohen's d ranged from 0.05 (depression) to 0.25 (PF), with all domains except PF in the small effect size range (<0.2). Similarly, ICCs were all of moderate agreement and ranged from 0.51 (pain) to 0.69 (depression). The percentage of dyads in agreement by severity groups was high with only 5% (pain), 8% (PF, peer relationships), and 9% (depression, anger) of pairs discordant. Regression models indicated only higher self-report score was associated (all p<0.05) with greater differences across all domains, though female gender was also associated with greater differences on depression only.

Conclusions: This study provides support for the use of pediatric proxy PROMIS depression, PF, peer relationships, pain interference, and anger scales in pediatric burn patients. Although agreement was moderate to good, proxy report should only be considered when self-report is not possible or practical. Caregivers typically report slightly worse severity of symptoms than children across all domains.

Introduction: Growing up with disfigurement and functional limitations resulting from childhood burns can be challenging. Initial stages of care involve painful surgeries, dressing changes, strenuous physical & occupational therapy, pressure garments and time away from family/school activities. Few studies have examined the voiced issues faced by youth while maturing with burns. This study's purpose was to determine if experiences in the post-injury phase differed between currently burn-injured youth vs. young adults burned as children.

Methods: A prior study asked Child Burn Survivors (CBS 10–16 yrs.) and Young Adults (YAs 17-25yrs.) to answer the statement: “The hardest thing about being burned is…”. The most common issues included: People Staring, Getting Unwanted Questions, Being Bullied, Remembering When I Was Burned, Having Additional Surgeries and My Scars. The current study asked participants to rate items on a 4-point scale from (1) Not at all to (4) Really a lot. The YAs were asked to consider issues they encountered maturing with burns.

Results: Child Survivors (CBS, n=147) mean age 13.4 years, male (n=46%) female (n=54%), and YA Survivors (YA, n = 81) male(n=39%) female (n=61%) mean age =19.1 yrs. and were predominately racial/ethnic minorities (CBS=67%; YA = 58%). No differences existed for age burned (CBS=6 yrs. vs. YA = 6.4 yrs.) hidden & visible scars (CBS=55% vs. YA=68%) and TBSA ≥ 50% (CBS=19% vs. YA =20%). Top mean scores for CBS's included: Remembering the Burn (2.05) & Getting Unwanted Questions (2.0). The YA group's top mean scores included Being Bullied (2.10) & People Staring (2.0). The CBS group reported that Getting Unwanted Questions was more problematic than the YA Group (p =0.03). YAs shared that Being Bullied was their biggest problem vs. CVS, significantly more so (p<0.01).

Conclusions: Bullying appears to be less of a problem for current child burn survivors than those previously burned. The difference may be due to a recent emphasis placed on anti-bullying in US schools. Findings highlight an ongoing need to address the psycho/social issues related to burns. Teaching interventions like the Phoenix Society's Rehearse Your Response can help youth address unwanted questions and staring. Providing children an opportunity to process the injury event may also improve their ability to cope with burn stressors.
Introduction: Burn survivors can experience challenges in social functioning (e.g., bullying, stigmatization) and self-concept (e.g., body image concerns). Use of coping strategies is associated with engagement in social supports and positive self-concept in pediatric oncology and physical injury populations; however, their relation has not been examined in pediatric burn survivors. This study aims to explore coping as it relates to social functioning and self-concept in these youth.

Methods: Fifty-one pediatric burn survivors aged 7–17 years (M=12.53; SD=2.68), and their primary caregiver participated. Youth and caregivers completed questionnaires, including the Child Coping Strategies Checklist (CCSC; youth report); the Burn Injury Social Questionnaire (BISQ; parent & youth report; higher scores = more social problems); and the Piers-Harris Children’s Self-Concept Scale-2 (PH-2; youth report). Associations between the BISQ, coping strategies (Active, Avoidance, Distraction, Support), self-concept, yearly family income, and burn injury characteristics (e.g., total body surface area; TBSA, participant grafting) were examined via bivariate correlations. Hierarchical linear regression was used to examine whether coping strategies (with significant bivariate correlations) predicted BISQ and PH-2 scores above and beyond burn injury and demographic variables. Three hierarchical regression models were run, one each for parent- and youth-report BISQ and youth-report PH-2 scores.

Results: Our sample is predominantly male (62.7%) and Caucasian (82.4%) with average TBSA of 8.74% (SD=11.02). Parent- and youth-reports on the BISQ were compared with patients without these disorders. Statistical analysis with chi-square for categorical variables and student’s t-test for continuous variables was conducted. Mortality between those with and without MPI and SUD were analyzed with a multivariable regression analysis.

Results: A total of 347 patients with a mean age of 43±17 years, 274 men and 73 women, were analyzed. The mean total body surface area burn (TBSA) was 38±18%, and 23% had inhalation injury. In this study population, 29.1% had SUD, 7.5% had MPI, and 2.3% had both. There was no difference with respect to age, gender, TBSA, frailty, or assignment to the liberal or restrictive transfusion strategy based on the presence of MPI, SUD, or both. Inhalation injury was more common in patients with MPI (27%) or SUD (35%) when compared with patients without these comorbidities (18%) or those who have both (11%) (p=0.006). Patients with MPI were more likely to die of their burn injuries (27%) when compared with those with SUD (17%), both (11%), or neither (8%) (p=0.014). On multivariate analysis for mortality controlling for TBSA and inhalation injury, MPI was found to be an independent predictor of death with an odds ratio of 5 (95% confidence interval 1.7–15, p=0.003).

Conclusions: In burns ≥20% TBSA, both MPI and SUD influence patient’s likelihood of sustaining inhalation injury. MPI is also independently associated with mortality in the study. Further work must be done to mitigate the effects of mental illness on burn outcomes.
Introduction: Burn injured patients are at high risk for developing Acute Stress Disorder (ASD) and Posttraumatic Stress Disorder (PTSD) following injury. ASD itself is a reliable predictor for the development of PTSD, which usually persists once established. Injury-related characteristics in burn patients (TBSA and anatomic location of burn) do not predict the development of psychological trauma. There is a paucity of literature examining acute psychosocial evaluations of patients with burn injury to address the need for early interventions. Behavioral health assessment and treatment in burn centers may foster improved detection and management of ASD among a variety of other mental health conditions. The goal of this study is to investigate the demographic and injury characteristics associated with new ASD diagnoses in a cohort of inpatient burn survivors.

Methods: Burn injured patients who were admitted to a regional burn center between June 2019 and June 2020 and referred for burn psychology evaluation were retrospectively reviewed. Minors, non-burn injured patients, and those with incomplete evaluations were excluded. Demographic, injury characteristic, health history, and psychologic evaluation results were collected from the medical record. ASD diagnosis was defined by criteria outlined in the PTSD Checklist for DSM-5 (PCL-5). Demographic and injury characteristic were compared between patients with and without ASD diagnoses. Statistical analysis was performed with Mann-Whitney, Chi-square, and Fisher's Exact test as appropriate. Significance was set at a p=0.05.

Results: Fifty-two patients with median age of 49.5 (IQR, 29–62) years and median TBSA of 6 (2.8–14.4) % met inclusion criteria. Of these, 11 (21%) patients were diagnosed with ASD. Patients with ASD were more often female, (73% vs. 29%, p=0.01), younger (38.5 years vs. 46 years, p=0.05), involved in a structural fire (45.5% vs. 10%, p=0.01), and employed at the time of injury (63% vs. 14.6%, p=0.002). There were no significant differences between groups in TBSA, hospital length of stay, ICU admission, or proportion of patients requiring operative intervention. Among patients who required operative intervention, those in the ASD group underwent fewer total procedures (1 vs. 4, p=0.05).

Conclusions: Patients who developed ASD were younger, more likely female, more often involved in structural fires, and employed. Markers of injury severity such as TBSA, need for operative intervention, ICU admission and hospital length of stay were not associated with the development of ASD.

Introduction: Access to quality health care services is important for acute burn care, but comprehensive burn care goes beyond acute hospitalization. Follow up is an essential part of recovery, where providers can assess late effects of burn and help the patients with community re-integration, injury rehabilitation, and mental health. However, not all patients return for follow up after burn injury due to barriers in care and patient characteristics. We hypothesized that patients with neuropsychiatric comorbidities and 0–10% of total body surface (TBSA%) are more likely to be lost at follow up compared to patients with no neuropsychiatric comorbidities and higher TBSA.

Methods: A retrospective analysis was completed on patients that were admitted to a verified Burn Center from January 2016 to June 2019. Patients that were under 18 years of age and patients that died prior to discharge were excluded. Patient characteristics included were age, gender, TBSA, discharge location, payer, and comorbidities. Univariate analysis was completed using Tableau and multiple logistic regression analysis using Stata. Neuropsychiatric comorbidities were defined as dementia, alcoholism, major psychiatric disease, and drug dependence. Lost to follow up was defined as no follow up in clinic after inpatient discharge date within 1 month.

Results: Of 562 patients, 35.94% (n=202) were female and 65.12% (n=366) were Caucasian followed by Asian 13.7% (n=77) and Other Race 13.7% (n=77). Of the 562 patients, 157 (27.95%) were lost to follow up. After adjusting for insurance type, race, and medical comorbidities, patients with neuropsychiatric comorbidities had double the risk (OR 2.052; 1.377 - 3.057 p<0.001) to be lost at follow up compared with those that did not have neuropsychiatric disorders. Homelessness was collinear with neuropsychiatric comorbidities suggesting an association. Patients with a TBSA >20% (n=37) were 3 times more likely to be lost at follow up in comparison with patients with 0–10% TBSA. (OR 2.921; 1.455–5.861 p<0.003).

Race, medical comorbidities, and insurance status had no significant impact on follow up.

Conclusions: Patients with dementia, alcoholism, major psychiatric disease, and drug dependence were more likely to be lost at follow up. Contrary to intuition, patients with burns >20% TBSA were also less likely to follow-up. Additional research is needed to better identify how psychosocial factors affect follow up in our burn patients and how to address those barriers. By focusing on our population and their needs, we can adjust our practices to make sure that we are providing holistic burn care.
100 Use of the PHQ-2 as a Depression Screening Tool to Meet BQUIP Guidelines
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Johns Hopkins, Baltimore, Maryland; University of Washington, Seattle, Washington; University of Washington, Seattle, Washington

Introduction: In 2015, the Burn Quality Improvement Program (BQUIP) guidelines were established with recommendations for systematic screening of Major Depressive Disorder at all verified burn centers. Our level one trauma center rolled out a program to screen all patients entering the burn service starting in June 2018. After a year of collecting data, we have been able to evaluate the program and make recommendations for other burn centers.

Methods: All patients admitted to the inpatient burn service who were over 12 years of age were screened by bedside nurses using the 2-item Patient Health Questionnaire (PHQ-2). Exclusion for screening included those who were intubated and sedated and/or not alert or oriented. A reminder automatically popped up in the nursing task list in the electronic medical record until it was given, or patient was coded as not appropriate for screening.

Results: A total of 509 patients were admitted to the Burn Service between June 2018 and May 2019. Of those, 40 were identified as not being appropriate for screening due to inability to regain consciousness, and 116 (24%) were not screened for unknown reasons. The remaining patients, 353 (77%) were screened with the PHQ-2 and 94% of these patients were screened on the same day of admit. Of the patients screened, 28 (8%) scored above the clinical cut-off for probable depression (PHQ-2 ≥ 3) and 265 (75.1%) did not endorse any symptoms on the PHQ-2. Of the 28 that screened positive, 16 (57.1%) received psychological services. Of those that did not receive psychological services, the majority were admitted for less than 3 days (n=10, 76.9%).

Conclusions: In the first year of the program the vast majority of eligible patients were able to be screened by nursing staff with a 2-item measure. A 77% screening rate is high for a trauma setting. This success is likely due to the automation of the task in the electronic medical record, the ease of use of the PHQ-2 and the dedication of the nursing staff. The 8% rate of a positive screen is higher than the general population (4%) but a similar rate to what is reported in the literature of burn survivors who are 5- and 10-years post burn injury. Given that most patients were screened within 24 hours of admission, we are capturing depressive symptoms that precede the injury. We know that depression can impair burn recovery (e.g., affect participation in therapy, impede wound healing) and lead to poorer long-term outcomes. Systematic screening of depressive symptoms upon admission will allow us to intervene earlier and potentially reduce barriers to optimal recovery. We will be discussing utilization of resources for providing inpatient services to patients with a positive screen.

101 Homeless Status, Distance from Clinic, and Substance Dependence Associated with Low Follow-Up Rates for Burn-Injured Survey Respondents
Eve A. Solomon, BA, Elizabeth Phelan, MSW, LCSW, Lilia G. Tumbaga, BSN, RN, Irina P. Karashchuk, B.S., David G. Greenhalgh, MD, Soman Sen, MD, Tina L. Palmieri, MD, Kathleen S. Romanowski, MD, FACS
University of California, Davis and Shriners Hospitals for Children Northern California, Sacramento, California

Introduction: Over 25% of burn-injured patients at our institution never attended a follow-up appointment. A quality-improvement discharge survey (QIS) identified potential barriers to follow-up as distance from the clinic, transportation, and time off work. This study compares follow-up rates before and after the QIS was administered and correlates them with patients’ self-identified barriers.

Methods: Following IRB approval, a retrospective chart review was conducted using electronic medical records of adult burn-center admits who responded to the QIS and were discharged between September 2019 and July 2020. Controls were burn-center admits discharged from 2016–2018, prior to the survey period. Exclusions included patients with non-burn injuries, and those who died in the hospital were transferred to another hospital, did not require follow-up, or followed up elsewhere. Data analysis was conducted using chi-square, t-test, and logistic regression models.

Results: The post-survey group includes 272 patients (mean age 47 ± 16.8 years, 201 males (73.6%), mean burn size (TBSA) of 9.3% ± 9.6%). The pre-survey control group includes 878 patients (mean age 45.1 ± 16.8 years, 646 males (73.6%), mean burn size (TBSA) 10.16 ± 11.7%). Compared to the pre-survey group, post-survey patients had a lower frequency of missed appointments (MA) (47.3% post vs. 56% pre), but worse overall follow-up rates (63.7% post vs. 74.5% pre). Per multivariate analysis, different factors were associated with follow-up and MA in the two groups (Table 1). Rates of follow-up and MA were not significantly different before and after the onset of the Covid-19 pandemic.

Conclusions: Patients who were surveyed to identify barriers to follow-up had fewer missed appointments but worse overall follow-up rates. Patients fail to follow up due to homelessness, substance dependence, and distance to the hospital. These findings are consistent with patients’ self-identified barriers to follow-up in a QI survey.

Table 1. Factors associated with lack of follow-up and MA in pre- and post-survey patients.

<table>
<thead>
<tr>
<th>Lack of Follow-Up</th>
<th>Missed Appointments</th>
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<tbody>
<tr>
<td><strong>Pre-survey group</strong></td>
<td><strong>Post-survey group</strong></td>
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<tr>
<td>Hospitalization (OR 0.56, p=0.003)</td>
<td>Hospitalization (OR 0.55, p=0.002)</td>
</tr>
<tr>
<td>Distance from hospital (OR 1.694, p=0.003)</td>
<td>Distance from hospital (OR 1.680, p=0.048)</td>
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<tr>
<td>Drug Dependence (OR 0.21, p=0.002)</td>
<td>Drug Dependence (OR 0.21, p=0.002)</td>
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<tr>
<td>Substance Dependence (OR 1.664, p=0.001)</td>
<td>Substance Dependence (OR 1.652, p=0.007)</td>
</tr>
<tr>
<td>Tobacco use (OR 0.814, p=0.01)</td>
<td>Tobacco use (OR 0.806, p=0.01)</td>
</tr>
<tr>
<td>Major psychosocial issues (OR 0.52, p=0.03)</td>
<td>Major psychosocial issues (OR 0.52, p=0.03)</td>
</tr>
<tr>
<td>Poverty (OR 1.02, p=0.03)</td>
<td>Poverty (OR 1.02, p=0.03)</td>
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</table>

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Early Palliative Care Consultation in the Burn Unit: Increasing Utilization and Areas for Improvement

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University of Colorado, Aurora, Colorado; University of Colorado Hospital, Aurora, Colorado; University of Colorado, Denver, Colorado; University of Colorado Anschutz Medical Center, Aurora, Colorado; University of Colorado, Aurora, Colorado; University of Colorado, Denver, Colorado

Introduction: Despite significant morbidity and mortality for major burns, palliative care consultation (PCC) is underutilized in this population. While use of PCC is increasing, a prior study showed that less than 2% of patients with major burns had PCC during admission. The purpose of this study is to examine the impact of a protocol using recommended “triggers” for PCC at a single academic burn center.

Methods: This is a retrospective review of patient deaths over a four-year period (9/2016–8/2020). Use of life-sustaining treatments, comfort care (de-escalation of one or more life-sustaining treatments) and do not resuscitate (DNR) orders were determined. Use of PCC was compared during periods before and after a protocol establishing recommended “triggers” for early (< 48 hrs of admission) PCC was instituted in 2019. Triggers included Baux score > 100 and/or complex decisions about treatment including need for cardiopulmonary resuscitation (CPR)/renal replacement therapy (RRT)/vasopressors, or at least two of the following: age > 70, major comorbidities, disagreement amongst family/patient/providers about best course of treatment, or no longer meeting expected milestones.

Results: A total of 33 patient deaths were reviewed. Most patients were male (n=28, 85%) and median age was 62 years [IQR 42–72]. Median Baux score was 112 [IQR 81–133]. Eleven patients (33%) had major comorbidities. Many patients had life-sustaining interventions such as intubation, RRT, or CPR, often prior to admission. Amongst patients who survived >24 hrs, 67% (n=14/21) had PCC. Frequency of PCC increased after protocol development, with 100% vs. 36% of patients having PCC before death (p=0.004). However, even during the later period, only half of patients had early PCC despite meeting criteria at admission.

Conclusions: Frequently, initiation of life-sustaining measures in severely injured burn patients occurs prior to or early during hospitalization. Thus, early goals of care discussions are valuable to prevent interventions that do not align with patient values and assist with de-escalation of life-sustaining treatment. In this small sample, we found that while there was increasing use of PCC overall after developing a protocol of recommended “triggers” for consultation, many patients who met criteria at admission did not receive early PCC.
Introduction: Evidence-based criteria for burn patient admission are poorly defined. Attempts have been made by commercial entities to align payors and providers with evidence-based admission criteria to optimize resource use. However, these admission criteria have not been examined critically to see if they are appropriate and effective. We developed an admission criteria algorithm based on these existing standards and have utilized it for nearly 18 months. The purpose of this study is to retrospectively review this algorithm with respect to inpatient needs and outcome to assess its effectiveness.

Methods: A retrospective chart review of patients admitted to the burn center over a 1-year period was performed. Incomplete datasets were excluded. Patients were grouped by TBSA, < 10%, 10–20% and > 20%. Appropriateness of admission was measured using length of stay (LOS) as a surrogate marker, hospitalizations of < 3 days, unless deceased, were deemed inappropriate (IAP) and 3 days or more as appropriate (AP).

Results: There were complete datasets for 530 patients, < 10% (n=423), 10–20% (n= 72), >20% (n=35). There were no significant differences in age, gender, or payor sources between the groups. Patients with larger TBSA burns were more likely to have suffered a flame/flash injury. All patients in the two larger TBSA groups met admission criteria per algorithm. All IAP were in the < 10% group. When compared to AP, IAP were younger, 31.6 vs. 44.0 years (p< .0001), had smaller TBSA injuries 2.8% vs. 3.5% (p=.0045), had fewer clinical findings 1.4 vs 1.8 (p <.0001), fewer interventions 1.8 vs 2.6 (p< .0001) but were more likely to have suffered burns to the head 30% vs 13% (p< .00001) and neck 9% vs 3% (p=.0164). AP patients were more likely to have suffered contact burns 27% vs. 17% (p=.0323), full-thickness injuries 39% vs 14% (p< .0001), involvement of a major joint 42% vs 29% (p=.0085), combined burn and trauma 3% vs. 0% (p=.0444) and burns to the buttocks 7% vs 2% (p=.0357). AP patients were also more likely to require IV analgesia 82% vs 71% (p=.0107) and evaluated as likely needing surgery 82% vs 15% (p<.00001).

Conclusions: The admission criteria algorithm performed perfectly in patients with a ≥ 10% TBSA injury. For patients with burn < 10% TBSA the algorithm was not followed as closely leading to some inappropriate admissions. Patients with smaller burns admitted appropriately were more likely to have full thickness burns, contact burns, burns over joints and to require surgery. The algorithm was highly accurate in patients with large burns, however additional refinement is needed for those patients with smaller burn injuries.
Implementation of a Burn Resource Team for Initial Debridement and Burn Management in a Pediatric Burn Center

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Children’s Hospital of Michigan, Detroit, Michigan

Introduction: Each year, approximately 700 patients are treated at our verified pediatric burn center. Previously, all patients were fast tracked through the Emergency Department (ED) or directly admitted to the burn unit and received intravenous (IV) morphine and midazolam for analgesia. Although the process was efficient (goal < 120 minutes), this strategy resulted in some patients being unable to tolerate wound debridement due to inadequate sedation. As a process improvement initiative, a burn resource team, consisting of experienced nurses was created. As part of the new process, all patients are initially evaluated and treated in the ED. The Pediatric Emergency Medicine team provides procedural sedation utilizing ketamine, allowing the resource team to assess, debride, and dress the wounds. The objective was to maintain efficiency with time to debridement and dressing application, while concurrently utilizing improved patient sedation.

Methods: Door to debridement time and sedation/analgesia for first debridement was retrospectively reviewed for each group. The pre-implementation group included 148 patients from May 2018 – April 2019. The post-implementation group included 163 patients from August 2019-July 2020. Specific inclusion criteria were age < 18 years and TBSA ≤ 5%.

Results: Of the 148 patients in the pre-implementation group, 82 patients (56%) received morphine and midazolam for their analgesia. These patients had a mean TBSA of 1.5% (0.25 - 5%). 38 patients (26%) received only morphine with a mean TBSA of 1.25% (0.25 - 4%). 14 patients (9%) received hydrocodone with a mean TBSA of 0.75% (0.25 - 2.25%). The additional 14 patients (9%) received an alternate analgesic with a mean TBSA of 0.75% (0.25 - 1%). Average door to debridement time for this group was 97 minutes. In the post implementation group, 94 of the 163 patients (58%) received ketamine sedation. These patients had a mean TBSA of 2% (0.25 - 5%). 49 patients (30%) received Intranasal fentanyl and/or midazolam with a mean TBSA of 1% (0.25 - 4%). 13 patients (8%) received hydrocodone with a mean TBSA of 1% (0.5 - 3%). The additional 7 patients (4%) received alternate analgesics with a mean TBSA of 1% (0.5 - 2%). Average door to debridement time for this group was 92 minutes.

Conclusions: The implementation of a burn resource team and administration of procedural sedation utilizing ketamine in the ED has improved sedation and analgesia for burn patients and marginally decreased time to debridement. There have been noticeable improvements in the consistency of the process as well as improved collaboration between the ED and burn teams.

Frailty Assessment in the Burn Population: A Single Center Retrospective Review

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Vanderbilt University Medical Center, Nashville, Tennessee; Vanderbilt University Medical Center, Mount Juliet, Tennessee; Vanderbilt University Medical Center, Nashville, Tennessee; Vanderbilt University Medical Center, Nashville, Tennessee; University of Utah Health, Salt Lake City, Utah

Introduction: Burn morbidity and mortality increases with advancing age. Frailty is characterized by reduced hematopoietic reserves and is associated with an increased biological age compared to chronological age. Our primary aim was to determine whether frailty as assessed on admission would be predictive of outcomes in the burn population.

Methods: We conducted a single institution 7-month retrospective chart review of all admitted acute burn patients ages 45 and older. Patient and injury characteristics were collected and compared using standard statistical analysis. Frailty scores were assessed upon admission using the FRAIL Scale.

Results: Eighty-five patients met inclusion criteria and were able to complete the FRAIL assessment. Patient and injury characteristics are listed in Table 1. Mean burn size was 6.7%TBSA (95%CI 4.9–8.4%). 34 patients (40%) were classified as robust (FRAIL score 0), 26(30.6%) as pre-frail (FRAIL score 1-Patients in the pre-frail/frail cohort received more palliative care consultations (p=.096) and had a longer length of stay (3.3d vs 7.55d p=.002), while prefrail patients had a similar LOS to frail patients (7.46 vs 7.64d p=.938). Patients in the pre-frail/frail cohort were also more likely to be discharged to a higher level of care than they were admitted from(p=.032) with prefrail patients experience an escalation in level of care more frequently than frail patients. The distribution by age by half-decade ranges is in Figure 1. By age 55–59, the majority of patients were prefrail or frail.

Conclusions: We demonstrated that frailty as assessed by the FRAIL score was predictive of increased length of stay and an escalation in post discharge care. In addition, patients characterized as pre-frail experience outcomes similar to frail patients and should be managed as such. Given the prevalence of frailty and prefrailty in the younger group of patients, we advocate for routine frailty screening beginning at age 55.
**Introduction:** Long term sequela of burn injuries include the development of scars leading to psychological, emotional, functional, and physical disabilities. There are multiple modalities for scar management including compression garments, topical silicone, orthotics, laser therapy, surgical releases, and medical treatment for symptom management. Multiple studies have found custom garments are a viable option to aid in improvement of range of motion, scar pliability, vascularity, color, height of scar, and improvement in appearance. Timing of garments is critical to the success of the treatment. The purpose of this quality improvement project is to develop an effective and efficient process to improve time to burn garment application.

**Methods:** At one verified ABA Burn Center, a retrospective chart review included adult burn patients, to compare the time for donning custom garments in the outpatient setting pre- and post-process improvement project. Pre-process improvement data was collected between October 1, 2018 and June 30, 2019. Post-process data collection carried from November 1, 2019 to August 31, 2020. A group including burn therapists, program manager, providers, and clinic staff met to identify the current practice and develop an improved workflow. An excel spreadsheet was developed to track key data points for continued improvement.

**Results:** A total of 33 patients were included in the initial pre-process improvement group (27 initial orders, 6 reorders) and 39 in the post-process group (24 initial orders, 15 reorders). The mean number of days for patients to receive their initial garment order was 98 days (range 19-280) pre-process and 45.6 days (range 19-106) post-process (p = 0.0001). For reorders, mean days for receiving the garment was 37.3 days (range 19-70) pre-process and post-process was 19.5 days (range 9-15) p = 0.039. Pre-process delays were related to packets not sent to vendor in a timely manner, necessary paperwork missing when sent to the vendor, lack of follow up for the status of the garment, insurance coverage, and staff being unaware of garment arrival. The major reason for delays with receiving garments in the post-process period was issues with insurance payments.

**Conclusions:** A defined, stepwise process may improve time to garment donning by patients. Support from insurance billing may further help improve this process.

**Conclusions:**

**Methods:** Data from the Pediatric Injury Quality Improvement Collaborative (PIQIC) were obtained for 1004 patients (n=1004) treated at five pediatric burn centers from July 2018-March 2020. LOS/TBSA burn ratios were calculated for each site. LOS/TBSA burn by institution and mechanism was analyzed. Generalized linear regression models were used to model the effect of hospital and burn mechanism on the LOS/TBSA ratio.

**Results:** Among the 1004 injuries, the most common burn mechanism was by scald (64%), followed by contact (16%) and flame (13%). The average LOS/TBSA burn ratio across all cases was 1.3 days (SD 2.2). Flame burns had a higher LOS/TBSA burn ratio than scald burns with a mean LOS/TBSA burn of 1.63 compared to 0.84. In adjusted models, scald burns, and chemical burns had the lowest LOS/TBSA burn ratio and electrical and friction burns had the highest LOS/TBSA burn ratio. The LOS/TBSA burn ratio was comparable across hospitals after adjustment for mechanism, with just Hospital 4 having a lower average LOS/TBSA burn of 0.49 days.

**Conclusions:** These data establish a multi-institutional ratio for the overall performance in LOS for pediatric burn patients. A LOS per TBSA ratio of about 1 was observed
across PIQIC centers, except for a lower ratio at one center. Additionally, it provides evidence on the variance in LOS per TBSA burn relative to the sustained burn mechanism. Further collaborative data analysis will allow us to recognize specific patterns and outcomes in pediatric burn care, which is essential for the implementation of quality improvement standards.

<table>
<thead>
<tr>
<th>Parameter</th>
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**Introduction:** High wound care complexity in a burn clinic mandates adequate nurse staffing and expertise to manage increasingly large wounds as outpatient. To achieve these service needs, appropriate charge capture is important for revenue generation. Our burn clinic performed a process improvement (PI) project using a Plan, Do, Study, Act (PDSA) cycle to improve the accuracy of charge capture for wound care episodes over the past 2 fiscal years (FY).

**Methods:** In the first phase (PLAN), we reviewed charges by 1-month sampling in FY20. We engaged stakeholders (medical and nursing providers, managers, revenue integrity and compliance teams) through iterative meetings. We performed a stakeholder analysis to identify their level of engagement, influence, and attitudes toward this PI. We next devised strategies for stakeholders to champion the project. The team developed and trialed the process by focusing on burn wound care Common Procedural Terminology (CPT) codes. In FY21, nurses began to enter CPT codes in accordance with burn wound care performed (DO). We then repeated a 1-month sampling of charges in FY21 (STUDY). We are now consolidating the new strategy, refreshing stakeholder engagement, and expanding it within our hospital (ACT).

**Results:** We identified multiple billing errors and opportunities to improve CPT code documentation for nursing wound care procedures in FY20. Stakeholder interviews revealed a gap between accurate billing and current practice. We proposed to alter the wound care billing workflow. Stakeholder engagement was high and well-represented among professional disciplines. In FY21 implementation, clinic nurses received the clinic coding in-service and were oriented to resource tools. We verified billing practice adherence via the institutional compliance department. FY21 sampling indicated a marked increase in accurate charges for burn wound care in the clinic (net+ $36,691). We have implemented real-time audits, identified and documented problems as they arise, and obtained feedback from nurses. The clinic is investigating non-burn wound care charge capture and has disseminated our findings through institutional shared governance.

**Conclusions:** The financial performance of outpatient burn nursing needs to be closely evaluated in today's shifting healthcare environment. Using a PDSA process led by nurses, the accuracy of charge capture for complex wound care has substantially improved and led to increased revenue. This model is potentially translatable to other specialty clinics.
Introduction: In September 2020, the American Burn Association released new pain guidelines following a rigorous literature review and input from experts. These guidelines were last updated 14 years ago and represent a multitude of changes including increased importance for non-opioid pain medication use and non-pharmacologic adjuncts given the current opioid crisis. Specifically, the main recommendations were to use opioid medication sparingly and always with adjuncts; acetaminophen utilized in all patients; NSAID use depending on baseline comorbidities and kidney function; neuropathic pain therapy for those with such pain/refractory to standard therapy; and ketamine for procedural sedation/adjunct for opioid consumption. Further, nonpharmacologic treatments include cognitive-behavioural therapy (CBT), hypnosis, and virtual reality should be considered. The objective of this study is to describe current pain medication prescription habits at one ABA-verified centre and how well they are in compliance with these new guidelines.

Methods: We conducted phase one of a quality improvement retrospective study of 514 patients admitted to an ABA-verified centre over a two-year period. Data included demographics and pain medication use which was compared against the new ABA American Burn Association 2020 Guidelines on the Management of Acute Pain in the Adult Burn Patient. Pain medication contraindications were defined using UpToDate Drug Information. Statistical analysis was descriptive in nature.

Results: 422 patients were admitted for acute burns. 65.9% were male with an average age of 46.4 (st dev 17.6, range 15–96). Flame burns were most common (n=209,49,5%) with average TBSA of 11.9% (st dev 16.5, range 0–98%) and 54 inhalation injuries (12.8%) covering an average length of stay of 15.6 days in the burn centre (st dev 16.8, range 1–146 days). A total of 3549 pain medications were prescribed: 1792 opioid (50.5%) and 1757 non-opioid (49.5%). Of those admitted, 93.8% were prescribed opioids, 72.5% NSAIDs, 87.2% acetaminophen, 74.4% nerve pain medications, and 25.3% ketamine. Opioids were not prescribed in 26 patients (6.2%) and only prescribed in 29 patients (69%). Regarding adjuncts, 4 (0.94%) had documented contraindications to NSAIDs and 3 (0.71%) to acetaminophen. No referrals were completed for CBT. Virtual reality and hypnosis are not available at this centre.

Conclusions: This work represents the first known study examining compliance to the new pain guidelines in an ABA-verified burn centre. There is significant room for improvement for the use of adjuncts specifically NSAIDs and acetaminophen as both were under prescribed. In addition, nonpharmacologic treatments are largely not available or not used and may be an untapped resource for better pain control.
Introduction: Antimicrobial resistance is an increasing problem in hospitals worldwide, though the prevalence of carbapenemase-producing Enterobacteriaceae (CPE) in our region is low. Burn patients are among the most vulnerable to infection because of the loss of the protective skin barrier. Because of this, burn centres prioritize infection prevention and control with measures like additional precautions, enhanced environmental cleaning, dedicated facilities, and mandatory use of personal protective equipment (PPE).

Methods: This report describes a CPE outbreak in a regional burn centre. We hypothesized that contamination of in-room hand hygiene sinks with CPE was a potential source of transmission. In a period of 2.5 months, four nosocomial cases of CPE were identified, three containing the KPC gene and one VIM gene. There was more than one month between the first and second KPC case, with no overlap in patient stay or rooms.

Results: The first two cases were identified while there was no CPE patient source on the unit. CPE KPC gene was isolated in sink drains of three different rooms. In addition to the rigorous infection control practices already in place due to the unique patient population, additional outbreak control measures were implemented. The burn centre restricted admissions to complex burns or burns ≥10% total body surface area, in consultation with the attending surgeon. No elective admissions were permitted. To avoid CPE exposure to new patients, initial admissions were rerouted to the emergency department and, if possible, the patient was admitted to another unit. Patient cohorting was implemented through nursing team separation for CPE positive and negative cases, and geographical separation of CPE positive cases to one side of the unit.

Conclusions: Despite aggressive infection control measures already in place at our burn centre, there was hospital-acquired CPE colonization/infection. Given there was CPE acquisition when there was no positive patients on the unit and CPE contaminated sinks of the same enzyme were identified, it suggests that hospital sink drains can become a potential source of CPE.

Introduction: Early excision and grafting for deeper hand burns is important for preservation of long-term hand function. Little information exists on long-term reconstructive and revision operations after acute grafting. Limited quantitative data is available on early predictors of this outcome. This study retrospectively examines a cohort of patients who underwent excision and grafting of acute hand burns and details their reconstructive course in the years after injury. Predictors of future reconstructive hand surgery are examined.

Methods: A retrospective review was conducted using medical records of patients admitted with acute burn injury to a major regional burn center from February 1999 to October 2015 and who subsequently underwent excision and grafting for closure of the acute wound. Information collected included demographics, burn size and etiology, anatomical involvement, grafting, contracture release, local tissue rearrangement, and regional and distant flaps. Regression analysis assessed for demographic and clinical predictors for future contracture release with grafts and/or local tissue rearrangement surgery.

Results: A total of 704 hands in 532 adults (71% male, median age 40 years, average burn size 14.9% TBSA) met study criteria (Table 1). Ninety-eight patients underwent at least one reconstructive surgery (122 burned hands). Mean length of follow-up was 1000 days. Multivariable logistic regression analysis showed that male gender was negatively associated (p < 0.001; OR 0.369; 90% CI, 0.233–0.584) with contracture release with graft whereas white race (p=0.030; OR 2.060; 90% CI, 1.192–3.560) and burn size ≥21% TBSA (p < 0.001; OR 3.962; 90% CI, 2.224–7.057) were positively associated. Males had a negative association (p=0.023; OR 0.527; 90% CI, 0.332–0.837) and burn size a positive
association with local tissue rearrangement (5–10% TBSA - p=0.041; OR 2.149; 90% CI, 1.161–3.975 and ≥21% TBSA - p< 0.001; OR 4.230; 90% CI, 7.927).

Conclusions: Approximately 1 in 6 acutely grafted hands underwent at least one reconstructive surgery of clinically significant contractures, primarily in digits and web spaces. Female gender and burn size were positive predictors of both categories of reconstructive surgery while white race was a positive predictor of release and graft.

TABLE 1: Factors Related to Hand Reconstruction After Burns

<table>
<thead>
<tr>
<th>Factor</th>
<th>Number of Burned Hands</th>
<th>Number of Patients with Bilateral Hand Burns</th>
<th>Mean Burn Size (% TBSA)</th>
<th>Mean Burn Size (% TBSA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>40 (17.4)</td>
<td>173</td>
<td>29.1</td>
<td>29.1</td>
</tr>
<tr>
<td>White</td>
<td>378 (75.8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>32 (6.6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>14 (3.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other/Unknown</td>
<td>20 (4.2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean Burn Size (% TBSA)</td>
<td>14.9 ± 15.9</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusions: Approximately 1 in 6 acutely grafted hands underwent at least one reconstructive surgery of clinically significant contractures, primarily in digits and web spaces. Female gender and burn size were positive predictors of both categories of reconstructive surgery while white race was a positive predictor of release and graft.

Introduction: The novel Coronavirus disease 2019 (COVID-19) has created profound challenges in healthcare delivery. Hospital systems have delayed or shut down elective surgeries and outpatient care. These measures resulted in profound disruptions to burn treatment regarding reconstructive care from surgery to therapy. This study aims to characterize burn patients’ perspectives on elective reconstructive surgery during COVID-19.

Methods: As part of a quality improvement initiative, a 12-component questionnaire to burn patients awaiting reconstructive surgery at a single ABA verified Burn Center during COVID-19 was conducted. Responses regarding willingness to undergo reconstruction during COVID-19, perceived medical and personal impacts of COVID-19, and perspectives on telehealth were gathered. Surveys were administered over the phone in English and Spanish to burn patients or to primary caregivers in the case of pediatric patients.

Results: We surveyed 23 participants who met our inclusion criteria. Average age was 23 and 43% were male. We found 22 (96%) patients were willing to undergo reconstruction during the COVID-19 pandemic. Table 1 outlines the responses to questions regarding telehealth and being a burn patient during COVID-19. Examples of stressors experienced by patients and their families due to COVID-19 included: inability to communicate with healthcare providers in person, increased anxiety in public places, delayed surgical care, and interruption of physical or occupational therapy. Family members in 5 out of the 8 Spanish speaking households lost their job due to COVID-19, resulting in financial stress for the burn patient.

Conclusions: The majority of patients expressed strong desires to return to surgical and therapy care delayed by COVID-19. Patients reported feeling especially vulnerable as burn patients and cited receiving healthcare and financial stressors as a result of the COVID-19 pandemic as the main causes.

Table 1: Patient Responses to COVID-19 Stressors and Telehealth

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree/Non</th>
<th>Neutral</th>
<th>Disagree/No</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you feel that telehealth was an important part of your care as a burn patient?</td>
<td>9</td>
<td>1</td>
<td>5</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>I am specifically concerned about my burn patient for being susceptible to COVID-19</td>
<td>8</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>COVID-19 has created specific stressors for me as a burn patient.</td>
<td>11</td>
<td>8</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Are you using digital platforms for social support?</td>
<td>NA</td>
<td>8</td>
<td>NA</td>
<td>15</td>
<td>NA</td>
</tr>
<tr>
<td>Were you involved in P/T programs that got cancelled due to COVID-19?</td>
<td>NA</td>
<td>7</td>
<td>NA</td>
<td>16</td>
<td>NA</td>
</tr>
</tbody>
</table>
The Impact of Burn Injury on Upper Extremity Prosthesis Users

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Introduction: Burns with upper extremity (UE) amputation present a unique rehabilitation challenge. The purpose of this study of UE amputees who are active prosthesis users was to compare outcomes for those with and without burns.

Methods: This is part of a larger nationwide study of U.S. military members and veterans with UE amputations. In-person data were collected at 5 sites. An therapist measured passive and active range of motion (PROM, AROM); administered the Quick Disability of the Arm, Shoulder, and Hand; Community Reintegration of Injured Service Members-Computer Adaptive-Test; Trinity Amputation and Prosthetic Experience Scale; health-related quality of life (VR-12); Activities Measure for Upper Extremity Amputees; Southampton Assessment Procedure; 9-Hole Peg Test; and Jebsen-Taylor Hand Function Test (JTHF); and recorded residual and phantom pain; timing of prosthesis receipt; and current prosthesis use. The IRB approved this study.

Results: Data were collected on 126 individuals with UE amputation, of whom 105 had data on etiology and were included. Of these, 13 (12.4%) had burns (B) vs non-burn (NB). The majority were unilateral amputees (69% B, 90% NB). Most were transradial (TR) amputees (B 84.6%, NB 66.3%) as opposed to transhumeral (TH). A minority received their prosthetics within the first 3 months post-amputation (11.1% B, 28.8% NB) (p=0.15). Variable age was 57.6 (SD 15.6) years for NB and 53.0 (20.6) years for B. Mean time since amputation was 22.5 (18.0) years for NB and 25.2 (17.3) years for B. The following non-significant differences in outcomes between B and NB were observed. Thirty-nine percent of B were employed following non-significant differences in outcomes between B and NB. A body-powered (66.7%) for B, myoelectric (50%) or body-powered (50%). For unilateral UE amputees, there were no differences between B and NB on performance testing for dexterity and functional tasks or in self-reported disability, quality of life or prevalence or intensity of pain. B trended towards more moderate to severe PROM deficits with shoulder forward flexion (TH B 50%, TH NB 23.1% [p=0.444]; TR B 20%, TR NB 5.6% [p=0.197]) and shoulder abduction (TH B 50%, TH NB 26.9% [p=0.497]; TR B 30%, TR NB 16.4% [p=0.376]). Also, B amputees with burns trended towards more PROM deficits with elbow flexion (B 20%, NB 6.9% [p=0.212]) and elbow extension (B 20%, NB 8.6% [p=0.272]). AROM deficits also trended greater in B.

Conclusions: We did not observe differences in physical function, pain levels, or quality of life between those with and without burns. Further studies with larger samples are needed, to include analysis of burn location, burn size, hospital length of stay, and rehabilitation care.
Feasibility and Scar Outcome with a Single-use Adhesive Silicone in Pediatric Burn Survivors

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Introduction: Silicone sheets are commonly used for prevention and treatment of burn scars and silicone-based products have recently been recommended as the gold standard non-invasive treatment choice. One problem with silicone gel sheets application is that the sheets lose their adhesive qualities making them difficult to affix to the patient and costly to replace. Use of such a product could improve ease and continuity with scar management. In addition, for this small cone was removed.

Methods: Medical records of pediatric burn survivors who used the adherent silicone sheets between September 2019 and July 2020 were retrospectively reviewed. Information regarding details of silicone use and scar outcome scores were extracted from the records. Data were analyzed using paired Student t-tests and Wilcoxon Signed Rank to compare scars before and after using the silicone.

Results: The silicone was applied to 22 body areas of 9 patients. The average age of the patients was 7.4 (±8.5) years and TBSA 53 ±17%. The time from injury or grafting to when the silicone was applied was 200.5 (±13.4) days. The silicone was worn without interruption for an average of 12.8 days. Total Patient Observer Scar Assessment Scale (POSAS) scores for both the patient and observer evaluations significantly improved after use with the single-use adherent silicone (↓13.83 patient p=.005, ↓5.4 observer p=.01). Evaluating individual scar parameters showed 4/7 patient reported and observed areas of the POSAS evaluation improved significantly with adherent silicone use (Figure 1). Only one patient reported a complication of itch at day 5 and the silicone was removed.

Conclusions: The single-use adhesive silicone investigated in this study appears to adequately adhere to patients over multiple days, thus overcoming common barriers to silicone use of the products falling off, getting lost and needing to be replaced. Use of such a product could improve ease and continuity with scar management. In addition, for this small cohort of patients, scar improvement was noted with silicone use. The results of this study indicate that larger prospective studies evaluating the silicone efficacy may be beneficial.

The Clinical and Demographic Predictors Associated with Physical Function in Pediatric Burn Survivors: A Burn Model System National Database Study

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Introduction: Burns are a common pediatric injury, and severe burns can interfere with a child’s physical function. Rehabilitation for these patients continues to evolve; however, little is known about how clinical and demographic factors affect long-term physical function outcomes. This study will evaluate the association between Patient Reported Outcome Measurement Information System–29 (PROMIS) physical function-mobility subscale scores (PF) and various clinical and demographic factors among pediatric burn survivors.

Methods: Data were collected from the Burn Model System National Database (1994–2020) and was compiled from five ABA verified burn centers. The data requested included pediatric self-report PROMIS PF scores assessed at 6 months post-burn. A linear regression model was performed with PF total score at 6 months as the dependent variable and total body surface area (TBSA) burned, age, sex, etiology of the burn, length hospital stay of stay (LOS), and race/ethnicity as independent variables.

Results: A total of 82 patients between the ages of 8–17 were included in the regression analysis. The mean physical function scores for the participants was 46.2 (SD=11.9), 20.0–57.1 with 50 (SD=10) being the average for the general population. The mean % TBSA burned was 37 (SD=19), 2–90. The regression model revealed an association (n=82; F=7.85; p< 0.001; R²=0.2648) of PF to the predictors LOS (p < 0.001; regression coefficient= -0.18) and White ethnicity compared to Hispanic (p < 0.001; regression coefficient=8.89).

Conclusions: In this study, pediatric burn patients’ self-reported physical function was associated with ethnicity and hospital stay, with longer hospital stay and Hispanic ethnicity resulting in lower PF.

Table 2. Linear regression analysis of factors affecting PROMIS physical function scores

<table>
<thead>
<tr>
<th>Total body surface area burned</th>
<th>Regression coefficient</th>
<th>Robust S.E.</th>
<th>p-value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>0.69</td>
<td>0.07</td>
<td>0.197</td>
</tr>
<tr>
<td>Race/ethnicity*</td>
<td>White</td>
<td>0.89</td>
<td>0.23</td>
<td>0.000</td>
</tr>
<tr>
<td>Other (Black and American Indian)</td>
<td>-3.71</td>
<td>0.60</td>
<td>0.32</td>
<td>-17.26 - 3.85</td>
</tr>
<tr>
<td>Age</td>
<td>-0.82</td>
<td>0.42</td>
<td>0.143</td>
<td>-1.45 -0.21</td>
</tr>
<tr>
<td>Female sex</td>
<td>0.62</td>
<td>0.24</td>
<td>0.028</td>
<td>-0.00 - 0.12</td>
</tr>
<tr>
<td>Length of hospital stay</td>
<td>-0.18</td>
<td>0.04</td>
<td>0.000</td>
<td>-0.26 -0.10</td>
</tr>
</tbody>
</table>

*Reference category is Hispanic
Satisfaction with Life and Community Integration Outcomes up to 20 Years after Burn Injury

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Introduction: Among the many challenges burn survivors face, community integration is often difficult and might affect overall satisfaction with life long-term. The purpose of this study is to examine quality of life, based on life satisfaction and community integration, at long-term follow-ups in the burn population.

Methods: Data from the Burn Model System National Database (1997–2020) were analyzed. Patient-reported outcome measures were collected at discharge with a recall of preinjury status, and at 5, 10, 15, and 20 years after injury. The Satisfaction with Life Scale (SWLS) was used to measure participants’ satisfaction with life and the Community Integration Questionnaire (CIQ) measured level of community integration. A random intercept model was used to fit the data and generate a score trajectory with 95% confidence intervals to demonstrate the changes in scores over time and the impact of the demographic and clinical covariates on the model. SWLS trajectory is depicted in the Figure.

Results: The study population included 214 adult burn survivors with a mean age of 45.2 years. The population was mainly male (65.9%) and white (77.1%) with a mean burn size of 22.5% and average length of hospital stay of 34.7 days. This study found that SWLS scores decrease over time, but CIQ scores were relatively stable. The CIQ model with additional covariates were not statistically significant and did not improve the fit of the model.

Conclusions: Satisfaction with life was significantly worse over time. Community integration showed little or no change over the long term.
A Survey of Burn Care Professionals to Characterize Patterns of Early Mobility in ICU Burn Patients

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Arizona Burn Center, Scottsdale, Arizona; Valleywise Health

Introduction: Early mobility in intensive care unit (ICU) patients has been demonstrated effective in improving functional status, range of motion, preventing complications, and decreasing length of stay. There is limited data regarding the early mobilization of burn ICU patients. The purpose of this study was to survey burn care providers to better understand their experience with early mobilization and explore perceived barriers and contraindications.

Methods: An internet-based 21-item survey was distributed to burn professionals at North American burn centers and units. Descriptive statistics were performed.

Results: There were a total of 63 respondents. Most respondents were physical therapists (33%), occupational therapists (33%), or nurses (25%), with >5 years of burn care experience (71%). Early mobility was characterized as both in bed and out of bed activities within 24 hours of ICU admission, up to any time during the course of mechanical ventilation or ICU stay. The majority of respondents (54%) indicated they mobilize patients on ventilators in bed and out of bed, while there was an even split on whether or not patients on vasopressor support were mobilized. Of those respondents (46%) who use the Richmond Agitation-Sedation Scale (RASS) to guide mobility, 14% mobilize patients with a RASS of -4 or -5 and 41% mobilize patients with a RASS of -3 to -2. The highest appropriate score for mobilization was +1 to +2 (76%). Hgb/Hct, line presence, ventilator mode, mental status, and vital signs were viewed as precautions to discuss with the medical team, rather than a contraindication to mobility. Respiratory rate < 6 and presence of ECMO were the areas of most concern, with the majority respondents indicating they would likely hold mobility. Most respondents indicated that they would mobilize any burn ICU patients after discussion with the medical team if necessary. The majority of respondents (72%) indicated that they did not have an early mobilization protocol for burn ICU patients.

Conclusions: There is a paucity of evidence available for early mobility in burn ICU patients. This survey demonstrates a lack of consensus regarding what constitutes early mobility and when patients should be mobilized. A multi-center observational trial is needed to inform the development of an evidence-based mobility protocol.
**Introduction:** Diabetes mellitus (DM) is a critical comorbidity with burn injury due to the disrupted healing process. Previous reports have confirmed the increased rate of osteomyelitis (OM) and subsequent amputation in this cohort, however this has yet to be studied in comparison to non-diabetic patients. In this retrospective analysis, we investigate OM and amputation in both the diabetic and non-diabetic lower extremity burn populations to determine the impact of DM on these outcomes.

**Methods:** The burn registry was used to identify all patients admitted to our tertiary burn center from January 1, 2014 to December 31, 2018. Only patients with lower extremity burns (foot and/or ankle) were included. Patients with burns to additional body areas were excluded. Amputations were categorized by time from injury. Statistical analysis was performed using Student’s *t* test, chi-squared test, and Fischer’s exact test.

**Results:** Of the 315 patients identified, 103 had a known diagnosis of DM and 212 did not. Scald injury was the most common mechanism and average TBSA was similar. Differences were observed in average length of stay (LOS) and admission cost, with diabetics demonstrating both a higher LOS (13.7 days vs 9.2 days, *p*-value= 0.0016) and cost ($72,883 vs $50,500, *p*-value= 0.0058) (Table 1). In total, 17 patients were found to have radiologically confirmed OM within three months of the burn injury. Fifteen of these patients had a history of DM and two had no history of DM (*p*-value= < 0.001) (Table 2). The DM OM patients were found to have a higher blood glucose level on admission (219 mg/dL vs 110 mg/dL, *p*-value= 0.0452). No significant difference was seen in Hgb A1c in diabetics with or without OM (9.26% vs 8.81%, *p* = 0.2743). Notably, when non-diabetics were diagnosed with OM, significant differences were observed in both LOS and cost in comparison to their counterparts without OM (36 days vs 9 days; *p* = 0.0003; $226,289 vs $48,818, *p* = 0.0001). Of the 11 patients who required an amputation, 10 (90.9%) of these patients had comorbid DM.

**Conclusions:** DM patients with lower extremity burns are more likely to develop OM than their non-diabetic counterparts. When radiologically confirmed OM is present, DM patients have an increased rate of amputation. OM incurs significant healthcare utilization and cost in both the diabetic and non-diabetic populations.
A Novel Way of Thinking About Blast Injury Classification

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Introduction: Blast injuries present unique challenges to civilian and military healthcare providers because of the complex and often severe nature of injuries spanning numerous anatomical regions, tissue types, and organ systems. Due to these factors, we devised a novel wound-focused classification system for implementation during triage and management of blast injuries to optimize outcomes and applied this system to patients treated at an ABA-certified burn center over 5 years.

Methods: A retrospective analysis of patients treated by an ABA-certified burn center for blast-related injuries from September 1, 2014 to October 31, 2019 was performed. Demographics, mechanism and distribution of injuries, interventions, and outcomes were evaluated. Injuries were classified using a wound-focused classification comprised of four zones: 1) areas closest to blast epicenter that had total or near-total tissue loss from the blast; 2) adjacent areas with thermal and chemical burns; 3) distant sites with shrapnel-related wounds; 4) injuries arising from barotrauma.

Results: We identified 64 patients who were mostly male (84%), averaging 38 ± 14 years old. Injury mechanisms included fireworks (19%), industrial accidents (16%), volatile fuels and drug labs (45%), and others including can, battery, lighter explosions (20%). All mechanisms had equivalent frequency of Zone 2 injuries with an average TBSA of 17 ± 18%. Drug-related blasts caused the highest TBSA (34 ± 23%) and the most full-thickness burns (33% vs average 23%). Fireworks had over five times (17% vs. 3%) more Zone 3 and three times (25% vs 8%) more Zone 4 injuries compared to the other mechanisms. Upper extremities were involved at twice the rate of other body regions (43% vs 19%). Patients presenting to our burn team over 24 hours after initial injury had infections in 50% of cases – a four-fold increase compared to non-delayed presentations (50% vs 13%). Overall, 45% required surgery (32% grafting, 3% flaps) but 100% of the drug-related blasts needed surgical intervention. Some patients (58%) required ICU admission with the highest rate (83%) in the drug-related group.

Conclusions: Blast injuries most often required admission for management of the Zone 2 component. Each blast mechanism resulted in distinct distributions of injury although fireworks had the greatest number of Zone 1, 3, and 4 injuries. Firework blasts were often less severe and more likely to present delayed with infectious complications. Larger blast mechanisms including drug-related lab explosions as well as industrial blasts had the highest rates of ICU admission, TBSA, full thickness depth, upper extremity involvement, and need for surgical intervention.
Autologous Skin Cell Suspension Achieves Closure of Donor Site Wounds Facilitating Early Re-harvesting for Large TBSA burn Injuries

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Introduction: Management of extensive burn injuries is complicated often resulting in significant morbidity and mortality. Current standard of care includes use of split-thickness skin grafts (STSG) to obtain definitive closure; however, this treatment is often limited by donor site availability, which requires repeated re-harvesting of donor sites to obtain definitive closure in large total body surface area injuries. Additionally, this limitation often leads to increased risk of infection, hypertrophic scarring, and extended hospital length of stay.

Autologous skin cell suspension (ASCS) prepared using the autologous cell harvesting device is an FDA approved point-of-care regenerative medicine technology that significantly reduces donor skin requirements to achieve definitive closure in acute thermal burn injuries across small and large burns. A prospective uncontrolled observational study (IDE 15945—NCT02992249) was conducted in which patients with life-threatening burn injuries were treated with ASCS. In this study, clinical outcomes were evaluated when ASCS was used in combination with wide meshed autografts for burn site treatment. Within the study, a subset of donor sites was also treated with ASCS and the purpose of the current work was to evaluate the clinical outcomes obtained to better understand impact on healing times and effect of re-harvesting in this compromised patient population.

Methods: ASCS was applied to the donor site after harvesting of split-thickness skin grafts. Clinical outcomes out to one year were evaluated, including the percentage of re-epithelialization, long-term cosmetic outcomes, and adverse events.

Results: Subjects (n=96) from 22 burn centers received ASCS as part of their donor site treatment regimen (n=528). Mean subject baseline demographics were: 30.2 years of age, 54.0 ± 17.4% TBSA injury, and 89.4 ± 32.9 Baux score with 37% of subjects having a score greater than 100. Percentage of donor sites healed, defined as ≥95% re-epithelialization, was 37.1% and 82.7% after week 1 and week 2, respectively. Approximately 20% of the donor sites treated with ASCS were re-harvested multiple times following initial healing (up to four times). Of these donor sites 39.3% (n=84), 81.0% (n=79), and 85.7% (n=77) were healed by week 1, week 2, and week 4, respectively. Scar assessments conducted on 427 donor sites after one year showed the majority had matched or mildly mismatched color, pigment, and texture. Safety analyses of adverse events (AEs) following ASCS treatment were unlikely or unrelated to the device.

Conclusions: This study demonstrates successful use of ASCS to achieve closure of donor site wounds in patients with extensive burn injuries.
**Introduction:** Adipose stem cells (ASCs) have shown therapeutic promise for inflammatory conditions that beget multi organ dysfunction, including burns. While ASCs have immunomodulatory properties, some studies have brought up safety concerns of increased pro-coagulant activity such as pulmonary microvascular thrombi formation after intravenous (IV) administration of ASCs. In the present study, the aims are two-fold: 1) to verify if IV administration of human ASCs promotes coagulation and 2) to determine if human ASCs affect organ function in a 40% total body surface area (TBSA) swine burn model.

**Methods:** Female Yorkshire swine (39.63 ± 8.26kg) were anesthetized and subjected to 40% TBSA full thickness contact burns according to a formerly established model. After recovery from anesthesia, animals were randomized to receive 15ml/kg Lactated Ringer’s Solution containing: 1- no ASCs; 2- a low dose (5x10^5 ASCs/kg), or 3- a high dose (5x10^6 ASCs/kg) over a 15-minute period as a bolus. Blood was collected at baseline (BL) and 3, 6, 12, and 24h post burn to determine the effect of ASCs on organ function and coagulation status. At 24h post-burn, animals were humanely euthanized, and kidney and liver tissue was collected for histological and Western blot analyses. Data is presented as mean ± SEM, and statistical significance was set at p < 0.05.

**Results:** The high dose of ASCs significantly increased the circulating number of monocytes starting at 12 hours. Two-way ANOVA revealed a significant effect of ASCs on both prothrombin times (PT) and international normalized ratio (INR) (1.03 ± 0.04, 0.93 ± 0.03, and 1.02 ± 0.04 for no, low and high ASC groups, respectively at 24 hours). There were no differences in partial thromboplastin time, fibrinogen, or d-dimer levels. Both doses of ASCs briefly exacerbated burn-induced increases in total bilirubin at 3 hours (0.062 ± 0.025mg/dL, 0.148 ± 0.060mg/dL, and 0.211 ± 0.086mg/dL in no, low, and high ASC groups, respectively). ASCs did not alter urine output; yet, there was a significant effect of ASCs on creatinine. Western blotting revealed a rise in caspase expression in the liver of animals receiving a low dose of ASCs, while there was no difference in caspase expression in kidneys.

**Conclusions:** We show that IV administration of xenogeneic ASCs produces minimal changes in coagulation status and renal and hepatic dysfunction. Modest changes in the extrinsic coagulation pathway were dose-dependent, while exacerbation of liver dysfunction was brief and normalized after administration of ASCs was completed. We cannot rule out that continuous infusion of ASCs would not have a cumulative effect on organ dysfunction.
Early Transcriptomic Response to Burn injury: Prolonged Inflammatory Response is Associated with Mortality

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Introduction: Burn injuries are associated with high morbidity and mortality. Burn care has improved significantly in the last few decades with emphasis on early surgical management, improvements in local wound care, and specialized critical care. While survival rates are improving, mortality remains high in certain patient populations, including those with larger burns. Burn injury induces a systemic hyperinflammatory response with detrimental side effects. Prior studies have offered early insights into the biochemical changes that occur after severe burn injury. The underlying cellular response is still largely unknown. The goal of this work is to characterize the blood transcriptome of severe burn injury and compare this response between patients who live or subsequently die of their injuries.

Methods: Burn patients presenting to a regional center between 2012–2017 were prospectively enrolled. Blood was collected on admission and at predetermined timepoints (Hours 2, 4, 8, 12, 24) over the first 24 hours. mRNA was isolated and a transcriptomic microarray was used to measure global transcript levels over time. To identify differentially regulated genes (FDR≤0.1) by injury severity, patients were grouped by burn size (TBSA >20%) and mortality. Microarray data was analyzed using bioinformatics software and pathway analysis. Descriptive statistics were generated with Mann-Whitney, Chi-Square, and Fisher’s exact test as appropriate.

Results: Sixty-eight patients were included in this analysis, most patients were male with a median age of 41 (IQR, 30.5–58.5) years, and TBSA of 20% (IQR, 11–34%). Thirty-five patients suffered %TBSA injury >20%, and this group experienced greater mortality (26% vs. 3%, p=0.008). There were no significant differences in age, race, or gender. Comparative analysis of genes from patients with < / ≥20% TBSA revealed 1250, 444, 209, 20, 865, and 557 differentially regulated genes at hours 0, 2, 4, 8, 12 and 24 respectively. Pathway analysis reveals an initial upregulation in several immune/inflammatory pathways within the ≥20% TBSA groups between hours 0–2 followed by shutdown between hours 12–24. Immune pathways include Th17 activation pathway and natural killer cell signaling, inflammatory pathways include EIF2 signaling. These pathways remain upregulated in the group of patients with >20% TBSA who died.

Conclusions: Severe burn injury is associated with an early proinflammatory immune response followed by shutdown of these pathways. Burn patients who die show continued upregulation in the first 24 hours after injury in several proinflammatory pathways compared to those who live.
Plasma from Patients with Burn Injury Increases Endothelial Permeability In-Vitro

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Introduction: The contribution of endothelial injury to the pathogenesis of burn shock is not well characterized. Human umbilical endothelial cells (HUVECs) have been used to study endotheliopathy in myriad shock states. This work investigates the impact of burn patient plasma on the vascular endothelium and its barrier function.

Methods: HUVECs were seeded into the apical chambers of transwell plates and cultured over 5–7 days to a confluent monolayer which was confirmed by a transendothelial electrical resistance (TEER) of ≥30Ω. After IRB approval, plasma was collected from burn-injured patients 4 hours after admission. Demographic and injury characteristics were collected from the medical record. Plasma Syndecan-1 (SDC-1) was quantified by ELISA. HUVEC monolayers were exposed to 10% multi-donor pooled healthy human plasma (HHPP) or burn patient plasma. Monolayers were subsequently incubated with FITC-Dextran (40,000 KDo). FITC diffusion through monolayers was measured in basal chamber supernatants. Monolayer permeability was measured with indices calculated by normalizing values to blank (transwell inserts) and HHPP-treated monolayer FITC diffusion. HUVECs were also cultured on glass slides and exposed to HHPP or burn patient plasma. Cells were fixed with 4% Paraffin in PH and F-Actin was stained with Texas Red-Phalloidin. Intercellular gap area was calculated using imaging software. Differences between treatment conditions were analyzed with Welch’s t-test and one-way ANOVA, simple linear regression was used to characterize the relationship between plasma SDC-1 and permeability indices, significance was set at p < 0.05.

Results: Eight burn patient plasma samples were tested. Patients were mostly male (75%) with a mean age of 50±20 years and mean %TBSA burn of 37±34%. Five burn plasma samples significantly increased monolayer permeability. There were no significant differences between patient samples that increased permeability in age, TBSA, gender, or in-hospital mortality. Monolayer permeability indices increased between 7–15% (p< 0.05) among burn plasma treatment conditions (n=6) that increased permeability. There was a strong relationship between monolayer permeability index (%) and plasma SDC-1 (µg/mL) (p=0.03, R²=0.93). Morphological F-actin rearrangement was apparent on microscopy and intercellular gap area was increased in burn plasma treatment conditions (12% vs. 49%, P≤0.0007, n=6).

Conclusions: Plasma from burn patients induces endothelial damage that increases endothelial cell monolayer permeability: The endothelial biomarker SDC-1 is a reliable indicator of endothelial damage. F-actin rearrangement and an increase in intercellular gap area likely contributes to burn endotheliopathy.

128 Nonlinear Dynamic Analysis of Heart Rate Variability Can Detect Sepsis in Severe Burns

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Introduction: Sepsis after burn injury affects 50–84% of adult patients and ~55% of pediatric patients. The diagnosis of sepsis in patients with severe burns is complicated by the overlap of clinical signs of post-burn hypermetabolic response with those of sepsis. Earlier detection of sepsis could lead to improved outcomes and decreased morbidity and mortality. Nonlinear dynamic (ND) analysis of heart rate variability (HRV) can identify non-random relationships between different HRV parameters by using a complex oscillogram. ND can be obtained even when heart rate recordings are weak or poor in quality, which is common in the setting of burns. We hypothesized that ND could detect differences in HRV after severe burns.

Methods: All patients enrolled during the study period at our institution with >20% total body surface area (TBSA) burn were eligible for this study. High-definition heart rate monitoring was collected three times for each patient in five-minute intervals. The first collection occurred after patient ICU admission, and the third collection occurred 16–24 hours. Matlab was used to analyze heart rate using the following common ND methods: Correlation dimension (CD), detrended fluctuation (DF), largest Lyapunov exponent (LLE), approximate entropy (AE), fractal dimension (FD), Hurst exponent (HE), and recurrence quantification analysis (RQA). Additionally, several linear time-domain parameters were analyzed, including heart rate (R), RR interval (RR), SD1, and SD2.

Results: A total of six non-septic (NS) and four septic (S) patients were enrolled in the study. There were no significant differences between the two groups in age, sex, percent TBSA, or percent TBSA of third-degree burns. Two non-linear parameters were significantly different between NS and S patients: AE and the density of recurrence points in RQA. AE was significantly lower in NS than S patients at all time points [(0.931±0.011 vs. 0.960±0.024, p=0.001); (0.923±0.019 vs. 0.959±0.025, p=0.008); (0.933±0.011 vs. 0.964±0.025, p=0.013)]. The density of recurrence points in RQA were significantly higher in NS than S patients at all time points [(90.4±40.2 vs. 41.4±27.8, p=0.029), (102.2±39.4 vs. 40.1±22.9, p=0.008), (92.5±34.4 vs. 45.5±33.9, p=0.043)].

Conclusions: The two ND parameters AE and RQA, can be used to distinguish between patients with and without sepsis in the setting of severe burns.
Stimulating the Cholinergic Anti-inflammatory Pathway Alters Inflammatory Cell Mobilization after Burn Injury

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Introduction: Severe burn injury causes a systemic inflammatory response (SIRS) that is characterized by mobilization of inflammatory cells into the circulation and is associated with distant organ injury that can lead to significant morbidity and mortality. The cholinergic anti-inflammatory pathway, mediated by the vagus nerve, regulates the anti-inflammatory response to injury and infection. We have previously shown in models of burn injury that stimulating the vagus nerve may be a potential therapy aimed at limiting SIRS. Here, we hypothesized that stimulating the vagus nerve (VNS) would limit the SIRS response by altering the mobilization and trafficking of inflammatory cells after burn injury.

Methods: Wild type 10–12-week-old C57BL/6 mice were subjected to a 15% total body 3rd degree burn or sham burn. Eight, two-month-old adult female mice were injured with a 30% total body surface area steam burn. A separate cohort of animals was treated with electrical stimulation of the cervical vagus nerve for 10 minutes immediately post-burn. Bone marrow, blood and lung tissue were collected 24 hours after burn injury. Flow cytometry of bone marrow was performed to measure Lineage- c-kit+ Sca-1+ (LSK) hematopoietic stem cells (HSC), then further analyzed to quantify changes in Long-term (LT) HSC, short-term (ST) HSC, and Multipotential Progenitor (MPP) compartments. Bone marrow, blood and perfused lung tissue were analyzed by flow cytometry using a panel of myeloid cell markers.

Results: Severe burn injury decreased bone marrow LSK expression by 50% compared to sham, with LT-HSC and MPP expression decreasing to a greater degree than ST-HSCs. VNS did not alter burn-induced changes in any bone marrow HSC cell type. Burn injury was associated with increased mobilization of CD45+CD11b+ monocytes and CD11b+Ly6C nh inflammatory monocytes into the peripheral blood and lung, while increased CD11b+Ly6C hi patrolling monocytes and Gr1+Ly6C- neutrophils was seen in the lung only. VNS significantly prevented the burn-induced increase in CD45+ inflammatory cells, CD11b+Ly6C nh patrolling monocytes and Gr1+Ly6C- neutrophils in the lung (see Figure), reducing their expression to sham levels, despite only modest changes to myeloid cell expression in the blood.

Conclusions: VNS attenuates myeloid cell trafficking to the lung after severe burn injury despite having no effect on emergency myelopoiesis in the bone marrow. Further studies are needed to define the mechanism by which the cholinergic anti-inflammatory pathway attenuates the SIRS response to burn.

Burn Injury Reduces Bone Marrow Mesenchymal Stem Cells and Sensitizes Their Adrenergic Receptor Subgroups in a Murine Model

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Introduction: Previous burn and traumatic injury studies have established that adrenergic signaling is increased after burn injury and may lead to an impairment of hematopoietic cell development in the bone marrow (BM). Nonetheless, mesenchymal stem cells (MSCs), which have gained momentum in regenerative medicine also play a predominant role in the BM niche. Understanding the propensity of the adrenergic receptor (AR) response by MSCs can be utilized for devising targeted therapies. However, the traditional plastic adherence procedure using ex vivo culture of BM cells for several weeks may skew the actual characteristics of MSCs. Our current study focused on isolating MSCs from freshly obtained BM in a murine scald burn model with a goal to characterize the expression pattern of native AR subgroups present on BM MSCs as compared to sham mice.

Methods: Eight, two-month-old adult female mice were subjected to a 15% total body 3rd degree burn or sham burn. The mice were sacrificed 7 days later. Femurs were removed and total bone marrow cells were flushed out. Multi parametric flow cytometry was used to gate for cells negative for hematopoietic cell markers (CD45, CD11B) and positive for MSC markers (CD90, CD105, CD106, SSEA, Ly6A) and AR subgroups (α1, α2, β1, β2, β3). We measured the number of BM MSCs, quantified the subtypes of ARs present on MSCs, and compared the ratio of AR antibody binding per total MSC population.

Results: Overall the frequency of MSCs per million total BM cells decreased by 48% post-burn injury with 165,300 ± 194 in sham versus 110,000 ± 30 in burn displayed as bar graph in Panel A. Over 90% of MSCs consistently express β2 AR and only 10% express α2 AR subgroup in both scald and sham burn. Presence of other subgroups ranged from 50% to 80% of MSCs as seen in histograms to the right of dotted line in Panel B. Our AR propensity score based on AR mean fluorescence intensity adjusted to total number of MSCs present was increased by 2.8-fold for α1, 2.5-fold for β1, 1.6-fold for β3, and 1.3-fold for β2 AR subgroups (Panel C). These findings indicate burn injury not only decreases the frequency of BM MSCs but also increases the affinity of certain AR subgroups present on MSCs. Since BM MSCs are the major source of cytokines, chemokines and growth factors; detailed studies on AR mediated signaling in BM MSCs is warranted.

Conclusions: Polarization of AR signaling in BM MSCs by burn-induced catecholamines may have broader implications for comorbidities such as bone resorption and muscle wasting observed in human patients post burn trauma.
Introduction: Burn-induced coagulopathy (BIC) greatly increases the risk of thrombosis, leading to organ dysfunction and death. Although BIC is attributed to a multitude of factors including hemodilution, SIRS, and excess coagulation, the exact molecular mechanisms are elusive. Determination of these mechanisms is essential to develop new strategies aimed at reducing the morbidity and mortality of BIC as commonly used anticoagulants are ineffective at preventing the consequences of BIC. Platelet dysfunction, which has been associated with bleeding, thrombosis, poor wound repair, and susceptibility to infection, occurs in BIC, but the etiology of this phenomenon is unknown. Burn injuries provoke a dramatic increase in plasma levels of inflammatory, coagulation, and fibrinolytic factors, potentially altering the physiology of blood cells and platelets. Therefore, we hypothesized that burn patient plasma pathologically alters normal platelet function.

Methods: In this prospective study, plasma samples were collected from 32 adult patients with burns >10% TBSA at a regional burn center. To assess the effects of burn plasma on platelet function, platelets isolated from healthy individuals were incubated with heparinized plasma from burn patients or control plasmas (N=15) for 2 hours. Following incubation, platelets were stimulated with various agonists, and markers of platelet activation (GPIIb/IIIa activation and P-selectin expression) were measured using flow cytometry.

Results: Platelets incubated with burn plasmas exhibited a reduction in response to stimulation compared with those incubated with control plasma. Both GPIIb/IIIa activation and P-selectin expression were affected, suggesting a defect in platelet signaling. This dysfunction did not strongly correlate with TBSA affected or modified Baux score but was significant when compared to healthy controls (P<0.05). However, measurement of markers of inflammation, coagulation, and fibrinolysis in burn plasmas revealed a significant correlation of both plasma D-dimer (P<0.02) and soluble P-selectin (P<0.05) with induced platelet dysfunction. This suggests circulating factors indicative of coagulation, fibrinolysis, and endothelial dysfunction may play a role in platelet dysfunction observed in BIC.

Conclusions: This study demonstrates an in vitro effect of burn patient plasma on platelet function, suggesting a possible benefit for resuscitation with FFP. BIC is a principal source of morbidity and mortality in burn patients, and current thromboprophylaxis for burn patients may not address critical elements of BIC. Future studies are required to optimize resuscitation and minimize the consequences of BIC.

Introduction: Platelet dysfunction has been demonstrated as a part of burn induced coagulopathy (BIC), however, the etiology and clinical significance are unknown. Determining the etiology and clinical significance of BIC platelet dysfunction is difficult in humans due to heterogeneity of injuries and treatment. The goal of this study was to develop a murine model of BIC burn-induced platelet dysfunction to allow for high-throughput investigation of the mechanisms and the possible effects platelet dysfunction has on burn outcomes.

Methods: Using an established murine model of burn injury, we investigated plasma and cellular markers of BIC. Under adequate anesthesia and analgesia six-week-old C57BL/6J mice were administered a ~30% TBSA dorsal burn by scalding. Sham animals received identical preparation and resuscitation without the burn injury. Blood was collected at 6-, 24-, and 48-hours post-burn for measurement of platelet function, and plasma was isolated for protein measurements of coagulopathy (N=5 per group per time point).

Results: Like findings in humans, mice exhibited systemic markers of BIC (excess coagulation, fibrinolysis, and inflammation) within the first 6–24 hours post-burn. Platelets in whole blood were treated with platelet agonists ADP and PAR4-activating peptide (PAR4AP), and markers of platelet signaling and function (P-selectin expression and GpIIb/IIIa activation) were measured by flow cytometry. At 6 hours post-procedure, platelets from burn mice exhibited a slight, insignificant increase in markers of activation and response to stimulation compared with platelets from sham mice. At 24 hours post-burn, burn mice exhibited a significant decrease in platelet count (P<0.02) and platelet function indicated by reduced GpIIb/IIIa activation (P<0.01) and P-selectin expression (P<0.05) in response to ADP and PAR4-AP compared with sham mice. Platelet function began to return at 48 hours post-burn with no significant difference between groups.

Conclusions: Platelet loss and dysfunction occur after burn injury, but the consequence of these effects is not well understood. The findings in this study are consistent across multiple experiments and resembled platelet dysfunction observed in different human traumatic injuries, validating the murine model as an inexpensive and efficient model of human injury in which to study platelet defects and the molecular mechanisms driving them.
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133 Oxidative Stress Can Be Significantly Influenced and Reduced by Polylactide-based Membrane Dressings
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Introduction: Oxidative stress is part of the physiological response to local thermal injuries and has systemic effects in more extensive burns, vascular hyperpermeability, burn edema, cellular damage, and functions of the heart, lung, liver, kidneys, muscles, and other organs. Free NO and OH radicals affect mitochondrial function, and lower energy delivery to other organelles releases thermal energy, leading to hypermetabolism. Antioxidant therapies have attempted to reduce the consequences of oxidative stress with limited effects; however, the effect of external dressings is unclear. This study aimed to investigate the positive effects of polylactide-based membranes (PLM) on oxidative stress and clinical outcomes in burns.

Methods: Herein, a prospective study assessed the correlation between oxidative stress and the severity of injuries by measuring serum malonaldehyde (MDA) and glutathione levels and the total oxidant and antioxidant capacities (TOC and TAC) among children with electrical injuries. Furthermore, a prospective randomized study evaluated the TOC and TAC, MDA, glutathione, IL-6, TNF-α, and TGF-β levels, and the ratio of telomerase positive staining in epidermal cells along the particle thickness of burns in children, when comparing polylactide dressings to Hydrofiber Ag(HFAg), autografts, and controls.

Results: Coherence between measured oxidative stress and injury severity was apparent herein. Application of PLMs significantly reduced oxidative stress in partial-thickness burns compared to HFAg. PLMs decreased the TOC (4.91 VS. 16.78 µmol/L, day 7) and increased the TAC (14.47 VS. 4.34 µmol/L, day 7). The healing duration was longer than that of HFAg (13 VS. 21 d). Proinflammatory IL-6 levels were significantly lower in the PLM group and TNF-α values were significantly reduced from days 7 to 14. The anti-inflammatory levels of TGF-β was significantly elevated (days 3–21) in the PLM Group. Telomerase levels and the cell count were higher in healed skin in the PLM group.

Conclusions: Oxidative stress depends on injury severity and is potentially influenced by dressings. PLM mediates the regulation of oxidative stress, as evident from the TOC and TAC, and pro- and anti-inflammatory cytokines including IL-6, TNF-α, and TGF-β by PLMs might positively influence the healing duration and skin quality in burns. These results could show that oxidative stress can be significantly influenced and reduced by PLM dressings.

134 The Effect of Adipose Derived Stromal Vascular Fraction on Stasis Zone in an Experimental Burn Model on Streptozocin – Induced Diabetic Rats
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Introduction: Stasis zone is the encircling area of the coagulation zone which is a critical area determining the depth and width of the necrosis in burn patients. In our study we aim to salvage the stasis zone by injecting adipose derived stromal vascular fraction (ADSVF).

Methods: Intraperitoneal Streptozotocin was administered for the induction of diabetes mellitus (DM) and the development of DM was confirmed by the measurement of blood glucose levels in the blood samples with blood glucometer weekly 48 hours after injection. Rats with blood glucose levels above 200 mg/dl were accepted as diabetic. The diabetic animals were followed for 4 weeks before the intervention. Thermal injury was applied on dorsum of diabetic Sprague – Dawley rats (n=20) according to the previously described “comb burn” model. After the burn injury (30 minutes) on Sprague – Dawley rats; rat dorsum was separated into 2 equal parts consisting of 4 burn zones (3 stasis zone) on each pair. ADSVF cells harvested from inguinal fat pads of diabetic Sprague – Dawley rats (n=5) were injected on the right side while same amount of phosphate buffered saline (PBS) injected on the left side of the same animal. One week later, average vital tissue on the stasis zone was determined by macroscopy, angiography and microscopy. Vascular density, inflammatory cell density and gradient of fibrosis were determined via immunohistochemical assay.

Results: Macroscopic stasis zone tissue survivability percentage (32 ± 3.28 %, 57 ± 4.28 %), average number of vessels (10.28 ± 1.28, 19.43 ± 1.72), capillary count (15.67 ± 1.97, 25.35 ± 2.15) and vascular density (1.55 ± 0.38, 2.14 ± 0.45) were higher on ADSVF side. Fibrosis gradient (1.87 ± 0.51, 1.50 ± 0.43) and inflammatory cell density (1.33 ± 0.40, 1.20 ± 0.32) were higher on the PBS side.

Conclusions: Macroscopic and microscopic findings determined that ADSVF has a statistically significant benefit for salvaging stasis zone on acute burn injuries in DM.
Introduction: Temporary wound closure with human allograft skin is considered the gold standard after early excision of a large burn injury. Limitations of allograft include availability, cost, and safety; thus, an alternative that provides the same quality with enhanced safety would be a valuable surgical adjunct to the clinical options currently available to treat severe and extensive full thickness burn wounds. A live cell skin xenotransplant from a clinical grade porcine donor is one candidate. Advantages of this alternative include retention of 70% or more of the innate metabolic activity following cryopreservation, vascularly favorable dermal thickness, and genetic modifications that eliminate hyperacute graft rejection. Combined, these result in pliability, strength, survivability, and function that far exceed those of conventional xenografts and mirror those of human allograft.

Methods: Split-thickness skin xenotransplants containing vital dermal and epidermal cells were aseptically procured from alpha-galactosyltransferase knockout porcine donors from a closed, Designated Pathogen Free, colony. They were then processed to achieve both sterility and cellular viability and cryopreserved for long term storage. In 2018, the FDA authorized a first-in-human Phase I clinical trial to evaluate the safety and tolerability of a genetically modified skin xenotransplant to treat severe and extensive burn wounds. A two cohort, open-label, dose-escalation study evaluated 6 consenting patients with severe burns requiring allograft. Each received surgical grafting with a skin xenotransplant and human allograft skin in a side-by-side, in-situ comparison.

Results: The skin xenotransplant was well tolerated by all patients, resulting in zero adverse events or safety issues, and without zoonotic disease transmission. In all cases, the skin xenotransplant appeared indistinguishable from the human allograft comparator and at the time of autografting, both were vascularized and fully adherent. These findings build upon the series of preclinical studies reported by these authors and presented at the ABA in 2019.

Conclusions: These highly promising patient outcomes demonstrate a potential treatment for complicated burns, especially when human allograft skin is unavailable. Further study of the efficacy of the porcine skin xenotransplants is warranted. As such, a multi-center, Phase II efficacy trial is planned for 2021.

Introduction: Burn experts are only 77% accurate when subjectively assessing burn depth, leaving almost a quarter of patients to undergo unnecessary surgery or conversely suffer a delay in treatment. To aid clinicians in burn depth assessment (BDA), new technologies are being studied with machine learning algorithms calibrated to histologic standards. Our group has iteratively created a theoretical burn biopsy algorithm (BBA) based on histologic analysis, and subsequently informed it with the largest burn wound biopsy repository in the literature. Here, we sought to report that process.

Methods: This was an IRB-approved, prospective, multicenter study. A BBA was created a priori and refined in an iterative manner, resulting in the current state of the algorithm seen in Figure 1. Patients with burn wounds assessed by burn experts as requiring excision and autograft underwent 4mm biopsies procured every 25cm². Serial still photos were obtained at enrollment and at excision intraoperatively. Burn biopsies were histologically assessed for presence/absence of epidermis, papillary dermis, reticular dermis, and proportion of necrotic adnexal structures by a dermatopathologist using H&E with whole slide scanning. First degree and superficial 2nd degree were considered to be burn wounds likely to have healed without surgery, while deep 2nd and 3rd degree burns were considered unlikely to heal by 21 days. Biopsy histopathology results were correlated with still photos by 3 burn experts for consensus of final burn depth diagnosis.

Results: Sixty-six subjects were enrolled with 117 wounds and 816 biopsies. The BBA was used to categorize 100% of subjects into 4 categories: 7% of burns were categorized as 1st degree, 13% as superficial 2nd degree, 43% as deep 2nd degree, and 37% as 3rd degree. Therefore 20% of burn wounds were incorrectly judged as needing excision and grafting by the clinical team. As H&E is unable to assess the viability of papillary and reticular dermis, with time our team came to appreciate the greater importance of adnexal structure necrosis over dermal appearance in assessing healing potential.

Conclusions: Our study demonstrates that a BBA with objective histologic criteria can be used to categorize BDA with clinical misclassification rates consistent with past literature. This study serves as the largest analysis of burn biopsies by modern day burn experts and the first to define histologic parameters for BDA.
137 Maximal Harvest Density of Full-Thickness Skin Columns in Skin Replacement Therapy
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Introduction: Split-thickness skin grafts (STSGs) are the mainstay of skin replacement therapy but fail to adequately reproduce basic skin functions and subject patients to new, open wounds that can cause significant pain and scarring. Full-thickness skin grafts (FTSGs) have improved cosmetic outcomes and better recapitulate skin functions, but few sites can serve as donors and requirement for "take" is greater. Prior research has shown that full-thickness skin column (FTSC) harvest results in improved healing of the injured site and decreased morbidity of the donor site at 10% harvest density. This study aims to determine the maximal harvest density of FTSC donor sites.

Methods: Ten donor sites were created on the dorsum of anesthetized swine (Sus scrofa domestica). STSG donor sites were harvested with a dermatome (12/1000 inch) and compared to FTSC donor sites with the highest possible harvest ratio of sixteen 1.5mm-diameter skin columns/1cm² (28% harvest density). Donor site morbidity was assessed via re-epithelialization, contraction, pigmentation, number of hair follicles, and scar thickness on post-burn day (PBD) 7, 14, 21, 28, 60, and 90.

Results: There were no significant differences in re-epithelialization or contraction between FTSC and STSG donor sites. STSG donor site pigmentation was significantly decreased as compared to control on all assessment days (p=0.0161, 0.0003, 0.0095, 0.0244, respectively), and remained significantly hypopigmented as compared to FTSC starting at PBD 14 (p< 0.0001). Pigmentation was decreased for FTSC donor sites at PBD 14 (p=0.0204) but significance was lost by PBD 21. Both FTSC and STSG donor sites showed significantly fewer hair follicles as compared to control at PBD 7 (p=0.0011, 0.0003, respectively). On PBD 21, STSG had significantly less hair follicles as compared to FTSC donor sites (p=0.0010). This resolved by PBD 28. FTSC scars were significantly thicker than control and STSG at PBD 28 (p=0.0348, 0.0038, respectively) and PBD 60 (p=0.0174, 0.0329, respectively). This significance was lost by PBD 90.

Conclusions: No statistically significant differences were seen in re-epithelialization and contraction between FTSC and STSG donor sites. STSG were hypopigmented as compared to FTSC donor sites and had significantly less hair follicles at day 21. FTSC donor site scars were significantly thicker than STSG. Although decreased donor site morbidity has been observed at lower harvest densities (10%), these results were not seen at 28%, which likely exceeds the optimal harvest density.
Evaluation of Healing Outcomes Combining Negative Pressure Wound Therapy with Autologous Skin Cell Suspension and Meshed Autografts: Pre-Clinical and Clinical Evidence

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Introduction: Negative pressure wound therapy (NPWT) is an option for securing meshed split thickness skin grafts (mSTSGs) after burn excision to optimize skin graft adherence, working by minimizing disruption by shear forces and promoting the continual removal of wound bed drainage. Recently, the use of autologous skin cell suspension (ASCS) has been approved for use in treating full-thickness burn injuries in conjunction with mSTSGs. Limited data exists regarding the impact of NPWT on healing outcomes when the cellular suspension is utilized. It was hypothesized that NPWT in conjunction with ASCS+mSTSGs would aid in skin graft adherence without compromise to healing outcomes.

Methods: In this study, a Duroc pig model of burn, excision, mSTSG, ASCS + NPWT was used (n=2), where each animal had 2 sets of paired burns. Four wounds received mSTSG+ASCS+NPWT through post-operative day 3, and 4 wounds received mSTSG+ACSC+ traditional ASCS dressings. Percent re-epithelialization was measured using digital planimetry and Image J. Graft-adherence was evaluated using a scale with blinded reviewers (0=no graft loss, 4= >50% graft loss). Histological architecture, pigmentation, elasticity, and blood perfusion and blood vessel density were assessed at multiple time points through 2 weeks. After the evaluation of its effectiveness in animal models, the same surgical technique, including NPWT, was used in patients with full-thickness burns (n=9), and wound healing trajectories were described.

Results: In the Duroc pig study, all wounds healed within 14 days with minimal scar pathology and no significant differences in percent re-epithelialization between NPWT and non-NPWT wounds were observed (61.09 ± 9.01 and 61.15 ± 0.82% at Day 7). Additionally, no differences were detected for pigmentation, perfusion, or blood vessel density. Overall, the non-NPWT group had higher amounts of graft loss (1.0 ± 1.41 vs. 0 ± 0). NPWT-treated wounds had significantly improved elasticity (NPWT=109.5 ± 21.23 vs. non-NPWT=177.5 ± 35.4, p< 0.05). There were no differences in histological architecture between treatment groups. Patients had a median age of 53 (37–69), and median TBSA of 12.5 (8–18) resulting primarily from scald burns (67%). There were no reported morbidities, and all wounds were re-epithelialized within an expected time period. The use of NPWT promoted graft adherence, and was useful as a bolster dressing in wounds that crossed joints.

Conclusions: These data suggest the positive attributes of the cellular suspension delivered are retained following the application of NPWT. Re-epithelialization, revascularization, and repigmentation are not adversely impacted.
Chronic 800 cm² left knee wound was treated with NPWT + saline instill treatment over STSG clinically shows promise to improve graft take in the future. 1.6mm thickness), STSG, and NPWT with or without intermittent saline instill (3x daily, 300mL, 15-minute soak). 1.6mm thickness) from swine (Sus scrofa domestica) were treated on the dorsum of two anesthetized swine were treated in vivo, 20 full-thickness 5 cm-diameter excisional wounds on the dorsum of two anesthetized swine were treated with dermal substitutes (DS, 0.4mm, 0.8mm, 1.2mm, or 1.6mm thickness), STSG, and NPWT with or without intermittent saline instill (3x daily, 300mL, 15-minute soak). Re-epithelialization was assessed at day 7 and 14. Lastly, a chronic 800cm² left knee wound was treated with NPWT + saline instill to improve graft take, and a case report of treatment of a non-healing wound in a single-stage procedure.

Methods: Ex vivo, STSGs (12/1000ths in) were harvested from normal human skin and excised keloid lesions (3 donors each), and were treated with multiple doses (0–10 μm) of α-mangostin in vitro. Proliferation was measured using an MTT assay, gene expression was measured using quantitative real-time PCR (qPCR), and protein levels in culture media were measured by enzyme-linked immunosorbent assay (ELISA). Apoptosis was assessed by measuring expression of C/EBP homologous protein (CHOP), which mediates endoplasmic reticulum stress-induced apoptosis, by qPCR.

Results: Dose-dependent decreases in proliferation of keloid and normal fibroblasts were observed following treatment with α-mangostin. The α-mangostin treated fibroblasts displayed significantly increased expression of CHOP indicating increased apoptosis. In addition, numerous changes in gene expression were observed in α-mangostin-treated keloid fibroblasts, including decreased expression of collagen type I alpha 1 chain (COL1A1) and increased expression of matrix metalloproteinase 1 (MMP1), MMP3, and MMP13. Secretion of pro-collagen I was decreased, and secretion of MMP1 and MMP3 proteins were increased, in α-mangostin-treated fibroblasts.

Conclusions: The results suggest that α-mangostin may exhibit antiproliferative, proapoptotic, and antifibrotic activities in keloid and normal fibroblasts.

Introduction: Keloids are disfiguring lesions that result from an abnormal wound healing process. Despite the availability of numerous therapeutic options, keloids remain challenging to treat and often recur after therapy. α-Mangostin, a natural xanthone isolated from the fruit of the Mangosteen tree, has been used for centuries in many Southeast Asian nations for medicinal purposes, and has gained attention more recently due to its anti-inflammatory, antimicrobial, and antioxidant properties, with numerous studies suggesting possible anticarcinogenic activities. Hypothetically, α-mangostin may have therapeutic value for keloid suppression. To investigate this hypothesis, the effects of α-mangostin on fibroblast proliferation, apoptosis, and gene expression in vitro were analyzed.

Methods: Dermal fibroblasts were isolated and cultured from normal human skin and excised keloid lesions (3 donors each), and were treated with multiple doses (0–10 μm) of α-mangostin in vitro. Proliferation was measured using an MTT assay, gene expression was measured using quantitative real-time PCR (qPCR), and protein levels in culture media were measured by enzyme-linked immunosorbent assay (ELISA). Apoptosis was assessed by measuring expression of C/EBP homologous protein (CHOP), which mediates endoplasmic reticulum stress-induced apoptosis, by qPCR.

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Conclusions: The results suggest that α-mangostin may exhibit antiproliferative, proapoptotic, and antifibrotic activities in keloid and normal fibroblasts.
Mild Burns Combined with Diet Induced Demyelination Does Not Affect Skeletal Muscle Function

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Introduction: Severe burns result in decreased skeletal muscle mass and function. Recent evidence suggests that massive burns disrupt the motor-neural system including motor neurons to partially explain skeletal muscle dysfunction in response to burns. However, impact of demyelination on burn induced skeletal muscle dysfunction has not been investigated. The purpose of this study was to determine the impact of exaggerated demyelination on skeletal muscle dysfunction after burn.

Methods: C57BL/6 (20-25g, male, n = 26) mice were separated into 6 groups (4-5 animals per group) by diet, burn injury and time point (burn or sham groups with two different diets measured at two different time points). Mice were fed with either cuprizone diet (0.2%) to induce severe demyelination or regular diet (18% protein) for 5 weeks prior to injury. Burns were administered by immersing the dorsal side of the animal into ~95 °C hot water for 10 seconds (~15 % body surface area, full thickness burn). In-situ gastrocnemius function was assessed by attaching the distal tendon of the muscle to a lever arm of a force transducer and stimulating the muscle via exposed sciatic nerve while the animal was under anesthesia. In-situ gastrocnemius muscle function was evaluated 3- and 7-days after burn.

Results: Food intake was 30% higher in cuprizone diet group compared to the regular diet group (p=0.002). However, there was no significant difference in body weight among groups (p=0.071). No significant difference was found in gastrocnemius wet weight, peak twitch tension, time to reach peak twitch tension, peak twitch half relaxation time, force-frequency relationship, maximum tetanic force, and fatigue index among groups (burn effect, diet effect, time effect, and their interactions: NS).

Conclusions: Mild burns combined with demyelination by diet had no effect on skeletal muscle function on our timepoints, and 15 % TBSA burn size was not sufficient to induce skeletal muscle dysfunction. The impact of burn induced neural damage on muscle function and performance indicates further investigation.

Transcriptome Analysis Captures Radiation Exposure in a Dose-sensitive Manner and Predicts Short-term Survival in a Mouse Model

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Introduction: A mass exposure to irradiation would be a challenge to health care systems. A simple tool or test that indicates the intensity of the absorbed radiation or the chances of survivability would be invaluable in this scenario. To identify biomarkers that potentially could provide novel biodosimetry tools, we have conducted a radiation dose-response and time-course experiment in mice that includes an assessment of the transcriptome of the skin.

Methods: Groups of mice (n=5) received whole-body X-ray exposures (0, 1, 3, 6, or 20Gy) and skin biopsies were obtained from each animal at times post-irradiation (h2, Days 4, 7, 21, 28). Biopsies were collected from the 20Gy cohort for only days 0, 4, and 7. Total RNA was isolated and microarrays were performed and analyzed using custom R scripts to obtain lists of probe sets differentially expressed. Changes in gene expression at Benjamini-Hochberg FDR adjusted P < 0.05 and FC >2 were deemed significant. Analyses were performed comparing the different doses of X-ray exposure over all time points.

Results: Mice in the 20Gy group were euthanized by d7 and the dose was considered lethal. Animals in 1, 3, and 6Gy groups completed the full experiment to d28. Sammon plot analysis of transcriptomes showed clear separation of samples based on the irradiation levels and time after exposure. The clearest separation was between samples of lethal and sublethal doses. Samples from animals exposed to sublethal doses separated more based on timepoints rather than the IR dose suggesting a level of similarity in the progression of the response to sublethal doses. Downregulation was the dominant modulation in the significantly differentially transcribed genes (SDTGs) in the 20Gy group. Temporal changes in ratios of upregulated/downregulated SDTGs (P < 0.05 and FC > 2) revealed further the difference between of transcriptome responses after exposure to lethal and sublethal doses and indicated a delayed peaks response with increasing IR doses within the sublethal range. About 59% of the SDTGs in 20gy were common to all timepoints while no more than 11% were common at the same duration in the other groups. Ratios of the number of SDTGs at h2 to those common to all TPs decreased in a dose-dependent manner with potential radiation dosimetric applications.

Conclusions: These results demonstrate a solid ability in detecting IR exposure, differentiating lethal and sublethal exposures, and differentiating among the exposure to sublethal doses.
Galunisertib Exerts Targeted Anti-Fibrotic Effects in In Vitro Models of Burn Wound Healing

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Introduction: Inhibition of TGF-β has shown promising in vitro and in vivo results for reduction of hypertrophic scarring after burn injury. However, TGF-β regulates diverse cellular pathways apart from fibrosis, including physiologic wound healing, cell cycle control, and homeostasis. Galunisertib, a novel small molecular tyrosine kinase inhibitor of TGF-beta receptor type 1, specifically targets downstream pro-fibrotic pathways of TGF-β signaling, has an excellent adverse effect profile, and minimal off-target effects. We hypothesized that galunisertib diminishes fibrotic phenotypes in a targeted fashion, making it a promising candidate drug for prevention of hypertrophic burn scar and contracture.

Methods: Commercially available fibroblasts were treated with TGF-β at concentrations typical of burn wounds to induce fibrotic phenotype fibroblasts (FPF). FPF cells were treated with galunisertib for 0, 1, 2, 3, and 7 days at concentrations ranging from 0.01 μM to 100 μM. FPF viability and proliferation were assessed with MTT assay. Modulation of FPF cell fibrotic gene and was analyzed using quantitative real-time PCR (qRT-PCR) of COL1A1, COL3A1, FN1, αSMA, CTGF, DCN, MMP1, and MMP13. Analysis of phenotype modulation was performed by western blotting of P-Smad2/3, collagen-1, fibronectin, and αSMA. Statistical analysis performed with students t-test and ANOVA.

Results: TGF-β treated FPF cells had significantly increased proliferation relative to commercially available fibroblasts, which was attenuated by treatment with 2.5–10 μM galunisertib at 2 or 3 days after treatment in a concentration dependent manner (p < 0.05) while also not causing a relative decrease in proliferation. Expression of FPF downstream pro-fibrotic genes underwent significant fold changes (FN1, αSMA, CTGF; p < 0.05). Protein expression showed decrease in both SMAD2/3 phosphorylation and fibrotic protein expression. Scratch assay analysis is ongoing.

Conclusions: Galunisertib exerts targeted dose-dependent inhibition of fibrotic gene expression and phenotypes in vitro without hindering cellular proliferation.

Neck Splint Fabrication

Malvina Sher, PT, DPT, Hope Hunter, PT, Jamie Heffernan, MSN, RN, Angela Rabbitts, MS,RN

Addressing the neck during burn rehabilitation is challenging, but critical as hypertrophy and contractures can result in adverse psychosocial, functional and cosmetic outcomes. Attention to the neck early in the rehabilitation process is crucial in minimizing scarring and preventing cervical contractures.

This video will demonstrate fabrication of a neck splint using silicon lined low-temperature thermoplastic material. The silicone-lined material is durable and has the capability of maintaining optimal pressure and position. It can be utilized alone or in a combination with compression garment to ensure 23 hours of pressure, which is crucial in preventing neck contractures, maintaining good cervical spine alignment and ROM, maximizing function and enhancing aesthetic appearance.

Based on our clinical experience, use of silicon lined low temperature thermoplastic splint allows for early and aggressive scar management. Furthermore, patients report improved compliance with wear and ease of care for this splint.
Positioning of Multiple Burned Joints- It Takes a Team

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Positioning of a burn patient with upper and lower extremity involvement is challenging and maintaining that position requires burn team support. This video displays positional strategies for the burn team to utilize to optimize recovery for the acute burn patient. Interventions strategies will include modifying the patient’s environment, management of orthotic devices and additional educational resources for successful execution of positional goals.

The Use of Biodegradable Temporizing Matrix

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Biodegradable temporizing matrix is a synthetic polyurethane dermal substitute that may have advantages over similar templates, which are mainly associated with its increased resistance to bacteria and infectious complications. It can be used to temporize large wounds in major burns, and to cover ungraftable beds, such as exposed bone or tendon. It has also been postulated to minimize the risk of scar contractures, which may warrant further studies. By means of a case report, this video illustrates its employment, showing the treatment stages of application, delamination, and grafting, as well as early postoperative results.
Introduction: Human connection is an essential element of healing for the burn survivor and their loved ones. The current global pandemic has created a barrier for in-person connection; hospitals nationwide have implemented visitor restrictions, which negatively impacts admitted patients. Our burn center integrated the use of video conferencing technology to increase connection amongst patients, loved ones, burn care team members, and burn survivors. We accomplished human interaction with our patients through virtual family meetings, peer support visits, and support groups.

Methods: Technology has been utilized in many different formats to help increase a patient’s connection with the outside world during the pandemic. Patient-centered family meetings were adapted to virtual formats and included the patient, the multidisciplinary burn care team, and the patient’s loved ones. We accomplished this by encouraging the patient’s family and the multidisciplinary team to join the meeting remotely, while the provider broadcasted from the patient room. In addition, the SOAR Peer Support group went entirely virtual, allowing survivors and peer supporters to attend and connect, despite in-person restrictions. Lastly, individual burn patient and SOAR visits were also adapted to the virtual platform.

Results: Video conferencing through a secured zoom platform was initiated in March 2020. From March 1, 2020 to September 24, 2020, 136 virtual family meetings were conducted, with an average of 4.5 family meetings per week. The quick adaptability to utilize technology allowed burn patients, loved ones, and burn care team members to continue to connect during times when those meetings would not have occurred. A virtual SOAR support group was held monthly, with an average of 3 attendees [2–6]. In this same time period, 14 SOAR Peer support individual meetings were conducted.

Conclusions: Despite the numerous challenges of a global pandemic, our Burn Center was able to proactively integrate technology to promote social connectedness. Utilization of technology allowed the burn multidisciplinary team to build trust with patients and their loved ones, offered invaluable patient-survivor relationships, and communicated the importance of social connection as an essential piece of burn recovery when our institution restricted visitors.
Introduction: Skin is not the only casualty following a burn accident. Many children suffer long term, debilitating emotional effects from their burn injury (Abdullah et al. 1994; Kornhaber et al. 2018). Armstrong-James et al. (2018) and Maslow and Lobato (2010) found that summer camps explicitly designed for burn survivor children can positively impact children’s adaptability to stases and comments and improve their sense of self-esteem. Camp Susquehanna has been a summer camp for burn survivors for the past 25+ years. When the COVID19 pandemic closed many businesses, we decided to transition our in-person camp to 100% online. Researchers demonstrated the positive effects of summer camp for burn survivors (Maslow & Lobato, 2010; Bakker et al. 2011). However, the effects of a 100% online camp are not known. Our concern was, are we able to transition and be as impactful as it is face to face at camp? What will the schedule and activities look like in this new format? How will we ensure all children participating will have access to online and the supplies necessary?

Methods: We opted to select a three-week format with two sessions a day divided into two age groups. We ensured every child had internet access then mailed out a “camp in the box.” It contained all the things needed for each planned activity. The critical question remained, however, will we be as impactful? The current research looks at quantitative and qualitative measures of self-esteem, happiness, and satisfaction following participation in a three-week summer program held in July 2020. We make comparisons to previous years’ results. The authors expected that self-esteem, happiness, and satisfaction levels matched or exceeded last years’ levels.

Results: We collected data from 42 campers and 22 volunteer camp counselors. Results show that campers were able to receive the support they needed, not only from the staff but also from their peers.

Conclusions: The delivery method was indeed different this year, but the positive effect on our campers remained the same.
Introduction: Coronavirus disease presented itself early in 2019 inducing a considerable degree of fear, worry, and unknown throughout the United States. National and State governed laws imposed social distancing measures, quarantining citizens, and isolating infected persons. Apart from its physical impact, COVID-19 pandemic has brought numerous changes to people's lives affecting people both physically and psychologically. A key component of quality of life of burn survivors consist of maintaining a long-term burn center connection through support groups. Our burn center developed a virtual format for aftercare to provide psychological support during the pandemic.

Methods: Regular attendees and new burn survivors were contacted by the aftercare specialist from an American Burn Associated verified burn center. Participants were surveyed on the best mode of contact and current addresses were obtained. “Happy Mail” was mailed to support group participants 3 times/month. Items included in these packages ranged from motivational sayings, gift cards, essential oils, candies, art projects, and reminders to log onto the virtual support groups. The gift packages also included a mental health check-in icebreaker. These gift packages took the place of our in-person support groups and contained all materials needed to engage and guide participation in the virtual monthly support group. Participants were then invited to join a social media support group for our local burn center.

Results: Burn survivors continued to receive quality psychosocial support to cope with and process feelings as well as validate emotions. Attendees regularly expressed gratitude in receiving “Happy Mail” as it brought a feeling of connectiveness to a group of burn survivors who rely on each other for peer support. The gift packages also served as a reminder of the upcoming virtual aftercare support groups as our attendance did not see a decline at monthly meetings.

Conclusions: Our experience suggests that a method of offering “Happy Mail” as part of a curriculum to augment virtual aftercare can be a model to adapt to the emotional support burn survivors and their family members need during the pandemic.

Introduction: Support group for burn survivors is immensely beneficial for reintegration and normalization of the burn recovery. The corona virus pandemic, however, limited in-person interactions significantly and decreased the travel capabilities. Our regional burn center serves an 8-state region, and as such, our every other month in-person support group consisted of survivors and family members from a large geographic area.

Methods: Support group volunteers and staff members recognized the need for continued support of survivors during the pandemic. Limitations of large, in-person meetings were implemented by our host organization to comply with pandemic safety guidelines. Evaluation of resources available led to development of a virtually supported meeting space. Email addresses were gathered to schedule. This allowed for interaction of survivors from an unlimited geographic area.

Results: Support group survivor volunteers and staff met to develop parameters, topics, IT support and logistics. Every other month support group was converted to a monthly gathering virtually due to easier access by survivors. Attendees completed a survey to evaluate and make recommendations for opportunities for improvement. The same number of survivors were present for in person and virtual meetings.

Conclusions: During this pandemic, limitations were placed that further isolate survivors. A virtually based support group has allowed for more frequent interactions between volunteers and new survivors. Various topics were discussed including survivor preparedness for public reintegration, worker's compensation and caregiver burnout. Speakers from multiple disciplines have been able to address issues requested by survivors. In this format, we have been able to continue the support of our survivors as they continue to recover. Social distancing has isolated many people during the pandemic; virtual support group has been paramount in continuing to connect our survivor family.
Introduction: When forming our virtual burn camp, burn camp leadership generated themes for each day to formulate a strategic camp curriculum, providing building blocks over the week to create camp community and connection. Each of the themes were well defined with defining concepts. The goal of the program was to provide consistency and guidance for our staff who were located all over the country and beyond to structure our virtual programming for our campers.

Methods: Burn camp leadership created a theme for each of the 5 days of virtual burn camp to create fluidity across the camp. Supporting these daily themes, we defined 5 core words to further outline the overall theme for the day. Our opening day theme was Creating Community. Accompanying our theme of Creating Community, we provided counselors with the following driving concepts: acceptance, belonging, inclusion, bonded, and connection.

Our theme for the second day was Growth. We provided the following driving concepts to support Growth: develop, flourish, thrive, stretch, and progressing. The third day’s theme was Inspire with the following driving concepts: encourage, motivate, energize, enthuse, and lead. Dream was the theme for the fourth day with the following driving concepts: aspire, consider, visualize, imagine, and ambition. Our last day of camp our theme was Hope to inspire kids to look into the future beyond virtual burn camp. The driving concepts included: optimism, plan, promise, confidence, and wish.

These themes and driving concepts with definitions were provided to our cabin counselors prior to camp and were sent out each morning. Counselors were required to complete a Google Survey at the end of each day to assess effectiveness and ability to execute the theme for the day.

Results: The themes and driving concepts allowed for intentionality for each day that provided fluidity for our virtual burn camp. Each daily theme built on the previous theme(s) to provide a connected community and intentional camp experience. Results of our Google Surveys showed the counselors were able to create community, facilitate growth, inspire campers, encourage campers to dream and instill hope.

Conclusions: Despite a challenging circumstance and an unprecedented situation facing our burn camp, our burn camp leadership team was able to create a structured and strategic framework with which to guide our virtual burn camp. This structure allowed our counselors to feel empowered to facilitate programming each day to connect our campers and move them forward despite difficult times.

Introduction: The social distancing restrictions mandated by the COVID-19 pandemic have directly impacted burn survivor support groups. Around the country, Pediatric Camps and Adult Support groups have been canceled or moved to an alternate format. While these alternative methods provide much-needed support and interaction for burn survivor groups, it is unknown how they compare to traditional, in-person support programs. In November 2020, our facility will replace our traditional Adult Burn Survivor Retreat with an entirely virtual, synchronous retreat. The retreat will feature many of the sessions and experiences from the in-person retreat but will be lacking the face-to-face contact that is so valued by our Adult Survivor Group. Educational sessions will be provided by adult psychologists and social workers, burn therapists and nurses. An adult burn survivor will provide the keynote address. Adult burn survivors, who have participated in prior year’s retreats, will be invited to participate in a comparison feedback survey.

Methods: Participants in the Virtual Adult Survivor Retreat will complete a post-retreat survey, comparing the virtual retreat experience to the traditional in-person retreat format. Likert scale questions will address participation level, benefit of retreat, specific feedback for sessions and ease of ability for survivors to interact with peers. In addition, the survey will seek to identify barriers of the virtual format as a means of providing needed survivor support.

Results: Survey results will be analyzed, and trends will be reported. Statistically significant results can be further explored to guide future virtual events.

Conclusions: Virtual events utilizing video platforms have become commonplace in the era of COVID-19, however, this format is still new, and the benefits have not been fully explored. Evidence has shown a direct benefit to survivors participating in support services. In an attempt to fill the gap left by the cancelation of in-person events, our facility is hosting a synchronous virtual retreat for adult burn survivors. Retreat evaluation and data comparing the virtual event to prior in-person events will be analyzed and reported.
Cancel Burn Camp: No Way! Our Institutions Creation of a Virtual Burn Camp and What it Taught Us About Our Patients

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Introduction: Last year we planned and created our own burn camp. We saw a need not being served and jumped in to create a camp experience that was archived in a documentary and received stellar reviews by all who attended. The kids’ camp expectations was exceeded and everyone was looking forward to 2020. We planned for a great 2020 camp experience and then COVID struck. We debated about the safety to proceed with residential camp as we knew it. Other camps cancelled but our inner need to serve wouldn’t let us do this.

Methods: Our planning committee quickly shifted and began planning for how we can bring that experience to a virtual platform. We engaged our Facebook group and called every kid on our list to inform the parents of the change. We then created a daily schedule and purchased the items needed for all activities. We then sent or delivered these with a gift card to kids that couldn’t make the pickups. Pickups were scheduled in the cities where most of our kids reside. We conducted daily yoga and meditation, cooking classes, painting and campfire stories. We mixed daily online sessions with 3 tailgating meet ups. We invited guest lectures and left the virtual space open for the kids to hang out.

Results: At the final tailgate/virtual pizza party, we had an awards ceremony and received testimonials from kids and parents about how for the first time siblings were able to participate. We delivered to 15 kids and had 20 attend the tailgate pickups. On average, we had 16 kids attend daily.

Conclusions: Parents could see how their child benefitted from this community and the intent of camp. This event revealed exactly where our patients reside from a socioeconomic standpoint. Deliveries to some homes left our volunteers in tears. This helped explain the discrepancy between interest expressed and the numbers that showed daily for events. It also made us recognize that camp means even more as it is an escape from their realities.

Clinical Sciences: Critical Care

Use of a burn sepsis screening protocol results in lower antibiotic usage rates

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Introduction: Antibiotic stewardship is widely recognized as being a necessary component of modern hospital care but remains difficult to put into practice particularly on burn services where the risk of infection is known to be higher than the general hospital population. Our burn service instituted a protocol for sepsis screening triggers and antibiotic usage, becoming the only unit in our hospital to do so. In-house quality metrics have shown this protocol to be successful in reducing utilization.

Methods: With the opening of our burn unit in April 2018, a burn sepsis screening protocol was put in place (see accompanying image). Briefly, the first level of screening consists of threshold hemodynamic and physiologic parameters. If these are met the pathway leads to drawing of basic laboratory tests plus lactate and procalcitonin. Group A findings consist of either Serum Lactic Acid $>$2.2mmol/L or Procalcitonin $>$0.69ng/ml, and Group B findings consist of: Platelets $<$ 100,000/mm$^3$ or Glucose $>$150 mg/dL or New Insulin Requirement. If one finding from each of groups A and B are present, antibiotics are started, and a source work up is initiated. De-identified aggregate data on antibiotic usage are routinely tracked as a quality metric by our hospital’s Infection Control Committee. The results from calendar year 2019 are presented here for all antibiotics, vancomycin usage, and beta-lactam usage. One-way Analysis of Variance with Tukey’s post-hoc testing was used to analyze the differences in intravenous antibiotic usage rates between the Burn Intensive Care Unit (BICU), the Trauma ICU (TICU), and the remainder of the hospital.

Results: The BICU used significantly fewer IV antibiotics than the TICU across all examined parameters and fewer than the remainder of the hospital for all antibiotics and vancomycin usage. Data is presented as antibiotic days/1000 patient days.

Conclusions: Initiation of a formal protocol for sepsis screening and IV antibiotic initiation significantly lowers antibiotic utilization. Future work will focus on this protocol’s impact on clinical outcomes.
510 A Case-controlled Retrospective Review of Fluid Resuscitation in Patients with Concomitant Burn and Trauma Injuries

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Introduction: Aggressive fluid resuscitation with crystalloid has been a mainstay of therapy in burn injuries for over 50 years. However, in trauma populations there has been a shift away from crystalloid based resuscitation and the early administration of blood products has been recommended. The primary objective of this study was to evaluate if large-volume crystalloid resuscitation of patients presenting with both burn and trauma injuries is associated with higher mortality and complications.

Methods: This was a matched case-controlled retrospective chart review of patients treated over a 5-year period that suffered mixed burn and trauma injuries (MI). Patients that suffered burn only injuries (BO) were used as the control and were matched on TBSA, age, and gender. All patients were resuscitated using the standard burn center resuscitation protocol.

Results: A total of 4,416 patients were admitted to the burn center during the study period. Of those 18 had concomitant burn and trauma injuries requiring burn fluid resuscitation and were successfully matched to BO patients. There was no difference in age, gender, ethnicity, % TBSA burned, presence of inhalation injury, or Injury Severity Score (ISS). BO patients were more likely to have flame/flash as the etiology of burn injury (p=0.0257). With fluid resuscitation, there was no difference in the total volume of fluid administered, or the amount of crystalloid or colloid administered. MI patients were more likely to have received blood products than BO patients (472 ml vs 19 ml, p=0.0387). There was no difference in the following outcome measures: mortality, ICU days, ventilator days, number of surgeries, infections, or major complications. The only significant outcome difference was that the BO patients had a greater hospital length of stay (44 days) than the MI patients (24 days, p < 0.001).

Conclusions: Aggressive fluid resuscitation using existing burn resuscitation protocols did not result in greater complications in burn-trauma patients than in burn only patients. Crystalloid-based burn resuscitation is safe in patients with combined burn and trauma injuries.

511 A Retrospective Review of the Timing of Tracheostomy in Mechanically Ventilated Patients

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Introduction: Tracheostomy is indicated for prolonged mechanical ventilation. Tracheostomy provides various benefits over prolonged endotracheal intubation including improved airway care, diminished need for sedation, reduced airway resistance, and increased patient comfort. However, the timing and effectiveness of tracheostomies has been controversial. Several studies, have indicated that early tracheostomy reduces the length of ICU and hospital stay, decrease the time on mechanical ventilation, and reduces the incidence of nosocomial pneumonia. In contrast other studies have shown that early tracheostomy shows no benefit, or even extends the length of mechanical ventilation in some patients. The purpose of this study was to evaluate the timing and the appropriateness of timing of tracheostomy.

Methods: This was a retrospective study of burn patients requiring mechanical ventilation over a 5-year period. The main comparison groups were endotracheal tube only (ETT) vs tracheostomy (Trach) and early tracheostomy (ETrach) vs. late tracheostomy (LTTrach). Tracheostomies that were performed within the first 7 days were considered to be ETrach.

Results: Age, gender, ethnicity, % TBSA burned, presence of inhalation injury did not differ between any of the groups. The Trach group demonstrated increased hospital length of stay (LOS) (22 vs. 39 days, p < 0.0001), greater number of ICU days (11 vs. 31 days, p < 0.0001), greater number of surgeries (3.7 vs. 6.6, p < 0.0001) and patients in this group were more likely to be discharged to a post-acute care facility rather than home, when compared to the ETT group (p < 0.0001). The Trach group also was more likely to develop ventilator-associated pneumonia (VAP) (23% vs. 48%, p < .0001), and more likely to develop swallowing abnormalities. Similarly, the LTTrach group demonstrated greater number of ICU days (25 vs. 32 days, p=0.4), greater number of ventilator days (23 vs. 29 days, p=.03), greater number of surgeries (4.5 vs 7.2, p=.02), but fewer days to liberate from the ventilator (19.4 vs 13.6 days, p=.04). This group also was more likely to develop VAP than the ETrach group (28% vs 53%, p=.03).

Conclusions: This study demonstrates a number of improved outcomes of tracheostomy over continued endotracheal intubation, and a number of improved outcomes of early tracheostomy over later tracheostomy. The most significant improved outcomes were decreased incidence of VAP and decreased swallowing difficulties following extubation/decannulation.
Objectives: characterize the use of bedside ultrasound examinations performed by advance practice providers and treating physicians in a regional burn intensive care unit

Methods: Daily bedside ultrasound examinations were performed utilizing a bedside ultrasound device by an advanced practice provider prior to rounds. The results were reviewed and compared to clinical volume assessment made during daily multidisciplinary rounds.

Results: 100 examinations were performed of those 32 were performed utilizing a bedside ultrasound device. Ultrasound images were archived to a centralized image repository and reviewed daily during multi-disciplinary rounds. Ultrasonographic volume assessment compared to clinical volume assessment made during daily multidisciplinary rounds.

Conclusions: Our results demonstrate that bedside ultrasound aides in guidance of both resuscitative and post-resuscitative efforts. We identified a cohort of patients who appeared hypervolemic clinically but US findings supported hypovolemia, we refer to as pseudohypervolemia. US volume assessment provides information that changes management. We believe point of care ultrasound is a viable tool in preventing over-resuscitation as well as to guide post-resuscitative diuresis.
514 Duration of Nebulized Heparin for Inhalation Injury
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Introduction: Inhalation injuries (IHI) are a major source of morbidity and mortality in burn patients. The purpose of this study is to evaluate short versus long duration of nebulized heparin in IHI and its effect on ventilator-free days.

Methods: This was a single-center retrospective analysis of adult patients with bronchoscopy-confirmed IHI admitted to a large academic medical center with an American Burn Association-verified Burn Unit between March 2013 and March 2018, who received nebulized heparin 10,000 units every four hours for three days or until the patient no longer had carbonaceous sputum, whichever is longer. Patients were excluded if they expired within 24 hours, had less than 48 hours of mechanical ventilation, or were made comfort care. The primary outcome was ventilator-free days of the first 28 days. Secondary outcomes include in-hospital mortality, length of hospitalization, baseline and day 3 lung inhalation score, reintubation, discharge disposition, and major and minor bleeding events. Baseline demographics were compared using descriptive statistics. Nominal data was compared using Chi-square test. Continuous data was analyzed using student’s t-test or Mann-Whitney U test, as appropriate. A sample size of 24 patients to be appropriately analyzed using student’s t-test or Mann-Whitney U test, as appropriate. A sample size of 24 patients to be appropriately powered (β = 0.2; α = 0.05) was required to show a mean difference of 8 days on the ventilator.

Results: A total of 40 patients were included in the study. Eleven patients received nebulized heparin for three days or less, and 29 patients received nebulized heparin for more than three days. Patients were primarily white, middle-aged males. More patients in the short duration group had a history of never smoking (4 vs 1, p = 0.04), and patients in the long duration group had a higher grade of inhalation injury (grade 3 vs grade 2, p = 0.01). Median ventilator free days of the first 28 was 4 days for the short duration group and 6 days for the long duration group (p = 0.88). There was no significant difference in length of hospital stay (12 days vs 20 days, p = 0.12), lung injury score, incidence of ventilator associated pneumonia, or bleeding events. No major bleeding events occurred.

Conclusions: This study introduces the potential use of carbonaceous sputum as a clinical marker for directing therapy and using a shorter duration of therapy as compared to previous studies. There was no difference found in ventilator free days between groups, and this study affirmed the safety of using nebulized heparin for IHI.

515 Evaluation of growth hormone use in patients with large burns and complex wounds
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Introduction: Large burn injuries lead to an extensive and prolonged catabolic state that results in loss of body mass and impaired wound healing. To combat this hypermetabolic response, different strategies have been employed including early excision and grafting, infection control, early nutrition and anabolic therapies such as oxandrolone. Human growth hormone is of interest for burn patients because of its anabolic properties. While its use has been associated with worse outcomes in the critically ill adult with sepsis, it has shown improved outcomes when used in pediatric burn patients. The purpose of this study was to retrospectively evaluate the appropriateness of human growth hormone use, its adverse events and cost in patients with large burns or complex wounds and poor wound healing.

Methods: This was an IRB approved, retrospective, single center chart review from 2011 to 2019 assessing human growth hormone prescribing patterns in the burn unit. The primary objective was appropriateness of use, defined as documentation of poor wound healing prior to initiation despite adequate nutrition delivery and use of standard anabolic therapies (i.e., oxandrolone). Secondary objectives included perceived benefit, adverse events and median therapy cost per patient of human growth hormone.

Results: Thirty-eight patients were included in the study, 79% of which were adults, with a median total body surface area involvement of 50% (IQR 40 to 71). Only forty-one per cent of patients receiving human growth hormone met our predefined criteria for appropriateness; this was primarily driven by poor documentation of wound healing. However, 80% of patients were receiving adequate nutrition and oxandrolone, indicating appropriate clinical use. Most adult patients received a dose of 20mg daily, while pediatrics received the weight based 0.2mg/kg daily dose. The median duration of treatment was 24 days (IQR 13–35) and median time from admission to growth hormone initiation was 27 days (IQR 12–34). Overall clinical improvement was noted in 53% of patients, as evident by increased weight, prealbumin and/or documentation of improved wound healing. The most common adverse effect noted was hyperglycemia, followed by new sepsis onset. The median therapy cost per patient was $42,000.

Conclusions: Human growth hormone may serve as a salvage therapy for large burns with poorly healing wounds. Prior to initiating therapy, nutrition must be optimized and standard, more researched anabolic therapies should be started. While receiving therapy, patients should be monitored for both hyperglycemia and the development of new sepsis.
Introduction: Rhabdomyolysis, a rapid breakdown of damaged skeletal muscle, is a serious complication known to occur in approximately 1% of burn patients. Muscle breakdown products can accumulate in the renal tubules leading to acute kidney injury (AKI) and increased deaths. Burn-associated factors such as under-resuscitation, infection, and nephrotoxic drugs likely increase incidence of AKI in those with rhabdomyolysis after burn. Other variables such as age, sex, and pre-existing conditions may also be implicated in this relationship. We investigated whether burn patients with rhabdomyolysis are at greater risk of developing AKI than others with rhabdomyolysis.

Methods: TruNetX, a global health research network, was accessed in September 2020 to create three patient cohorts with a combination of rhabdomyolysis and burns. Data from years 2000 to 2020 from 38 health care organizations was used. Cohort 1 included burned patients who developed rhabdomyolysis within 14 days after injury. Cohort 2 were those with rhabdomyolysis who did not suffer a burn within 14 days prior to diagnosis. Cohort 3 included burned patients who did not develop rhabdomyolysis within 14 days of the burn. Burn diagnosis was identified by ICD-10 codes T20-25, T26-28, or T30-32; rhabdomyolysis was identified with M62.82. We identified 699 patients in Cohort 1. Propensity score matching was done to Cohorts 2 and 3 to balance similar demographics and pre-existing conditions to Cohort 1. Cohorts were then compared to assess the risk of developing AKI (N=17) within 14 days of the initial event.

Results: Cohort 1 had a mean age at incidence of 48.4±19.8; 552 patients were male and 146 were female. 154 patients with hypertensive diseases, 66 with diabetes mellitus, 41 with chronic kidney disease, and 51 overweight or obese patients were identified. Matched Cohorts 2 and 3 had the same number of patients and similar demographics and pre-existing conditions as Cohort 1. 391 of 699 burn patients with rhabdomyolysis (56%), 293 of 699 non-burn patients with rhabdomyolysis (42%), and 23 of 699 burn patients without rhabdomyolysis (3%) developed AKI within 14 days. The risk ratio difference for developing AKI between burn patients and non-burn patients with rhabdomyolysis was 14.02% with a 95% CI of 8.831–19.209% (< 0.0001 p-value) and between burn patients with and without rhabdomyolysis was 52.647% with a 95% CI of 48.736–56.557% (< 0.0001 p-value). The odds ratios for developing AKI were 1.759 and 37.312, respectively.

Conclusions: We found the risk of developing AKI in burn patients with rhabdomyolysis to be significantly augmented compared to non-burn patients with rhabdomyolysis or burn patients without rhabdomyolysis.
518 Massive Burn Injury Outcomes in Children
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Introduction: Advances in the care of burn injured pediatric patients has improved mortality over the last 20 years. However, massive burn injuries in pediatric patients, while overall rare, have a significant morbidity and mortality. The primary aim for this study is to analyze outcomes in massive pediatric burn injuries.

Methods: After institutional review board approval, a retrospective study of children with burn injuries 50% TBSA or greater who were admitted to our pediatric burn center from 2009 to 2019 was conducted. Data collected include age, gender, ethnicity, race, country of residence, % TBSA, degree of burn, presence of inhalation injury, hospital duration, intensive care duration, presence of tracheostomy, number and types of surgeries performed and discharge outcomes. All mean values are mean±standard deviation, all median values are median (interquartile range), and p-value < 0.05 were considered significant.

Results: This study included 84 patients (60.7% male) with a mean age of 8±6 years old. The median time from injury to admission was 2(1–4) days. 56% of patients were from Mexico, 43% were from the United States and 1 patient was from American Samoa. 21% of the patients died. There was no difference in the extent of burn injury between patients who died (68±14% TBSA) versus those who lived (66±12% TBSA). The median length of stay was significantly shorter in the patients who died (19(5–44) vs. 74(35–138) days p=0.0001). Patients who died also suffered more inhalation injury (61% vs. 21%, p=0.01). After adjusting for age and TBSA, inhalation was a significant independent predictor of death (OR- 4.3, (1.4-13 95% CI), p=0.01).

Conclusions: Over the past decade, nearly 80% of children with massive burn injuries survived. The children who died as a result of their massive burn injury, died within the first month of admission. Inhalation injury significantly and independently increases the risk of dying in pediatric patients with a massive burn injury.

519 The Routine Addition of Maintenance IV Fluid is Not Warranted during all Pediatric Burn Resuscitation: A Retrospective Study
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Introduction: Pediatric burn resuscitation has improved dramatically over the years with improved survival and outcomes. Recent studies have shown the amount of fluid given (ml/kg/%TBSA) has direct correlation to the outcomes. Over resuscitation (fluid creep) results in multiple systemic and wound complications. We hypothesize the addition of maintenance IV fluid with Parkland resuscitation fluid in younger pediatric burns (<30kg) may not be needed to achieve adequate end points of resuscitation.

Methods: We performed a retrospective chart analysis of our pediatric burn patients at our institution by categorizing younger patients (<30kg) into two groups: The maintenance IV fluid (MF) group and the resuscitation fluid (RF) only group. We identified 18 patients that met the criteria with 9 patients in each group. All of the patients in both groups were under 30kg, age range 2-8yrs, and TBSA: 16–50 %. We included 3 patients under 20% TBSA that were resuscitated due to full thickness burns and smoke inhalation injury. We analyzed their hourly and 24-hour fluid administration including all oral intake and tube feeds as well as their hourly vitals, urine output, and laboratory values during the resuscitation.

Results: We found that the RF group received 1.311+/−1.295 cc/kg cc less fluid compared to the MF group without any hypoglycemic events or deleterious hemodynamic effects. The patients who had good oral intake or received tube feeds during resuscitation resulted in significantly less resuscitation volume than the estimated resuscitation volume in both groups.

Conclusions: We conclude that resuscitation can be safely done in pediatric burn patients under 30 kg without adding routine maintenance IV fluid. Early oral and enteral feeding is very critical in all burn patients. The volume that was administered enterally should also be considered in hourly fluid titration rates to reduce the resuscitation fluids given thereby preventing fluid creep and ensuing deleterious complications.
Introduction: Current practice for major pediatric burns includes fluid resuscitation using formulas that estimate fluid requirements based on weight and/or body surface area (BSA) along with percent total burn surface area (TBSA). Adult studies have shown that these formulas can cause fluid overload in obese patients and increase risk of complications. These findings have not been validated in pediatric patients. This study aims to evaluate whether a weight-based resuscitation formula increases the risk of complications in obese children following burn injuries and compares fluid estimates to those that incorporate BSA.

Methods: A retrospective review was conducted on 110 children (≤ 18 years old) admitted to an ABA-verified urban pediatric burn center from October 2008 to May 2020. Patients had ≥15% TBSA, were resuscitated with the weight-based Parkland formula, and had fluids titrated to urine output every two hours (1 ml/kg/hr if ≤ 30kg; 0.5 ml/kg/hr if > 30kg). Demographics, burn type, and TBSA were collected on admission. BSA-based Galveston and BSA-incorporated Cincinnati formula resuscitation predictions were also calculated. Output and input volumes were collected at 8h and 24h post-injury. Complications were collected throughout the hospital stay. Patients were classified into CDC-defined weight groups based on percentile ranges. Statistical analysis was conducted using SPSS Statistics version 10.0.

Results: This study included 11 underweight, 60 normal weight, 18 overweight, and 21 obese children. Our patients had a mean age-based weight CDC percentile of 62.2%, and mean TBSA of 25.4%. Predicted resuscitation volumes increased as CDC percentile increased for all three formulas (p=0.033, 0.092, 0.038), however there were no significant differences between overweight and obese children. Total fluid administered was higher as CDC percentile increased (p=0.023). However, overweight children received more total fluid than obese children. The difference between total fluids given and Galveston predicted resuscitation volumes were significant across all groups (p=0.042); however, the difference using the Parkland and Cincinnati formulas were not statistically significant. There were more children in the normal weight group who developed complications compared to other groups, but these findings were not significant.

Conclusions: The Parkland formula tended to underpredict fluid needs in the underweight, normal weight, and overweight children, and it overpredicted fluid needs for the obese. Further research is needed to determine the value of weight-based vs BSA-based or incorporated formulas in terms of their risk of complications.
522 Perioperative Echocardiographic Assessment of Malnutrition-Related Cardiomyopathy: A Case Series

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Introduction: It is known that systolic dysfunction (dilated cardiomyopathy) may occur in a high percentage of patients with large TBSA burns. The reversible myocardial depression may be due to many factors: thermal injury, sepsis, severe malnutrition. Monitoring nutritional status is an integral part of improving post-burn cardiomyopathy. Perioperative echocardiography can be used to assess the degree of cardiac dysfunction and alter treatment in these patients.

Methods: Serial echocardiographic parameters were measured (ejection fraction, fractional shortening, pericardial fluid) in 4 patients with evidence of malnutrition (low BMI, low albumin and prealbumin, muscle wasting), delayed wound healing, and a late presentation to the hospital. Initial echocardiography was performed post-injury day 30 -142; follow-up exams were performed in some patients up to 2 years post-injury. Acutely injured or septic patients were excluded.

Results: Echocardiographic measurements were obtained in 4 patients, ages 7–21. The TBSA ranged from 33–95% and included flame injury and electrical burns. The initial ejection fraction ranged from 12–38% in patients with a BMI range of 10–16. The mean initial albumin was 1.65g/dL; the mean prealbumin was 10.8mg/dL. Selenium deficiency was noted in 1 patient. Dobutamine was required intraoperatively in several patients.

Conclusions: Patients presenting with malnutrition and impaired wound healing all had evidence of cardiomyopathy of varying degrees. However, the degree of systolic dysfunction varied significantly. Chronic surgical grafting was used to manage burn wounds, while slow nutritional rehabilitation normalized the patient’s BMI with careful avoidance of refeeding syndrome. As exemplified by serial echocardiography, one patient’s EF improved over 1 year from 12% to 50–55% as the nutritional status also improved, demonstrated by the normalization of his BMI. Despite the lower ejection fractions, many patients maintained an adequate cardiac index and required only short-term inotropic agents. Intraoperative and serial echocardiography allowed for continued monitoring and alteration of the heart failure medication regimens if required. With time and adequate nutrition, cardiac function improved, although many remained with mild dysfunction in the first year.

523 Retrospective Outcomes Analysis of Tracheostomy in Paediatric Burn Population

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Introduction: For decades, controversy has raged regarding the placement of tracheostomy in severe paediatric burns. Numerous variables including extent of smoke inhalation injury, % TBSA burned, age of the patient, and co-morbidities among others complicate reaching consensus. Furthermore, paediatric patients are particularly susceptible to complications including inadvertent loss of airway and long-term swallowing and other anatomic issues. Additionally, previous analysis of the efficacy of tracheostomy in paediatric burn patients appears to be hindered by a lack of nationwide analysis. The aim of this study was to explore the efficacy of tracheostomy in the general paediatric burn patient population.

Methods: De-identified patient data was obtained from the TriNetX Research Network database. Two cohorts were identified: paediatric burn patients with tracheostomy (cohort A) and paediatric burn patients without tracheostomy (cohort B). Burn patients were identified using the ICD-10 codes T20-T25 & T30-T32. Tracheostomy was identified using the ICD-10 codes 1005887, 1014613, 31600, 31601, 31603, 31604, 31610, and Z93.0. A total of 132 patients were identified in cohort A in 23 HCOs and 83,117 patients were identified in cohort B in 38 HCOs. Infection, hypovolemia, pulmonary injury, laryngeal injury, pneumonia, and death were compared between the cohorts.

Results: Cohort A had a mean age of 11 (SD=5) and Cohort B had a mean age of 9 (SD=5). Paediatric burn patients with tracheostomy had a higher risk for death, infection, hypovolemia, pulmonary injury, laryngeal injury, and pneumonia when compared to their non-tracheostomy counterparts. The risk ratios for these outcomes were 62.452, 4.713, 9.267, 26.483, 116.163, and 18.154, respectively.

Conclusions: The analysis of the longitudinal outcomes of pediatric burn patients with tracheostomy as compared to those without tracheostomy demonstrated the tracheostomy cohort suffered much worse mortality and morbidity across several metrics. The potential benefits of tracheostomy placement in pediatric burn patients should be weighed against these outcomes.
Use of Broad-Spectrum Antibiotics and Sepsis-3 Criteria in Burns
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Introduction: Sepsis is a diagnostic challenge in critically ill patients; especially so in the burn population because the signs and symptoms of sepsis are pervasive after injury. The Sepsis-3 criteria identify organ dysfunction as an acute change in SOFA score ≥ 2 points consequent to infection. The objective of this study was to evaluate if Sepsis-3 criteria were fulfilled when broad-spectrum antimicrobial therapy was started in a burn cohort.

Methods: We included all adult (≥ 18 years) patients with an acute burn admitted to our burn centre within 2 days of injury between 2016 and 2019. Only patients that received meropenem or piperacillin/tazobactam during their acute hospitalization period were included. Patients were stratified based on the Sepsis-3 definition using evidence of infection and evaluation of organ failure in the 48-hour period prior to the administration of antibiotics.

Results: We studied 70 patients, with 24 patients in the control group and 46 patients in the Sepsis-3 group. Demographics were similar among the control and Sepsis-3 groups: mean age was 44 ± 18 versus 48 ± 18 years (p=0.372); but injury severity was significantly different: median percent TBSA burn 18% vs. 32% (p=0.003) and proportion of inhalation injury 13% vs. 50% (p=0.002). Length of stay (LOS) was significantly longer in the Sepsis-3 group, control group median 23 days vs. median 43 days (p<0.001). However, LOS/TBSA was not significantly different in the control group compared to the Sepsis-3 group: median 1.6 vs. 1.4 days per percent TBSA burn (p=0.777). Mortality was similar among the groups: 13% vs. 20% (p=0.526). The proportion of patients diagnosed by a physician with sepsis was also similar with 21% in the control group vs. 33% in the Sepsis-3 group (p=0.406).

Conclusions: Though the Sepsis-3 group had greater injury severity, mortality, and LOS in-hospital, when normalized to TBSA, was similar. Patients were diagnosed by a physician with sepsis in less than a third of cases. This raises the question of why broad-spectrum antibiotics were started. Potentially, patients were treated based on clinical suspicion of sepsis instead of delaying treatment until diagnosis was confirmed. Benefits of early antibiotic administration must be considered in conjunction with antimicrobial stewardship.

Biomarkers for the Early Diagnosis of Sepsis in Burns: Systematic Review and Meta-analysis
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Introduction: Early clinical diagnosis of sepsis in burns patients is notoriously difficult, and many biomarkers have been proposed as adjuncts to clinical assessment. We aimed to evaluate the diagnostic performance of all previously studied biomarkers for the early diagnosis of sepsis in hospitalized patients with burns.

Methods: We conducted a systematic literature search to February 2020 of Medline, Embase, Cochrane Central, Biosis Previews, Web of Science, and Medline In-Process. Only diagnostic studies utilising a sepsis definition of positive blood cultures or a combination of infection, systemic inflammation, and organ dysfunction were included. Where possible, contingency tables were used as reported or constructed from original data using a cut-off based on Youden’s index. Pooled sensitivity and specificity estimates were derived for each biomarker using random effects meta-analysis.

Results: We included 27 studies evaluating 56 different biomarkers. Procalcitonin was moderately sensitive and specific for sepsis in patients with burns (sensitivity 72%, specificity 74%). CRP was also moderately sensitive and specific (74% and 64% respectively). White cell count had poor sensitivity and specificity (46% and 59% respectively). All other biomarkers had insufficient studies to include in a meta-analysis, however cell free DNA, nuclear DNA, BDG, BNP, and SVI showed the most promise in single studies. There was considerable heterogeneity between studies reflecting different definitions and cut-offs.

Conclusions: The most widely studied biomarkers are poorly predictive for sepsis in burn patients. Several promising candidates have been reported which should be evaluated in further studies. A standardized approach to the evaluation of diagnostic markers (including time of sampling, approach to cut-offs and outcome) would be useful.
Outcomes of Burn Patients with Pre-Existing Human Immunodeficiency Virus: A Systematic-Review and Meta-Analysis

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Introduction: Burn injuries are well known to cause a state of immunosuppression in patients. This can result in wound infections, a common complication in burn injuries, that can lead to sepsis and increased mortality. Human immunodeficiency virus (HIV) is also known to cause immunosuppression in patients. The outcomes of burn patients with pre-existing HIV infections, however, are not yet completely understood. We conducted a systematic review and meta-analysis to compare the outcomes of burn patients with pre-existing HIV against those without this chronic infection.

Methods: We searched MEDLINE (Pubmed), Google Scholar, Scopus, and Embase for studies that compared outcomes and complications between burn patients with and without HIV. From this search, we screened 445 articles. Through our selection criteria, five articles focusing on HIV patients were selected for systematic review and meta-analysis. Data were analyzed using the Cochrane Review Manager (RevMan) Data Analysis package to produce pooled odds ratios and mean differences from the random effect model.

Results: Five studies observing a total of 24,419 burn patients, published between 2000 and 2017, were included. Of these, two are prospective studies and three are retrospective chart reviews. The primary outcome of mortality for HIV+ patients compared to HIV- patients had an odds ratio of 2.04 (CI= 0.46–9.14) in the random effects model. Secondary outcomes of sepsis and wound infection odds ratios were 1.47 (CI= 0.44–4.99) and 1.10 (CI= 0.28–4.25), respectively. The length of stay (LOS) between studies showed an overall mean difference of 0.95 (CI=-8.08–9.99). Most studies had a greater proportion of male patients. TBSA between studies ranged from 13.1% and 35%.

Conclusions: From our results, we concluded that HIV+ had a tendency toward greater mortality (OR=2.04) and sepsis (OR=1.47). However, mortality and sepsis had confidence intervals of [0.46–9.14] and [0.44–4.99], respectively. Therefore, we cannot definitively state that HIV infection is responsible for greater mortality or sepsis in burn patients. Additionally, LOS analysis also showed a wide confidence interval [-8.08–9.99], preventing us from making reliable deductions about this outcome. We believe further research is needed before universal conclusion or recommendations are appropriate.
Use of Bioelectrical Impedance Analysis for Assessing Phase Angle, Hydration Status, and Predicting Outcomes in Critically Ill Patients: A Systematic Review and Meta-Analysis

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Introduction: Bioelectrical impedance analysis (BIA) is a simple, noninvasive method of assessing body composition. BIA operates by sending a low-voltage electric current through the body and measuring the impedance to that current. Parameters obtained from BIA have been used to investigate a range of variables such as nutrition and hydration status in a variety of patient populations. Phase angle is also a unique parameter that is thought to reflect cellular health. BIA parameters can undergo further analysis by bioelectrical impedance vector analysis (BIVA) which can provide information about hydration status. Burn and critical care patients pose a unique challenge because they are particularly sensitive to fluid shifts and metabolic derangements which are associated with poorer outcomes. The utility of BIA and BIVA in this patient population has not been well studied. Thus, we have conducted a systematic review and meta-analysis of the ability of BIVA and BIA parameters to assess cellular health and hydration status in critically ill adults and whether they can be correlated with outcomes.

Methods: A search was performed on PubMed and Google Scholar in accordance with PRISMA guidelines between June 2020-August 2020 utilizing the keywords: bioelectrical impedance analysis, critical care, critical, body composition, phase angle, water, fluid. Inclusion criteria were articles investigating the relationship between BIA, BIVA and outcomes with regards to phase angle, hydration, and fluid status in critically ill adults. Reviews, non-English articles, and studies involving pediatric patients were excluded. A meta-analysis was conducted on the correlation between mean phase angle and mortality.

Results: The final analysis included 21 articles; 4 articles were included in the meta-analysis. Statistically significant correlations were found between phase angle and mortality in 9/13 articles, hospital length of stay in 4/7 articles, ICU length of stay in 5/7 articles, and mechanical ventilation duration in 1/4 articles. For meta-analysis, mean phase angle in survivors and non-survivors was 4.5 and 3.9 respectively, and this difference was statistically significant (Figure 1, p< 0.01). Significant correlations were found between ECW/TBW and mortality in 4/7 articles, and BIVA derived hydration status and mortality in 6/7 articles.

Conclusions: BIA and BIVA may be used as a prognostic indicator for outcomes in critical care patients. Further investigations are needed to explore this relationship in the burn patient population.
Introduction: Oxygen therapy is a mainstream treatment for many cardiopulmonary disease processes in the United States with COPD being most common. Despite various warnings against smoking on oxygen therapy, some patients continue to smoke on oxygen and sustain burn-related injuries. These patients are frequently intubated due to concern for inhalation injury. We aim to characterize the injury patterns, morbidities, and mortalities associated with burns sustained while on oxygen therapy at home. We hypothesize that the prevalence of these injuries is underrecognized.

Methods: We performed a retrospective review of all patients ≥45 years of age admitted to our regional burn center from 10/2018-4/2019. Injuries related to smoking on home oxygen were isolated and patient and injury characteristics are described.

Results: A total of 143 patients were included in this review. 20 patients (15%) had injuries related to smoking on home oxygen. Patient and injury characteristics are described in Table 1. Notably, 25% of patients had injuries related to smoking and none of those patients had an inhalation injury documented on bronchoscopy. Four patients were intubated within a day of admission & one patient was extubated on hospital day 2. No patient died in the hospital. Nine patients (45%) required an escalation of care in the post-acute care period.

Conclusions: Smoking on home oxygen is an underestimated problem and better education is needed for both patients receiving the therapy and providers prescribing the therapy. Due to the mechanism, inhalation injury is rare though a significant percentage of patients continue to receive prophylactic intubation.

Table 1

<table>
<thead>
<tr>
<th>Patient and Injury Characteristics (N=143)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients smoking on home O2, n (% of N)</td>
<td>20 (15%)</td>
</tr>
<tr>
<td>Age, range</td>
<td>48-79</td>
</tr>
<tr>
<td>Male Gender (% of n)</td>
<td>23 (65%)</td>
</tr>
<tr>
<td>Patients intubated, n (% of n)</td>
<td>5 (25%)</td>
</tr>
<tr>
<td>Inhalation injury, n</td>
<td>0</td>
</tr>
<tr>
<td>Length of stay, days (range)</td>
<td>3.35 (1.33-5.7)</td>
</tr>
</tbody>
</table>

529 Acute Colonic Pseudo-Obstruction: A Critical Complication in Burn Patients

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Introduction: Acute Colonic Pseudo-Obstruction (ACPO) is a rare clinical condition characterized by gross dilatation of the large bowel in the absence of an obstruction. It presents a particularly complex challenge in diagnosis and management in the context of burn trauma. We followed five burn patients who developed ACPO that did not respond to conservative treatments. These patients ultimately required surgical intervention to resolve their ACPO. Through our study, we propose that traditional management may not be successful in fully treating ACPO in burn patients without recurrence and that complete resolution necessitates a more aggressive management course, often in the form of surgical intervention.

Methods: We studied the clinical course of all burn patients who developed ACPO in the past 2 years at our burn center. Using Electronic Health Records, we collected patient demographic data, percent total burn surface area (%TBSA), hospital length of stay, cecal diameter, bowel regimen for catharsis, and vital sign measurements. Abdominal CT scans and X-rays were used to monitor the progression of cecal diameter.

Results: We have noted that burn patients who are at a high risk of developing ACPO tend to either be obese, have large TBSA burns (>20%), or have a combination of both. Furthermore, patients who had a greater percentage of 3rd degree burns had worse outcomes. All patients received acetylcholinesterase inhibitors (AChEi’s), but ultimately underwent some manner of further intervention for complete resolution of ACPO. Two patients were treated solely with decompression: one via NGT suction, the other via colonoscope. Three patients received surgical intervention through hemicolectomy, subtotal colectomy, and cecostomy. The former two subsequently expired, one due to direct ACPO complications; the latter three survived and remain well today.

Conclusions: ACPO is a rare but serious complication in burn patients that may easily be missed by the diagnosing clinician. In the treatment of ACPO in burn patients, one should consider a more aggressive approach, as traditional medical therapy may not be enough to resolve the original distention or prevent a recurrence. In our review of five burn patients that subsequently developed ACPO, surgical intervention was universally the mechanism by which definitive resolution of the condition was achieved.

530 Case Report of Curling's Ulcer in Convalescing Burn Patient

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Introduction: Although stress ulcer disease related to burn injury was noted previously, it was the report of a series of
10 cases by Curling which lent the name to the finding. Occurrence of the disease has been attributed to the stress factors of hemodynamic instability with resultant decrease in defense factors of the gastroduodenal epithelium noted as patients began to survive massive burns. At one time, the incidence was reported as high as 23% of hospitalized burn patients. However, with advances in supportive care and antacid therapy, some have wondered if Curling’s ulcers may have become extinct.

**Methods:** We report the case of a 21-year-old male admitted after MVC with 53% TBSA burn (32% full-thickness) and multiple blunt trauma injuries. Early in his course he underwent splenectomy, small bowel resection, right hemicolectomy, and ORIF of an unstable lumbar fracture, and below-knee amputation. He underwent staged excision and grafting of burn wounds and had been autografted with exception of about 11%TBSA of the left lower extremity (wound controlled with allograft). On hospital day 38, the patient was noted to have melanotic colostomy output with a concomitant drop in hemoglobin level from 7.6 g/dl to 3.5 g/dl.

**Results:** The gastroenterology service was consulted, and they performed upper endoscopy on hospital day 39. A large amount of clotted blood was seen in the stomach, but the source of bleeding was not visualized. Subsequent endoscopy the following day showed an erosion of gastric mucosa in the gastric fundus consistent with ulcer, on which two clips were placed. The patient’s stool was tested for H. pylori antigen and the test was negative. The patient continued on a proton pump inhibitor, non-steroidal anti-inflammatory drugs were held, and his hemoglobin stabilized and melanotic ostomy output resolved.

**Conclusions:** Antacid therapy, H2-blockers, and proton pump inhibitors have historically been used in cases of large burns. However, in the care of other critically ill patients the association of this therapy with ventilator associated pneumonia has lead to new scrutiny. In addition, a renewed emphasis on multimodal pain management may be introducing a bias towards an increase in so-called aggressive factors, namely NSAIDS administered over longer periods. Advances in critical care of burn patients have made Curling’s ulcers rare, but not extinct.

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**Clinical Sciences: Nutrition and Metabolism**

**R-123**

**531 The Effect of Burn Wound Size on Caloric Requirements: A Correlation of Nutritional Changes to the Clinical State**

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**Introduction:** Caloric intake has been a vital component for burn wound healing and recovery. The hypothesis was that caloric requirements are based on injury severity & post-burn week as predicated by indirect calorimetry (IC)/predictive equations.

**Methods:** This was a retrospective chart review of 115 burn patients (2012–2017). Caloric requirements were determined by the Curreri equation [which includes % total body surface area (TBSA)] and IC for a 5-week period provided mainly by enteral nutrition. Patients received supplements and total parenteral nutrition as needed.

**Results:** The mean ±sd age was 43±18 years, 41±18 % TBSA, and mortality of 26 (23%). The major mechanisms of injury were flame/flash/explosions. There were 59 (51%) of patients with < 40 % TBSA burns, [median Injury Severity Score (ISS) 9; Apache score 14], and 56 (49%) with ≥40 % TBSA [median ISS 25; Apache score 21], p < .0001. The Respiratory Quotient (RQ) had a median of 0.94 (range 0.79 to 1.02). The median number of surgeries for the < 40 % TBSA group was 5 versus 12 for the ≥40 % TBSA, p < .0001. The Injury Factor did not differ from weeks 1–5 (1.8 for < 40 % TBSA and 2.0 for the ≥40 % TBSA). The Curreri equation calculation for this study was a median 3640 (range 2161–5950) calories. The Curreri equation resulted in significantly increased caloric recommendations for the ≥ 40 %TBSA compared to the < 40 %TBSA patients, p < .0001. The < 40 %TBSA group had caloric requirements ranging between 1500–2700 calories compared to the ≥ 40 %TBSA group, whose calories ranged between 2000–3700. The total daily caloric recommendations were also significantly increased in the ≥40 %TBSA compared to the < 40 %TBSA patients. The maximum levels of resting energy expenditure (REE) from IC, total daily calories recommended by the dietitian and average calories ranged between 3000–4500 in the < 40 %TBSA group and 3600–6700 in the ≥ 40 %TBSA group. The caloric recommendations increased for all patients from week 1 to week 3 and leveled off during weeks 4–5.

**Conclusions:** Patient caloric requirements were dependent not only on the severity of the burn injury but also the post-burn hospitalization during which surgeries, debridement/grafting, and infectious complications occurred. They increased until the third week post-burn and leveled off in the recovery period. The study caloric recommendations and requirements were consistent with the REE and Curreri equation assessments.
Intravenous Supplementation of Micronutrients in Patients with Severe Burns

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Introduction: Pneumonia is a prominent cause of morbidity and mortality in burn patients. The European Society for Clinical Nutrition and Metabolism (ESPEN) recommends supplementing with intravenous copper, selenium, and zinc, as a randomized controlled trials on burn patients in Switzerland showed decreased pneumonia rates. The purpose of this performance improvement project was to determine whether the intravenous supplementation of copper, selenium, and zinc had an association with the incidence of pneumonia in patients with total body surface area (TBSA) burns over 20% in order to determine if this practice should be re-initiated.

Methods: Based on available randomized controlled trial evidence, we began the clinical practice of providing intravenous trace elements to our patients with burns over 20% TBSA who were admitted to the burn intensive care unit and who had a central line. This clinical practice ended after 2 years when there was a national shortage of these intravenous trace elements. We performed a retrospective evaluation on patients admitted for initial burn care to our intensive care unit who received an intravenous solution containing 4 mg copper, 500 mcg selenium, and 40 mg zinc daily for a goal duration of two days. In order to compare the incidence of pneumonia within the first 30 hospital days in patients who received intravenous trace element supplementation to those who did not, we matched patients based on age, burn size, and gender. Matched subjects were admitted either before or after the time period of intravenous trace element supplementation and these subjects received oral zinc supplementation. Descriptive statistics and Chi-Square were performed using JMP. Significance was set at p<0.05.

Results: Pneumonia occurred in 63% of the 52 included patients with the following characteristics: 71% male, 52 ± 18 years old, 43 ± 15% TBSA burn, 29 ± 25 mechanical ventilator days, and 44% mortality. A significant difference in the incidence of pneumonia during the first 30 hospital days was not found between groups (intravenous trace element group: 70%; comparison group: 56%; p=0.28).

Conclusions: Supplementation of intravenous copper, selenium, and zinc was not significantly associated with incidence of pneumonia in our severely burned patients, contrary to previous research findings.
Persistent Copper and Zinc Deficiency in Excess of 30 Days Post Burn Injury
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Introduction: Copper and zinc deficiencies are common after burn injury, with the lowest levels usually occurring within seven days. Both trace elements are important for wound healing, but due to competition for absorption in the small intestine, oral replacement of zinc and copper may not be sufficient. Nutritional guidelines recommend copper and zinc replacement for up to 30 days, but little data is available to guide long-term trace element replacement.

Methods: This case series includes four patients with 15% or larger total body surface area burns who had hypocupremia at least 30 days after admission despite receiving at least the recommended daily allowance of copper via tube feeds.

Results: In two patients, copper levels increased following discontinuation of oral zinc tablets. However, one patient had continued hypocupremia and increasing zinc levels while receiving zinc only from tube feeds, suggesting this amount of zinc may decrease dietary copper absorption. For one patient with 95% TBSA burns, hypocupremia was associated with polyneuropathy and osteopenia. Another patient experienced an acute drop in zinc levels associated with bacteremia and sepsis.

Conclusions: In this case series, hypocupremia was associated with anemia and zinc deficiency with poor wound healing. Additional multicenter practice reviews of copper and zinc supplementation in burn centers would be beneficial.

Vitamin C in the Management of Burn Patients: A Review of Benefits and Risks
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Introduction: Burns are a global public health problem. Micronutrients play an essential role in defense mechanisms and immunity. Vitamin C has fostered a growing interest. We reviewed current evidence regarding the effects of Vitamin C on management of burn patients and aims to understand its benefits and risks.

Methods: A narrative review was performed from January 2000 through September 2020 via PubMed by searching the terms “vitamin C”, “ascorbic acid” and “burns”. The search yielded a total of 170 journal articles. The following were excluded: commentaries, experimental research and studies on non-human subjects. Ultimately, 20 articles qualified for review.

Results: A total of 924 patients were studied. The literature collectively endorsed a difference in patient outcomes when vitamin C is administered on the first day of admission. The average age across the studies was 15–45 years old. Only 10% of studies included vulnerable age groups (2–15 years old). The Mean Total Body Surface Area (TBSA) of patients was 31%. Most of the studies excluded patients with co-morbidities.

The benefits of vitamin C in various aspects of burn management were documented in 70% of studies. Patients who were given vitamin C exhibited a decrease in fluid requirement in 42% of the studies when compared to controls. Additionally, a decrease in wound healing time was reported in 35% of studies, a decreased rate of post-burn infections was reported in 28%, and 14% of studies state that patients given vitamin C had reduced edema.

The effect of vitamin C dosing methods on outcomes was also examined. It was reported by 14% of Studies that low-dose Vitamin C infusion does not improve outcomes, while 50% of studies that used high-dose infusion revealed improved results. Additionally, when comparing oral route of administration 20% of studies used high-dose with favorable results. In regards to risk, oxalate nephropathy, acute kidney injury, and renal failure was documented by six studies.

Conclusions: Our review concludes that there is decreased fluid requirement, improvement in edema, healing time and post burn infections when high-dose vitamin C (66mg/kg/hr) is given to adults on first day of admission and continuously infused for 24 hours in 1st and 2nd degree burn involving 10 to 40% TBSA. However, there is an associated risk of acute kidney injury and renal failure.
**536 Use of Bioelectrical Impedance Analysis for Assessment of Nutritional Status: A Systematic Review**

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**Introduction:** Nutritional support is an essential component of care for burn patients. Burns can induce a hypermetabolic state greater than twice the normal metabolic rate which can lead to higher rates of lean tissue mass breakdown. Despite its importance, there is no clear gold standard for monitoring nutritional status in the burn and critical care population. Many current methods of assessing body composition can be costly, labor-intensive, and inaccurate. Bioelectrical impedance analysis (BIA) is a promising new technology for assessing body composition that functions by sending a low-voltage current through the body and measuring the impedance to that current. Parameters derived from BIA have been demonstrated to reflect cellular health and correlate with nutritional status. The use of BIA to assess nutritional status in the critical care and burn population has not been well investigated. Thus, we have conducted a systematic review of the use of BIA to assess nutritional status in critically ill adults.

**Methods:** A search was conducted on Pubmed and Google Scholar in accordance with PRISMA guidelines between June 2020-August 2020 utilizing the keywords: bioelectrical impedance analysis, critical care, critical, nutrition, body composition, lean body mass, phase angle, water, fluid. Inclusion criteria were articles investigating the relationship between BIA and nutritional status in critically ill adults. Reviews, non-English articles, and studies involving pediatric patients were excluded.

**Results:** Our final study included 14 articles. BIA measured muscle mass was compared to a CT scan in two studies, with both reporting a statistically significant correlation. One article compared the ability of BIA and ultrasound to assess muscle mass, and this relationship was statistically significant. BIA derived phase angle was compared to NUTRIC and Subjective Global Assessment scores in four articles with all four reporting significant correlations. BIA was also compared to biochemical markers of nutrition such as albumin and two of three articles found significant correlations. One article compared BIA with gas exchange measured by indirect calorimetry and found that BIA could accurately assess body cell mass. No articles were found comparing BIA with other common nutritional markers such as prealbumin or nitrogen balance.

**Conclusions:** BIA shows promise as a method of assessing body composition and nutritional status in the critically ill patient population.

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**537 Autologous Skin Cell Suspension for the Treatment of Small (≤10% TBSA) Mixed-Depth Burns**

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**Introduction:** Split-thickness skin grafts (STSGs) have been the standard of care for many decades. Despite their widespread use, STSGs frequently fail. Autologous skin cell suspension (ASCS) is an FDA approved point of care regenerative medicine technology that reduces donor skin requirements without compromising clinical outcomes. ASCS allows for early treatment and less donor skin harvested that may be useful for hard-to-treat anatomical locations, in compromised patients that have risks for impaired wound healing, or elderly patients with thinner skin. We examined ASCS treatment as an adjunct to meshed autografts in adults with small mixed-depth/full-thickness burns.

**Methods:** We obtained IRB-approval for a prospective, multi-center, uncontrolled observational study that allowed continued access to ASCS before FDA approval (ClinicalTrials.gov Identifiers: NCT03333941). Subjects with mixed-depth/full-thickness injuries that required skin grafting with a minimum treatment area of 320 cm$^2$ and burns ranging from 5–50% TBSA were eligible for study enrollment. Our analyses included only patients >18 years of age and ≤10% TBSA mixed-depth/full-thickness injuries that had completed the trial. All subjects had ≥1 burn wounds treated with meshed autografts (2:1–4:1) in combination with ASCS. Healing outcomes were assessed following ASCS treatment by direct visualization of each individual wound and included healing, scar outcomes, and safety data.

**Results:** Analyses included 20 subjects older than 18 years of age with ≤10% TBSA mixed-depth/full-thickness injuries. Of these, compromised wound healing was seen in 50.0% of subjects. Burn wounds with ≥90% re-epithelialization increased over time, with 62%, 80%, and 100% of wounds achieving closure at Weeks 1, 2, and 8, respectively. Similar results were seen in subjects with comorbidities known to affect wound healing and in elderly subjects despite their risks for impaired healing. Total POSAS patient (37.8 and 35.4) and observer scores were comparable (23.3 and 18.4) at Weeks 12 and 24. Safety events were typical for this patient population, and no serious adverse events occurred for any of the wounds.

**Conclusions:** This analysis provides additional information supporting the use of ASCS for the treatment of small, mixed-depth/full-thickness acute thermal burn injuries in adults, notably those with risk factors for impaired wound healing.
**Introduction:** Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis (SJS/TEN) are life-threatening dermatologic conditions, which are best approached by a multidisciplinary team practicing burn-equivalent care. There is a lack of consensus on wound management in these patients, in particular whether to debride detached epidermis. Our center instituted "antishear" wound therapy thirty-five years ago, where detached skin is left in situ as a biologic dressing. A standardized protocol aims to avoid shear forces to prevent further desquamation of involved areas. In this study, we follow-up on our outcomes with antishear therapy during the latter half of our center's experience.

**Methods:** A retrospective chart review was conducted for all patients admitted between July 2004 – May 2020 with a Dermatologist-confirmed diagnosis of SJS/TEN. Patients admitted with non-SJS/TEN dermatologic diagnoses and those treated outside of the burn center were excluded. All patients were treated with burn-equivalent critical care and antishear wound therapy. Data was characterized by demographics, inciting agent, total body surface area (%TBSA) affected, hospital course, and any administered systemic therapy. Univariate regression was performed to identify factors that increased mortality. Standardized mortality ratios were calculated at each SCORTEN level and in aggregate.

**Results:** Of the 51 patients that met inclusion criteria, 10 (20%), 22 (43%), and 19 (37%) developed SJS (< 10% TBSA), SJS/TEN overlap (10%-30% TBSA), and TEN (>30% TBSA) respectively. Mean SCORTEN (day 3) and %TBSA were 2.6 and 28%, respectively. Overall mortality was 22%; SCORTEN < 2 (p < 0.001), %TBSA involvement (p < 0.02), and development of multi-system organ failure (p = 0.001) correlated with increased mortality. No mortality was observed for patients with a SCORTEN ≤ 2. Patients with SCORTEN scores of ≤3 and >3 had standardized mortality ratios of 0.63 (p = 0.21) and 0.78 (p = 0.17), respectively, representing 37% and 22% reductions in mortality. The standardized mortality ratio across the entire cohort was 0.73 (p = 0.14), representing a 23% reduction in mortality.

**Conclusions:** Incorporating the antishear approach as part of burn-equivalent care in SJS/TENS patients is an effective alternative with equivalent mortality outcomes compared to SCORTEN predictions. Standardized mortality ratios were lower for patients with SCORTEN ≤ 3 and SCORTEN >3, but limited sample size reduced ability to show statistical significance.
540  Treatment of Severe Burns with Autologous Skin Cell Suspension and Meshed Autograft with Allograft Overlay

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Introduction: Autologous skin cell suspension (ASCS) is gaining in popularity in the treatment of severe burns. Prior to the approval of ASCS, widely meshed autograft with allograft overlay is the standard of care in the treatment of severe burns. We are reporting a novel technique of using ASCS and widely meshed autograft with allograft overlay on a series of patients with full thickness flame and scald burns.

Methods: The study is a retrospective chart review of patients from May 2019 to February of 2020. Inclusion criteria: full thickness injury, had multiple staged excisions, with or without allografting, grafted widely meshed 4:1 autograft and ASCS with allograft overlay. Demographic data, grafting information, and time to re-epithelialization with photographic evidence were collected.

Results: Six patients were studied from the inclusion criteria: age 24–70, TBSA% 16–77. All surgeries were performed by a single surgeon. All patients had excision/wound bed preparation via tangential excision, autografted with 4:1 mesh. ASCS was applied, and 2:1 allograft was secured onto the wound. Size of the grafts range from 235 cm2 to 3880 cm2. Average time to ≥95% re-epithelialization was 23 days (range 15 days to 35 days).

Conclusions: By using this novel technique, average time to fully epithelialized was 23 days. This compares favorably to the previously presented outcome of ≥95% re-epithelialization in 96% of ASCS-treated wounds after 8 weeks. More studies are needed to validate this finding.

541 72 Facial Burns Treated with Autologous Skin Cell Suspension- A Real World Data Analysis Across 5 U.S. Burn Centers

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Introduction: Optimal management of facial burn injuries remains a significant challenge in burn care. Acute surgical intervention is often coupled with delayed reconstructive procedures as an essential option for burn care. Experience with new surgical technologies could challenge historic reconstructive ladders. Our goal was to pragmatically assess the rate of successful intervention with autologous skin cell suspension (ASCS) for the treatment of facial burn injuries from real-world data.

Methods: A retrospective review from five burn centers over a three-year period was performed from deidentified registry data for facial burn injuries initially treated with ASCS. Cases of non-acute thermal burn and burns not involving the face were excluded. Data collection included: date of surgery, last follow-up date, need for grafting (split or full thickness skin graft, STSG or FTSG, respectively) or reapplication of ASCS within the same hospitalization, and reconstruction not including laser procedures due to scarring during the follow-up period. Descriptive statistics were calculated and data are reported as median with interquartile ranges where appropriate.

Results: A total of 72 burn injuries were treated with ASCS for facial burn injuries. Two burn centers treated 4 patients each, one treated 18, and the remaining two treated 22 and 24 patients. The median follow-up was 199 days (range 9 -1,150 days). Acute failure requiring a second treatment with ASCS or application of a full-thickness or split-thickness autograft occurred in 12 (16%) of the patients with 5 undergoing re-application of ASCS and 7 undergoing FTSG or STSG. Reconstruction secondary to scarring during the follow-up period occurred in 10 (14%) of patients. Reconstruction was required in 1 of 5 patients that underwent a second treatment with ASCS as opposed to 4 of 5 patients treated with FTSG or STSG.

Conclusions: This study represents the largest experience with the use of ASCS for the management of facial burn injury in the reported literature. Use of ASCS from real-world data indicated that ASCS successfully resulted in definitive wound closure in 90% of the patients treated with facial burn injuries, with 10% requiring secondary intervention. This failure rate is below the previously published rate of 33%, indicating the disruptive potential of this technology for the management of facial burn injuries.
A Prospective Observational Trial of Clinical Burn Wound Imaging with Spatial Frequency Domain Imaging

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Introduction: While visual assessment is the standard for burn severity evaluation, new technologies are attempting to increase objectivity. Burn depth assessment accuracy improves over time as the appearance changes, but earlier diagnosis potentially leads to prompt treatment and shorter recovery. Laser Speckle Imaging (LSI), FDA approved for grading burns, is typically done 72hrs after injury. Spatial Frequency Domain Imaging (SFDI), a novel technology only tested in animal burn models, uses multiple wavelengths of patterned light to quantify tissue absorption (hemodynamics) and scattering (structure). SFDI has shown the potential to differentiate burns as early as 24hrs postburn by measuring scattering ($\mu_s'$) changes due to collagen damage. Here, we examine SFDI burn severity assessment in clinical patients, and compare against LSI and clinical assessment.

Methods: 5 burn cases were imaged with LSI and SFDI approximately 24 and 72hrs postburn. The clinician was blinded to imaging results and made diagnoses on their standard of care.

Results: One patient received no surgical intervention, one received excision and xenograft, and two received excision and autograft. An autograft was recommended for one patient, but not performed due to preexisting conditions. SFDI measurements at 24hrs showed low $\mu_s'$ values in regions that eventually required autografts, and high $\mu_s'$ in burns that did not. While clinical decisions were made no earlier than 72hrs postburn, $\mu_s'$ maps at 24hrs postburn were able to illustrate severity in these regions. In 2 of 3 autograft cases, LSI was unable to determine the severity until 72hrs postburn.

Conclusions: Here, we compared SFDI to LSI in a clinical setting to quantify burn wound severity. Similar to animal models, SFDI was demonstrated to accurately characterize severity earlier than the perfusion-based LSI. This is likely due to sensitivity of $\mu_s'$ measured by SFDI to the structural changes in damaged collagen (i.e., zone of coagulation) that occur immediately postburn.
### 543 Escharotomy Incisions in the Burn Foot and Toe with Compartment Syndrome

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Valleywise Health Medical Center, Phoenix, Arizona

**Introduction:** Patients with burn injuries are at risk for lower extremity compartment syndrome, especially if the injury is circumferential. The hypothesis was that two dorsal escharotomy incisions to release foot and toe compartment syndrome would be most efficacious in the prevention of lower extremity amputations.

**Methods:** This was a retrospective chart review of foot compartment syndrome in burn patients between January 2001 and May 2019.

**Results:** The study consisted of 59 feet from 32 patients who had been admitted to the Burn Center for thermal injury. The patient age was a mean±sd of 29±30 years, and 41±29 as the % total body surface area (%TBSA); there were 19 males and 13 females. All patients had received fluid resuscitation on admission. Twenty-one (66%) of the patients did not require amputations after undergoing a median of two incisions (range 1–5); 6 of 59 (11%) required fasciotomies. Compared to medial or dorsal or multiple escharotomies, the majority of patients who underwent two dorsal foot escharotomies did not require amputations, *p* = .0001. Significantly more patients were alive with no amputation 15 (50%) compared to 4 (13%) (dead with amputations), *p* = .02. Survivors were significantly younger than the non-survivors (median 20 and range1-69) compared to the non-survivors (48, 12–59), *p* = .04. The survivors also had significantly less severe %TBSA median 22 (range 2–75) versus 83 (35–95) %TBSA, *p* < .0002. Dorsal/Lateral incisions had the highest number of amputations.

**Conclusions:** Foot dorsal compartment release is the most effective site for escharotomies in the treatment of burn-induced compartment syndrome. It does not require more than two incisions at the skin/fat level and over the second and fourth metatarsal bones on the dorsal part of the foot to decrease the lower extremity amputation rate in the majority of cases.

### 544 Temporizing Matrix in the Complex Wound: A Retrospective Three-year Review

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**Introduction:** A complex wound is a wound that will not heal spontaneously or with simple or standard closure techniques. Often functional structures (bone, tendon, fascia, joint capsule etc.) are exposed and a matrix can be used for bridging of these structures. The Temporizing Matrix is an entirely synthetic matrix made from polyurethane open-cell foam. This matrix was used in the burn center for three years for the indication “complex wound” with good success. The study objective was to evaluate success rate (leading to wound closure after STSG, duration of treatment) and complications (infection, failure, scarring) on this patient cohort. IRB approval was obtained.

**Methods:** All charts of patients receiving the Matrix between June 2017 through May 2020 were reviewed. Data collected were demographics, surgery dates, wound descriptions, healing, infection, failure, reaplication, time from application to STSG, time to healing, post discharge complications and scar quality.

**Results:** 33 patients with 37 complex wounds were identified to meet inclusion criteria, 61% male, 39% female, age ranging from 3 months to 72 years. The wounds were caused by Burns, necrotizing infections, trauma or amputation post burn. The Matrix was placed for widely exposed structures (70%), failed STSG (3%), thin subcutaneous tissue coverage over amputation stumps (15%) and other reasons (12%). Primary graft success was 97%. Infection rate was 15% with 8% reaplication. Most infections were treated locally. The average Vancouver scar scale rating after discharge was 9/15.

**Conclusions:** This temporizing Matrix in preparation to STSG led to successful wound closure in 97% of these complex wounds with low complication rates and an acceptable long-term scar.
Pharmacologic and Comorbid Factors Associated with Stevens-Johnson Syndrome and Toxic Epidermal Necrolysis Syndrome

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University of Texas Medical Branch, Galveston, Texas

Introduction: Stevens-Johnson syndrome (SJS) and toxic epidermal necrolysis syndrome (TENS) share immunemediated etiology for epidermal detachment and pharmacologic triggers. Both conditions are on a spectrum of diseases of varying severity, with TENS representing the graver end of the continuum. The demographics and comorbidities of this population remain relatively unknown due to their rare incidence. Comorbidities determine the causative drugs used, but also afford triggers for the autoimmune cascade resulting in SJS or TENS. We analyzed the trends of comorbid and pharmacologic risk factors associated with these diseases in over 3,000 patients.

Methods: We used the TriNetX Global Health Research Network from 2009–2020 to identify 3,515 patients diagnosed with SJS or TENS (ICD-10 codes L51.1–51.3). We then obtained annual demographic and comorbidity data. We indexed patients into cohorts that were prescribed a high-risk drug as previously reported in the literature to be associated with SJS and TENS development. Our control cohort consisted of patients that did not take these high-risk drugs. These cohorts were analyzed to identify the relative risk of developing SJS or TENS 4 to 56 days after taking a high-risk drug. Similarly, we excluded co-medication of the other high-risk drugs and compared these patients to our control group.

Results: The mean age was 46 with a female predominance (59.8%). The most common comorbidities were hypertension (20.2–21.3%), mood affective disorders (12.4–15.8%), or kidney disease (11.6–12.8%), and the prevalence of these have remained constant. Phenobarbital had the highest risk for these diseases (RR: 20.2, CI: 13.58–29.93), followed by phenytoin (RR: 13.51–47.53) and carbamazepine (RR: 13.74–46.36). Well reported triggers like sulfamethoxazole, allopurinol, and sertraline only represented moderate risk (RR: 7.7, CI: 6.11–9.83; RR: 5.2, CI: 2.77–9.73; RR: 1.7, CI: 0.90–3.16) even after excluding co-founding factors.

Conclusions: This study suggests that seizure disorder medications such as phenobarbital, carbamazepine, and phenytoin demonstrate the highest risk for developing SJS and TENS.

Management of Pediatric Pavement Burns

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University Medical Center Lions Burn Care Center, Las Vegas, Nevada

Introduction: Pavement burns are common in a dry high heat climate. This study reviews the etiology, management and outcome of pavement burns in children.

Methods: All patients age < 18 who suffered contact burns from hot pavement from Jan 1, 2014 to Dec 31, 2019 were reviewed. A total of 45 patient charts met inclusion criteria. High ambient temperature on each date, and zip code of each injury was extracted from Weather Underground (www.wunderground.com)

Results: In this study, 45 patients met criteria and were reviewed, of whom 27 patients (60%) were male. Average age was 3.29 years (SD 0.69), made up two discrete age groups: age under 3 (n= 40, 89%) and 14+ (n=5, 11%). 38 patients (84%) had no known medical history. All had 2nd degree burns and one patient (2%) had third degree burns. Mean total body surface area (TBSA) was 2.5% (SD 1.4%, range 0.75% to 5.5%). Burn etiology included 31 patients (69%) walking barefoot on pavement, 6 (13%) falling onto pavement, and other/unknown etiology for the remaining 8 patients (18%). 30 patients (67%) had injuries on the plantar aspect of bilateral feet, 2 (4%) to bilateral palms of hands, 4 (9%) to other parts of upper extremities and 10 (22%) to other parts of lower extremities.

Thirty-four (34) patients (76%) were managed without any hospitalization. Those that were hospitalized had an average length of stay (LOS) of 2.72 days (range 1–9 days). All burns were managed non-operatively with topical therapy alone. 35 patients (78%) were managed initially with Silvadene, and 6 (13%) with bacitracin. Aqeous was utilized in 10 patients at a follow-up visit (22%). Three patients (6.7%) were treated with collagenase enzyme therapy. One patient developed a superficial infection requiring oral antibiotic therapy.

Conclusions: Pavement burns in children are partial thickness and are safely managed with topical therapy alone, with good outcomes. Patients age 3 and under are a vulnerable population and therefore at particular risk of injury.

<table>
<thead>
<tr>
<th></th>
<th>N = 45</th>
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<tbody>
<tr>
<td>Male, n (%)</td>
<td>27 (60%)</td>
</tr>
<tr>
<td>Age, mean (SD)</td>
<td>3.29 (4.61)</td>
</tr>
<tr>
<td>Age, median (IQR)</td>
<td>1.58 (1.25 – 2)</td>
</tr>
<tr>
<td>TBSAS, mean (SD)</td>
<td>2.5% (1.4%)</td>
</tr>
<tr>
<td>2nd Degree Burn, n (%)</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>3rd Degree Burn, n (%)</td>
<td>11 (24%)</td>
</tr>
<tr>
<td>Hospital LOS (median, IQR)</td>
<td>2 (1 – 4)</td>
</tr>
<tr>
<td>Surgery, n (%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Topical Antimicrobials, n (%)</td>
<td>41 (91%)</td>
</tr>
<tr>
<td>Enzyme Debridment, n (%)</td>
<td>3 (6.7%)</td>
</tr>
<tr>
<td>Systemic Antibiotics, n (%)</td>
<td>1 (2.2%)</td>
</tr>
<tr>
<td>Days to 95% healed, mean (SD)</td>
<td>10.5 (8.9)</td>
</tr>
<tr>
<td>Days to 95% healed, median (IQR)</td>
<td>8 (4 – 14)</td>
</tr>
</tbody>
</table>
Introduction: Escharotomy is the relaxation of the eschar through longitudinal or horizontal incisions in order to protect the region's deep perfusion. The pressure that it will create in the peripheral areas such as hard eschar limb, trunk, and neck causes the circulatory disorder in the limb and the risk of limb loss, inadequate thoracic expansion in the thorax and vital perfusion and oxygenation problems in the neck. It is one of the most basic rules of burn surgery to perform the determined escharotomy incisions very quickly and without hesitation to prevent complications. In this report, a case of facial subunit principles based escharotomy is presented.

Methods: A 42-year-old man felt into hot sand while working in an iron and steel factory. Patient was transferred to our burn unit for corresponding 35% of the total body surface burns on the face, neck and upper extremities. The patient was consulted to plastic surgery after the initiation of fluid replacement therapy, insertion of a chest tube for hemothorax, and tracheostomy. The patient had massive edema in the face and neck (Figure 1). There was no capillary fill in the facial skin. Doppler ultrasound examination showed bilateral weak facial artery, temporal superficial artery, supraorbital and trochlear artery flow.

Results: A decision was made to perform escharotomy to relieve arterial traces at 10th hour of the injury. Bilateral nasolabial, infraorbital rim, superior glabellar, temporal incisions were performed from eschar to subcutaneous fat layer in accordance with aesthetic subunits (Figure 2). Relief of the base perfusion during escharotomy was observed and bleeding was observed at the base of the incision. Doppler examination was repeated after escharotomy. The facial edema rapidly regressed. Deep epithelization and reepithelization was observed in the areas with hair roots within 10 days and the patient was operated on the 15th day of hospitalization for debridement and skin grafting. Eschars were debrided and covered with split thickness skin grafts according to aesthetic subunit principles. Post-operative image of the patient seen (Figure 3).

Conclusions: Face is not an area in which eschar formation commonly seen because of its robust vascular supply and protection reflex of the patients. Although descriptive drawings and guides for facial escharotomy has not been published yet, relaxation of axial arteries in terms of compression due to eschar formation may be needed. In this report, a case of facial subunit principles based escharotomy is presented and acceptable results were achieved.
549 Lessons Learned from Two Survivors of Greater Than 90% Total Body Surface Area Full Thickness Burn Injuries Using a Dermal Biodegradable Substitute and Autologous Skin Cell Suspension: A Case Series

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Introduction: Advances in burn injury knowledge, critical care, and pharmacological developments have increased survival rates among extensive burn patients. Survival now depends not just on skin coverage, but effective control of SIRS response, metabolic derangement, fluid loss and sepsis. Novel synthetic dermal substitutes create robustness, thickness, and pliability of the skin in addition to an improved aesthetic appearance while: point-of-care autologous skin cell harvesting enhances treatment by amplifying small split-thickness skin samples to produce an autologous skin cell suspension (ASCS) to cover a larger burn area. This study reports on two survivors with greater than 90% total body surface area full-thickness burns utilizing a combined treatment of a dermal substitute along with ASCS and traditional burn management strategies.

Methods: Chart review of two patients with >90% burns and inhalation injury after being trapped in a burning vehicle following a traffic collision occurred. Most of the burns in both patients were “leathery” and consistent with full thickness, sparing only the plantar and dorsal aspect of the feet and bilateral small areas of the hip in Patient 1. Patient 2 had fourth-degree burns in some areas of the chest and flank with only the bilateral groin regions and feet spared. The patients were treated with a multi-step process which included using allograft, dermal substitute, and ASCS with split-thickness skin grafts (STSG) in place of cultured epidermal autograft to achieve coverage of >90% burns with high meshed ratio.

Results: The dermal substitute was limited to deep burns that penetrated down to fat, muscle, and/or joints. Fluid loss was well controlled by the dermal substitute during initial resuscitation. Post reconstruction, areas covered with the dermal substitute and grafted with autogenous STSG with ASCS exhibited less hypertrophy and contracture bands. The elbow and knee joints showed minimal restriction with passive motion and good skin compliance, but contractures persisted in areas where 4th degree tendon and fascia thermal injury occurred. Areas that showed signs of infection were trimmed or unroofed and allowed to drain while maintaining the remainder of the dermal substitute.

Conclusions: The use of dermal substitutes and ASCS allowed the care team to achieve SIRS control, improved fluid management, enhanced skin coverage, and reduced hospitalization stay. The process experienced in these cases shows promise for future patients with extensive burns. Both patients were able to survive and show improvement during rehabilitation.

550 A retrospective Study of a Zinc-oxide/dimethicone for Pediatric Perineal Burn Treatment

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Wayne State University, Detroit, Michigan; Children’s Hospital of Michigan, Detroit, Michigan; Children’s Hospital of Michigan, Detroit, Michigan; Children’s Hospital of Michigan, Detroit, Michigan; Children’s Hospital of Michigan, Detroit, Michigan

Introduction: Silver-based treatments have seen widespread use for the management of burns. Recent literature, however, has demonstrated silver nanoparticles may negatively impact healing time due to its toxic effect on keratinocytes and fibroblasts at higher concentrations. At our institution, an ABA-verified pediatric burn center, the use of a silver sulfadiazine cream for management of post-discharge perineal and genital burn wounds has been replaced by a zinc-oxide/dimethicone spray-on solution initiated for its comparative ease of use. The dimethicone allows the spray to be occlusive without interfering with clothing, yet easily removed. We believed this would improve compliance with at-home treatments. Zinc-oxide’s antimicrobial activity has been demonstrated in vitro and the results from animal studies are promising for burn management. This is the first study of zinc-oxide’s efficacy as a burn management agent in humans.

Our burn center’s experience with both silver sulfadiazine and zinc-oxide/dimethicone creates an opportunity to compare these products for the treatment of burn wounds. We sought to analyze the time to healing of burns treated by silver sulfadiazine against zinc-oxide/dimethicone in order to determine if zinc-oxide/dimethicone, in its easy-to-use form, is a viable alternative to silver sulfadiazine.

Methods: A retrospective review of medical records was conducted at a large pediatric verified burn center. Data on 98 patients was collected from the burn registry and electronic medical records. 58 patients received silver sulfadiazine while 40 received zinc-oxide/dimethicone. Four patients were removed from the silver sulfadiazine group due to incomplete data. All patients were initially treated by the burn team with follow up in burn clinic on a weekly basis until healing was achieved.

Results: Time to healing was significantly lower in the zinc-oxide/dimethicone intervention group (10.61 +/- .918 days) than the silver sulfadiazine control group (16.88 +/- 2.134 days). The silver sulfadiazine group contained patients with total body surface area burns significantly greater than the zinc-oxide/dimethicone group (mean: 11.57% versus 6.64%); likely due to selective treatment when zinc-oxide/dimethicone was first introduced at our facility. Differences in depth and size of burn wounds may have confound our results and negatively impacted healing time in the control group. No infection, allergic reaction, or other adverse events were noted in any patient.

Conclusions: Zinc-oxide/dimethicone had a significantly lower healing time than silver sulfadiazine in the treatment of at-home, post-discharge 2nd degree pediatric burns to the perineum, genitalia, suprapubic, and buttocks. Further study is needed to quantify its efficacy.
Fish Skin Compared to Cadaver Skin as a Temporary Coverage and Wound Bed Preparation for Full Thickness Burns: An Early Feasibility Trial.

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MedStar Washington Hospital Center/Georgetown University SOM, Washington, DC, District of Columbia; MedStar Health Research Institute, Washington, District of Columbia

Introduction: Full-thickness thermal burns may require staged procedures with temporary coverage to ensure the wound bed is optimized for autografting. A potential dermal substitute for thermal injury is fish skin grafts. These are made in Iceland from freeze dried, sterilized, decellularized skin of North Atlantic cod (Gadus morhua). The gentle processing of the fish skin removes the risk of viral disease transmission to humans and retains its naturally occurring Omega3 fatty acids which are known for their pain and inflammation modulating effects. Fish skin graft has a shelf life of 3 years at room temperature, whereas cadaver skin, the current standard of care at many institutions, has to be cryopreserved, is donor derived, and contains only trace amounts of Omega3. While fish skin graft has been cleared by the FDA as a medical device for use in acute, surgical, chronic wounds, and partial thickness burns, it has not yet been indicated for use in full-thickness burns. The purpose of this clinical trial is to assess the safety and efficacy of decellularized, freeze dried fish skin as an alternative to cadaveric skin (standard of care) for temporary coverage in the setting of a full-thickness burn requiring staged grafting.

Methods: Patients with full thickness burns to their extremities and/or chest were randomized to have two adjacent areas (70–140 cm² each) covered with either fish skin or cadaver skin for one week following excision. Patients then received a split thickness skin graft (STSG). Healing was observed by blinded assessors for each area weekly for three weeks, with a scarring assessment completed at 3 months post STSG. Background pain was measured by a visual analogue scale (VAS) for pain and wounds were photographed at each time point.

Results: Five patients are included in this initial analysis and all completed the 3-month post STSG follow up. TBSA ranged from 8–37%. The fish skin treated area was assessed to be 90% healed at the same timeframe or earlier than cadaver treated areas in all subjects. There was a trend towards a reduction in pain in the fish skin covered areas. One patient was unable to give a pain score due to heavy sedation.

Adverse events were reported in all five patients, but none were associated with the use of the investigational product. Graft failures were observed in two cadaver skin covered areas and one partial failure in a fish skin covered area.

Conclusions: Results from this trial so far indicate that the fish skin is safe and non-inferior to cadaver skin as an early coverage for full thickness burns. Enrollment in this study is still ongoing, and patients will be followed up for 12 months.

Limb Salvage: Amputations Prevented with Dehydrated Human Amnion/Chorion Membrane Allografts (dHACM) Used in Combination with Decellularized Human Collagen Matrix (dHCM)

Marc R. Matthews, MD, FACS, Emily Helmick, DO PGY5, Christopher Mellon, DO, Danielle Thorburn, MD, Areta Kowal-Vern, MD, FCAP, FASCP, CTBS, William H. Tettelbach, MD, FACP, FIDSA, FUHM, CWS, Kevin N. Foster, MD, MBA, FACS
The Arizona Burn Center Valleywise Health, Scottsdale, Arizona; Valleywise Medical Center, Phoenix, Arizona; Arizona Burn Center, Phoenix, Arizona; Mayo Clinic Arizona, Phoenix, Arizona; Arizona Burn Center, Valleywise Health Medical Center, Scottsdale, Arizona; MiMedx Group, Western Peak Specialty Hospital, Park City, Utah; The Arizona Burn Center Valleywise Health, Phoenix, Arizona

Introduction: Burn and traumatic limb injuries with exposed bone/tendon typically require surgical flaps or amputations for healing. Some burn patients are not candidates for these invasive techniques. Placental amnionic membrane has been used as a wound dressing for more than 100 years and may offer an alternative to flaps and/or amputations. Processed dehydrated human amnion/chorion membrane (dHACM), from human placentical tissue, contains type 1 human collagen as well as non-viable cells and 285 identified regulatory proteins including growth factors, chemokines, cytokines, metalloproteinases, and other tissue growth and inflammatory mediators. dHACM has been successfully used as a dressing for wound ulcers, burns, donor sites, & surgical debridement. This study reports the use of dHACM as a limb salvage tool in four patients with severe injuries.

Methods: This is a retrospective case series of patients suffering severe lower extremity injury with bone/tendon exposure that had applied dHACM/dHCM over or packed (depending on wound depth), then covered with 3% bismuth tribromophenate petrolatum dressing & glycerol/hydroxyethylcellulose lubricant. Negative pressure wound therapy (NPWT) was initiated; wound re-evaluation occurred in seven days. dHACM/dHCM was reapplied if required (bone still exposed).

Results: There were 3 males and 1 female with three burns and one NSTI. The mean±sd (median) age was 58±23 (61) years; % total burn surface area 3±3 (2); length of hospital stay 48±30 (40) days; number of tangential excisions & debridements 6.5±1 (6.5); days from admission to product application 49±47 (34) and discharge 24±19 (19) days; negative pressure wound therapy (NPWT) 53±6 (56) days. All four patients continued treatment upon discharge with clinic visits and home NPWT. All recovered with good results and no complications. Treatment may be continued with NPWT therapy at home or in a skilled nursing facility. Patients healed after two to three dHACM/dHCM applications and did not require leg or foot amputations.

Conclusions: In select limb salvage cases, dHACM/HCM may be a promising alternative to extremity amputations, tissue transfer flaps or other techniques for secondary intention healing of wounds with bone/tendon exposure.
553 Treatment of Scalp Pressure Ulcers with an Aerosol Formula with Silver Sulfadiazine, Lidocaine and Vitamin A: Early Clinical Experience

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Hospital Italiano de Buenos Aires, Buenos Aires, Ciudad Autonoma de Buenos Aires

Introduction: Management of scalp pressure ulcers (SPU) in patients admitted to intensive care units (ICU) remains a challenge. The impossibility of freely moving the head due to different factors such as the intubation, enteral nutrition, dialysis and use of extracorporeal membrane oxygenation among others, makes the management of these wounds problematic. Herein, we present our early clinical experience in the treatment of SPU with a novel aerosol formulation of silver sulfadiazine.

Methods: A prospective study including all patients with SPU who were treated with an aerosol formula that includes silver sulfadiazine, lidocaine and vitamin A was carried out. Wound dressings were changed every 12h and consisted in wound cleansing, aerosol application and occlusion with sterile gauze.

Evolution of each SPU was controlled with pictures and measures on the affected area every 48 hours. In order to determine the total wound area, pictures were analyzed using the Informatics Image System from the U.S National Institute of Health.

Results: Six patients were prospectively followed and were included in this study. There were 2 females and 4 males. Average age was 70.8 years (range 41–99), while average hospital stay in the ICU was 14 days (range 5–22).

None of these patients experienced wound progression to a more critical stage. One patient had a favorable evolution from stage IV to stage II. Also, none of them showed clinical signs of a local infection of the SPU.

The average quantity of aerosol used per dressing was 1.3 ml which represents 2.6 mm/day and a cost of A$106,16 (U$S 1,45). As the cost of hydrocolloid dressings, at our institution, is A$602 per dressing (U$S 8,24), this represented an important saving in costs.

Conclusions: In this case series, the use of this novel aerosol formulation of silver sulfadiazine has shown promising results in the treatment of SPU in patients admitted to ICU, facilitating the application and saving costs. Further and larger studies to confirm our encouraging preliminary results are warranted.

Table 1

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Piscine Skin</th>
<th>Lactic Acid Membrane</th>
<th>Split-thickness Skin Graft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elasticity</td>
<td>8.2</td>
<td>6.5</td>
<td>6.8</td>
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<tr>
<td>Water content</td>
<td>0.7</td>
<td>0.4</td>
<td>0.6</td>
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<tr>
<td>Sebum</td>
<td>3.5</td>
<td>2.6</td>
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</tbody>
</table>

Table 2

Results

554 A Comparison of Intact Piscine Skin, Split-thickness Skin Graft, and Lactic Acid Membrane in Treating Superficial and Deep Burn Wounds Following Enzymatic Debridement

Christoph Wällner, Jana Holtermann, Marius Drysch, Johannes Maximilian Wagner, Mehran Dadras, Alexander Sogorski, Maxi Sacher, Mustafa Becerilli, Marcus Lehnhardt, Björn Behr, n/a
Bergmannsheil Bochum, Bochum, Nordrhein-Westfalen

Introduction: The optimal therapy for deep burn wounds is based on the principle of rapid necrectomy and coverage in order to achieve healing that is as scar-free as possible. The available infrastructure and the patient's condition represent limitations. With enzymatic debridement, selective bedside debridement can now be performed, however the optimal cover after enzymatic debridement has not been elucidated to date. In this study we compare superficial dermal and deep dermal wounds, which are either covered with lactic acid membrane, piscine skin, or split-thickness skin graft. To validate our approach the healed burn wounds were examined for objective (elasticity, water content, sebum, wound healing) and subjective skin quality as part of our standard follow-up care.

Methods: In this study, 12 patients who had received piscine skin, lactic acid membrane, or split-thickness skin graft after enzymatic debridement were retrospectively examined objectively and subjectively for scar quality as part of follow-up care 12 months after the accident. The wound healing process was also documented.

Results: Acceleration of wound healing was observed with the application of piscine skin vs split-thickness skin graft or lactic acid membrane. Skin elasticity was comparable to that of split-thickness skin graft but significantly better than lactic acid membrane. The sebum production in wounds treated with piscine skin was higher compared to lactic acid membrane covered wounds. The water storage capacity in the piscine skin treated wounds was also significantly higher than in lactic acid membrane or split-thickness skin graft treated wounds. Using the POSAS score, an improvement in elasticity, thickness, pigmentation, and relief was shown in piscine skin treated wounds, as well as a reduction in pain and itching, compared to split-thickness skin graft or lactic acid membrane.

Conclusions: The use of intact piscine skin immediately following enzymatic debridement in burn wounds results in faster wound healing and better patient outcomes compared to split-thickness skin graft or lactic acid membrane.
Early Application of a Water-soluble Surfactant Dressing for Partial-thickness Burn Wounds to Reduce Wound Conversion

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Firefighters’ Burn Center, Memphis, Tennessee; University of Tennessee Health Science Center, Cordova, Tennessee; University of Tennessee Health Science Center, Memphis, Tennessee; University of Tennessee Health Science Center, Memphis, Tennessee; Firefighters’ Regional Burn Center, Memphis, Tennessee; University of Tennessee Health Science Center, Memphis, Tennessee

Introduction: Surfactant-based wound dressings have been utilized in chronic, non-healing wounds and small burn wounds to soften and aid removal of wound debris. In vitro data suggest enhanced healing properties are due to the ability to stabilize and potentially reseal plasma membranes, thereby, retaining cellular integrity and enhance wound healing. Further, surfactant-based wound dressings are non-ionic and may facilitate removal, sensitize, or prevent bacterial biofilms. Biofilms are an evolved, protective mechanism bacteria utilize to reduce antimicrobial efficacy. Removal or penetration of biofilms is essential for bacterial eradication. This case series presents outcomes from use of a water-soluble surfactant dressing (WSD) is used at hospital admission for treating partial thickness (PT) burn wounds.

Methods: This retrospective, single-center, electronic health record review, included patients, if they were admitted between August 1, 2019 - January 31, 2020, at least 18 years old, and sustained a PT burn wound treated with WSD on admission. Pregnant or incarcerated patients were excluded. The WSD was applied following initial wound debridement, and then twice daily until either discharge or it was deemed burn wound excision would be required. PT tissue salvage was calculated from body mass index (BMI), PT total body surface area (TBSA) burned, and cm² requiring autografting. SigmaPlot 11.0 was utilized for statistical analysis.

Results: Thirty-two patients were included. All but one patient had a TBSA burned less than 20% with median (IQR) of 6% (3.5,9). Fifteen also had some full thickness injuries. Seventy-eight percent had flame injuries; 19% contact. Two had inhalation injuries. All but four had a significant past medical and/or social history. Fifty-nine percent had a history of substance abuse and 22% had diabetes. Nine patients had a delayed admission. The median BMI was 26 (24.3,34.2). There were no deaths. Seven patients were discharged within 48 hours to complete outpatient treatment. Median length of stay was 7 days (4.8,12.8). There was lack of any full thickness conversion to the applied areas in 69% of patients; 91% demonstrated either complete or some tissue salvage. Median % PT tissue salvage was 100 (75.3,100). The WSD was well tolerated and no patients developed a wound infection to the applied area.

Conclusions: Understanding inherent design limitations, this case series demonstrates feasibility of early application, and potential efficacy preventing wound conversion in a complex population with comorbidities and polysubstance abuse.
Amniotic Fluid Injections in Chronic Non-Healing Wounds in Pediatric Patients: A Case Series

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Introduction: Amniotic tissues are used to support wound healing in a variety of fields and wound types including chronic stasis ulcers, lower extremity wounds in diabetic patients, poorly healing injuries associated with burns, and surgical wounds associated with intestinal fistulas. To date, the use of amniotic fluid (AF) alone has not been described in the literature. The properties of AF alone would suggest the potential for regenerative and accelerated healing. This descriptive, retrospective review evaluates the effects of AF injected into chronic, poorly healing burn wounds.

Methods: We conducted a retrospective chart review across five years and identified a total of 39 pediatric patients with chronic, poorly healing burn wounds, nine of whom were treated with AF injections. Five of these patients were excluded due to incomplete post-treatment data. All patients were managed in the ambulatory care setting. We evaluated Vancouver Burn Scar Scale (VBSS) and Patient and Observer Scar Assessment Scale (POSAS) scores as well as pre- and post-treatment photos of the wounds.

Results: Four patients aged 1–16 years met inclusion criteria with TBSA ranging from 1% to 57.5%. All patients tolerated the procedure well and none suffered adverse events associated with treatment. The average time from injury to treatment with AF was 14 months. Patient A is a 1-year-old male with bilateral posterior thigh wounds that remained open following skin grafting of a 57.5% TBSA injury who received injection of AF 5 months after injury. One month after treatment with AF injections, both posterior thigh wounds were closed (Figure 1). Patient B is a 9-year-old male with posterior thigh wounds that remained open following grafting of an 8% TBSA injury who received an injection of AF 10 months after injury. Following injections with AF the wounds closed over a period of 6 months (Figure 1). Patient C is a 10-year-old female with extensive contracture scarring across the upper torso, bilateral axilla and neck from a 25% TBSA injury who received an AF injection at 37 months post-injury. Areas of open wound in the axilla closed following a combination of laser treatment to scar areas and AF injections. Patient D is a 16-year-old female with 1% TBSA injury to the posterior thigh treated with split thickness skin grafting that failed to close. Following injection with AF four months after injury, the wound closed over a period of 3 months (Figure 1). VBSS scores and POSAS scores did not significantly correlate with wound healing observed.

Conclusions: Injection of amniotic fluid is a low-risk treatment adjunct that can be used to improve chronic burn wounds.
Introduction: Burn wound depth assessments are an important component of determining patient prognosis and making appropriate management decisions. Clinical appraisal of the burn wound by an experienced burn surgeon is standard of care but has limitations. Forward-looking Infrared (FLIR) is a new technology in burn care that can provide a non-invasive, quantitative method of evaluating burn wound depth. FLIR utilizes a specialized camera that can capture the infrared emissivity of the skin, and the resulting images can be analyzed to determine burn depth and healing potential of a burn wound. Though FLIR has great potential for burn wound assessment, its use for this has not been well documented. Thus, we have conducted a systematic review and meta-analysis of the current use of FLIR technology to assess burn depth and healing potential.

Methods: A systematic review of the literature was performed on PubMed and Google Scholar between June 2020-August 2020 using the following keywords: thermal imaging, FLIR, forward looking infrared, burn, burn depth. Meta-analysis was performed on the mean sensitivity and specificity of the ability of FLIR to predict healing potential. Inclusion criteria were articles investigating the use of FLIR for burn wound assessments in adults, pediatric patients and animal models. Reviews and non-English articles were excluded.

Results: A total of 11 articles were included in the final review. Statistically significant correlations were found between FLIR and laser doppler imaging (LDI) in 3/3 clinical studies. A case report of a single patient found that FLIR was more accurate than LDI for assessing burn depth. Three articles investigated the ability of FLIR to predict healing potential, with all three reporting statistically significant results. Significant temperature differences between burnt and unburnt skin were found in 2/2 articles. FLIR was compared to clinical assessment by burn surgeons in two articles; one article found that FLIR was more accurate for assessing burn depth, while the other article found that clinical assessment was more accurate for predicting healing potential < 21 days. Mean sensitivity and specificity of the ability of FLIR to determine healing potential < 15 days was 44.5 and 98.8 respectively. Mean sensitivity and specificity of the ability of FLIR to determine healing potential < 21 days was 44.0 and 77.4 respectively.

Conclusions: FLIR is an accurate, simple, and cost-effective method of burn wound assessment. FLIR has been demonstrated to have significant correlations with other methods of assessing burns such as LDI and can be utilized to accurately assess burn depth and healing potential.

<table>
<thead>
<tr>
<th>Healing Potential (Days)</th>
<th>ΔT for Determining Healing Potential (°C)</th>
<th>Mean Sensitivity of ΔT (%)</th>
<th>Mean Specificity of ΔT (%)</th>
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<td>&lt;21</td>
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559 Benzocaine-Lidocaine-Tetracaine (BLT) Cream Adverse Effects in Burn Patients: A Case Report and Literature Review

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Introduction: Historically, BLT cream has been used at our burn center in laser procedures and tattoo removal with 6–8% lidocaine to improve tolerance of outpatient procedures. Recently, the laser BLT formulation (8%) has been trialed as an opioid-sparing alternative for managing pain during inpatient microneedling procedures. When utilizing this formulation for microneedling, the high percentage of lidocaine absorption may correlate with adverse central nervous system (CNS) effects.

Methods: A literature evaluation and retrospective chart review of burn patients receiving BLT cream for inpatient microneedling was performed.

Results: From January to June 2020, two elderly females (77 and 78 years old) received several doses of BLT cream during inpatient microneedling procedures with no documented adverse events attributed to the medication. A 68 year old male with a total body surface area (TBSA) of 8% reported dizziness shortly after he received BLT cream. Vitals were normal, but the patient was unable to focus his eyes or communicate clearly. Neurological exam revealed sluggish, pinpoint pupils. Patient remained disoriented with gargling and tongue thrusting though vitals remained stable. At this time, the remainder of the BLT cream was removed from the wound and his mentation returned to baseline within 90 minutes. No residual neurologic deficits occurred. No other potential causes were identified. Literature review revealed topical lidocaine can be absorbed systemically and cause CNS depression, confusion, and disorientation. Based on limited published data in healthy patients, it is recommended to use no more than 5% of topical lidocaine in large quantities, especially over raw surfaces or blistered areas. The amount of lidocaine systemically absorbed is linked to both the duration of application and the surface area over which it is applied. Using study data from lidocaine/prilocaine 2.5% cream and lidocaine patches, we explored a safer BLT formulation for burn patients as published data do not exist for this group.

Conclusions: Based on our review, we determined 2% to be the maximum lidocaine concentration to apply to a burn wound, 5% TBSA as the maximum surface area involved, and total exposure time limited to 30 minutes or less to reduce incidence of adverse effects. Specifically, formulations with a higher lidocaine concentration applied to a burn wound have the potential to result in untoward neurological deficits.

560 Vacuum Assisted Dressing can be Used as an Effective Dressing Over Non-cultured, Autologous Skin Cell Suspension (ASCS) Combined with Wide Meshed Split Thickness Autografts (mSTSG)

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Introduction: There are accounts of various dressings being applied over epidermal spray cell suspension graft(s) (SCSG) with varying success and no one perfect dressing. We present 3 patients with ASCS grafts used in combination with mSTSG that were treated with vacuum assisted dressing with excellent outcomes.

Methods: All 3 of our patients received surgical debridement, down to healthy viable tissue with exposed tendon. BTM Dermal matrix was used in 2 of the 3 patients with exposed tendon. All three patients had mSTSG with ACSS autografts. All grafts were covered with telfa™ clear, followed by tacky macroporous silver dressing, then a vacuum assisted closure device. These were left undisturbed until post operative day (POD) 5.

Results: All patients had their dressings taken down on POD #5 with excellent results. The interstices were closed quickly with no negative outcome noted from the vacuum dressings. All patients had excellent wound closure and good function postoperatively.

Conclusions: Vacuum assisted closure devices can be used to cover ASCS and wide meshed grafts with good outcomes. They provide patients with a stable dressing that does not need to be changed and leads to excellent graft take and wound closure.
Bilateral Upper Extremity Amputation After High Voltage Electrical Injury: A Case Report
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John H Stroger Hospital of Cook County, Chicago, Illinois; Jinnah Hospital Lahore, Lahore, Punjab; North Shore University Health System, Chicago, Illinois; John H Stroger Hospital of Cook County, Chicago, Illinois; John H Stroger Hospital of Cook County, Chicago, Illinois; John H Stroger Hospital of Cook County, Chicago, Illinois; John H Stroger Hospital of Cook County, Chicago, Illinois; John H Stroger Hospital of Cook County, Chicago, Illinois

Introduction: Electrical injuries represent 0.4–3.2% of admissions to burn units and are responsible for >500 deaths per year in the United States. Approximately half occur in the workplace and are the fourth leading cause of work-related traumatic death. The extent of injury can be drastically underestimated by total body surface area percentage (TBSA). Along with cutaneous burns, high voltage electrical injuries can lead to necrosis of muscle, bone, nervous tissue, and blood vessels. Aggressive management allows for patient survival, but at significant cost. Newer technologic advances help improve functional outcomes.

Methods: This case-report was conducted via retrospective chart review of the case presented.

Results: A 43-year-old male sustained a HVEI (>10,000 V) after contacting an active wire while working as a linesman for an electric company. He presented after less than 15-minute transport from an outside hospital with full thickness burns and auto-amputation to all fingers on both hands and the distal third of the left hand (Images 1 and 2). There were full thickness circumferential burns to the entire left and right upper extremities with contractures, with the burns extending into the axilla, and chest wall musculature. The patient had 4th degree burns and a large wound to the left shoulder with posterior extension to the scapula, flank and back with approximately 25% TBSA (Image 3). Compartments were tense in both upper extremities. Patient was sedated and intubated to protect the airway and placed on mechanical ventilation. A femoral central line was then placed, and the patient was given pain control, continued fluid resuscitation, and blood products. Dark red colored urine from a foley catheter that was immediately identified as rhabdomyolysis induced myoglobinuria. Labs drawn demonstrated elevated troponin I, CK >40,000, BUN 18, creatinine 1.0, K+ 5.2 and phosphate 5.6. Decision was made immediately for operative intervention with emergent amputation of both upper extremities in the light of rhabdomyolysis secondary to tissue necrosis and oliguria. During the patient’s hospital course, he underwent multiple operations for further debridement with vacuum-assisted closure therapy and skin grafting of sites, as well as targeted muscle reinnervation (TMR) 6 months later at an outside hospital.

Conclusions: Although HVEI only account for a small percentage of burn admissions, they are associated with greater morbidity than low-voltage injuries. Patients with HVEI often incur multiple injuries, more surgical procedures, have higher rates of complications, and more long term psychological and rehabilitative difficulties. Despite the need for amputation in some of these critically ill patients, options exist that allow for them to obtain long term functional success.
Introduction: The coronavirus disease pandemic has placed enormous strain on all medical services with ICU capabilities throughout the Northeast region. The surge in ICU beds might severely limit burn centers to accept burn patients in a regional mass casualty incident.

Methods: Burn bed data was collected by a regional burn disaster consortium. Open burn bed census was collected via telephone from each burn center in the consortium on April 15th, May 7th, May 21st, June 4th and June 18th of 2020. This data was compared to published data from 2009 to 2016.

Results: The results are listed in Table 1. Lowest available burn bed was 35 beds on April 15th, 2020.

Conclusions: Although a disaster may impact surrounding local and state hospitals, it does not always impact a burn center’s ability to transfer patients from a local trauma center or nearby burn center. A pandemic however affects a larger region and impacts all hospitals within that region. Peak ICU utilization in the Northeast was between the second and third week of April. During the peak utilization time, burn bed census was about 50% of the historical average. Burn bed census did not return to historical average until May 7, 2020. If a mass casualty event occurred in the pandemic region, the Northeast region would have to reach out to other ABA designated regions for assistance.

Historically, burn mass casualty plans are based on the capacity to move burn patients to other burn centers in order to relieve surge capacity at the affected center. This data illustrates that, in a pandemic, burn beds are being utilized for non-burn patients. The ability to follow these plans will be greatly impacted.

<table>
<thead>
<tr>
<th>Date</th>
<th>Burn Bed Census</th>
<th>Historical Average</th>
<th>Historical Range</th>
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<td>58-77</td>
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<tr>
<td>May 7th, 2020</td>
<td>57</td>
<td>65</td>
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</tr>
<tr>
<td>May 21st, 2020</td>
<td>74</td>
<td>65</td>
<td>48-85</td>
</tr>
<tr>
<td>June 4th, 2020</td>
<td>66</td>
<td>74.3</td>
<td>60-92</td>
</tr>
<tr>
<td>June 18th, 2020</td>
<td>80</td>
<td>74.3</td>
<td>60-92</td>
</tr>
</tbody>
</table>

“After the Fire”; The Legacy of a College Dormitory Fire Twenty Years Later

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Introduction: In January 2000 fire erupted at a local college. Panicked students, many who failed to attend school-sponsored fire drills or ignored the alarms that night, found themselves scrambling to escape. Seven students were admitted for severe burns to a near-by burn center (BC), with 54 initially staged in the Emergency Department. While this dormitory fire took place more than twenty years ago, its legacy is still being felt today.

Methods: History shows that, with any tragedy, there are lessons to learn that lessen the impact of property destruction, injury or death. Literature review of several major fires looked at their impact promoting burn care and fire safety to correlate those lessons with this fire. Four key areas of improvement emerged: disaster preparedness, media relations, legislation, and fire prevention.

Results: Changes to BC disaster preparedness included formation of a more comprehensive plan, revisions to triage and transfer protocols, new guidelines for unit staffing, creation of a mid-Atlantic group of BCs that eventually morphed into the Eastern Regional Burn Disaster Consortium, and installation of a medical command center for regional disaster response. Media relations saw a collaboration with law enforcement, due to criminal investigation, and a partnership with a syndicated newspaper to document the journey of two survivors. A series of articles eventually resulted in a Pulitzer Prize-finalist book, with award winning photographs displayed at a national museum. Redesigned fire safety programs targeted high school and college students emphasizing escape plans, and clinical education included disaster drills. Two survivors became motivational speakers, sharing their personal story on campuses across the United States. New legislation mandated sprinkler installation in dormitories nationwide, and a non-profit foundation was formed to improve burn care. The anniversary of this fire is still commemorated each year with a ceremony and wreath-laying on campus.

Conclusions: Despite this dormitory fire being ranked as the deadliest in state history, all these years later the legacy of this landmark event remains one of triumph and resilience as its lessons still to resonate today.
Managing California’s Creek Fire Mass Casualty’s Incident

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UCSF Fresno, Leon S. Peters Burn Center, Fresno, California; Leon S. Peters Burn Center UCSF Fresno, Fresno, California; UCSF Fresno, Leon S. Peters Burn Center, Fresno, California

Introduction: California’s Creek Fire is not only the largest single wildfire in a state known for huge and destructive blazes, it spawned two rare fire tornados with winds over 100mph, a day after the fire started in early September. Huntington Lake and Mammoth Pool were the sites of these rare events leading to hundreds of trapped campers. An air rescue operation airlifted hundreds of trapped people to safety. Twenty days after the start of the fire, it had burned >300,000 acres with only 36% containment by fire crews. This review is an evaluation of our hospitals response team and the events surrounding that night.

Methods: Our on-call surgeon had called in the back-up surgeon to run a second trauma operating room. It was at this time, the news had reported trapped campers near Mammoth Pool. The burn surgeon was notified and reported to the emergency department (ED) as word of 65 possible victims spread. Local disaster response planning was initiated with an ED physician triaging patients at the regional airport. Initial calls were made to the division chief and burn medical director. The nursing director was notified along with any available nursing staff with 8 ICU nurses volunteering to report. Immediately, lateral transfer orders were placed for all burn patients housed in the burn center which has 10 ICU bed capabilities.

Results: The first helicopter landed with 5 of the burn victims presenting to our hospital. 4 of the victims were male and 1 female with ages ranging from 17 to 27. Total body surface area burn was estimated on each with 2 minor burns < 10% and 3 moderate sized burns of roughly 25%. These patients were quickly triaged in the ED and traumatic injuries evaluated. 3 of the patients were placed in ICU level care with the 2 remaining patients housed in the ED as word trickled in about another rescue effort with an additional 95 people. By morning, an additional 2 patients were transferred to our burn center from the surrounding hospitals and another 2 patients evaluated for burns sustained in separate events. All patients were taken to the operating room over the next 24-48 hours for excision and autologous spray on skin grafts (ASCS) in combination with widely meshed skin grafts or ASCS alone.

Conclusions: Communication, teamwork, and personnel that are dedicated to the care of burn patients made this tragic incident manageable. The Creek Fire hit home for many of the burn staff not only because of the patients that were cared for, but because this area of California was a beloved respite for many. A debriefing with a chaplain, grief counselor, and psychotherapist, was held within 2 weeks of the incident to provide support to the staff during this devastating time.

Pandemia Experience in Pediatric Minor to Moderate Burns and the Role of Telemedicine in Treatment

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Introduction: A huge number of pediatric burn injuries are minor to moderate burns. During covid-19 pandemia, these cases have continued to require medical attention. Aim of the present study was to share our burn center’s pandemia experience in minor to moderate burns in children.

Methods: Records of 117 victims (age:0 to 17yrs) were documented [study period: 3/11/2020 (pandemia declaration by WHO)-9/11/2020). Data were classified according to treatment modalities (outpatient/inpatient/telemedicine). Age; sex; extent of burns; burn cause; environment in which injury occurred; referral history (time interval between injury and referral; other hospitals before arriving at our center) were noted for each case. Thereafter, subjects were divided into two subgroups according to pandemia calendar: GroupI consisted of referrals in march+april+may (national ‘lock-down’ period for children n=60) and GroupII consisted of referrals in june+july+august+september (’new normal’ period with limited social life n=57) (mean±SE,p< .05).

Results: Outpatients comprised 82,1% of all referrals(n=96) with 361 in-person visits. Mean age was 4,2yrs±0,4(min:0 max:17); male/female ratio was 1,04/1. Mean total body surface area(TBSA) burned was 2,6%±0,6(min:0 max:20). The most common burn causes were scalds(n=79; 82,3%) and contact burns (n=11;11,5%). Number of referrals on the same day with injury was 41 (42,7%) and 65 referrals were unmediated (67,7%).

Inpatients comprised of 11,1% of all referrals (n=13). Mean age was 3,9yrs ± 1,7 (min:1 max: 16). Male/female ratio was 0,9/1. Mean TBSA burned was 9,3%±1,8 (min:1 max:18). The most common burn cause was scalds(92,3%;n=12). Nine patients were hospitalized on the same day with injury (69,2%). Ten patients were referred from other hospitals (76,9%). Mean length of hospital stay was 6,77days±1,4 (min:1 max:14).

Telemedicine visits (n=33) which were carried out for 23 children via e-mail and phone/video calls included photographic follow up visits for scars, treatment of contact dermatitis and controls of wound-dressings. Comparison of ‘lock-down’ period (groupI) with ‘new normal’ period (groupII) revealed that almost whole telemedicine service was carried out in groupI except two interurban visits in groupII. Findings were similar in both groups except the significant increment of outdoor burns and remarkable presence of sun burns in groupII(p<.05).

Conclusions: Covid pandemia has created extraordinary conditions; however present data suggests that minor to moderate burns in childhood continue to occur anyway. Telemedicine is an advantageous method under pandemia conditions. Therefore, attempts for basic burn-care guidelines including telemedicine facilities should be supported.
Introduction: Paraquat dichloride is a widely used, highly toxic chemical herbicide and a leading cause of fatal poisonings. Toxicity is thought to be related to lipid peroxidation. Hours after exposure, patients may experience signs and symptoms ranging from nausea to multi-system organ failure. To prevent pulmonary complications and death, it is recommended to give patients repeated pulse therapy with cyclophosphamide and methylprednisolone administered over a 72-hour period. Our objective is to report our center's experience treating patients who had been exposed to paraquat over a two-day period.

Methods: Patients were identified using Institutional Burn Center registry, and linked to the clinical and administrative data. Demographics, length of stay, costs and mortality were evaluated.

Results: There were nine patients admitted from the exposure. All were male. All survived. Eight were undocumented migrant farmer workers. The average age was 36 years (range 25–59 years). The average length of stay was 3.3 days (range 2–5 days). Fifty-six percent had cutaneous injury, but only one required debridement and placement of a skin substitute. Thirty-three percent complained of continued shortness of breath after discharge. Average total hospital cost was $28,131 ($9,500–51,000).

Conclusions: Paraquat is a highly toxic herbicide and exposure can be fatal if not treated promptly. Immediate decontamination and repeated pulse therapy with cyclophosphamide and methylprednisolone may be lifesaving.

Introduction: Medically complicated burn patients can present with complex social situations that lead to difficult ethical decision. While the four principles of biomedical ethics, viz., respect for autonomy, nonmaleficence, beneficence, and justice, offer guidance, they may not lead to a clear resolution. Instead, providers may be faced with making a recommendation that is ethically uncomfortable.

Methods: At the 2109 ABA Annual Meeting, we presented a poster of the following real-life case:

Patient is a 47-year-old male who has an 81% TBSA burn, is intubated, and is unable to participate in medical decision making. He needs four limb amputations. His chance of long-term survival with amputation is less than 20%, and the best case scenario is a vent-dependent life with tetraplegia. His complicated family, which include his wife, ex-wife, children, and siblings, is unable to agree on what interventions should be provided.

The poster included a QR code and a link, both of which took respondents to a 10-item survey. Later in 2019, we asked the organizers of our regional burn conference to email a case summary and a link to the same survey to registered participants.

The survey addressed medical appropriateness and various factors that might affect decision making.

Results: We received responses from 12 attendees at the ABA Annual Meeting and 18 regional conference registrants. On the 8 questions for which only a single response was permitted, 64% of respondents on average chose the same answer. This number goes up to 72% if we restrict to the 5 questions with only two options. Though these numbers indicate a degree of consensus, they also reflect a notable lack of agreement. In fact, less than 77% of respondents agreed about the medical appropriateness of not amputating, the roles that quality of life and justice (resource allocation) should play in decision making, whether the level of evidence needed to withdraw treatment is the same as is needed to continue, how to handle the conflicting claims of family members, and the level of importance that should be attached to the team's comfort. In the case of the last two issues, none of the 5 available responses for each question received more than a third of the votes. The only position unanimously endorsed on the survey was that comfort care should be an option for the patient/family.

Conclusions: Our data suggest that there is substantial disagreement among those involved in burn care regarding important aspects of decision making for a patient who is medically, socially, and ethically complicated.
Introduction: Classically, ethics in pregnancy have revolved around abortion. However, there are numerous issues that require attention including the fetus as a patient, the mother’s autonomy, and medical treatment of the pregnant patient amongst others. These are further complicated when the pregnant patient has sustained a traumatic or burn injury. Although there are numerous case reports of managing the pregnant burn patient, there is a paucity of literature that focuses on the ethical challenges in the pregnant patient.

Methods: We report the case of an 18-year-old engaged female who sustained 60% total body surface area full-thickness burns. She was found to be 6 weeks pregnant with a viable fetus on ultrasound. The pregnancy was not planned, but desired. During the early portion of the hospitalization, she was found to lack capacity for both complex medical decision making and assigning of a surrogate decision maker. Furthermore, her mother only intermittently had custody of the patient when she was a minor, complicating whether she would be the best surrogate decision maker. Medical treatments that would significantly decrease morbidity and mortality would have had a negative impact on the viability of the fetus. Morning sickness compromised the nutrition care of the patient. Ethical issues that arose included capacity for complex medical decision making, the mother’s autonomy, surrogate decision making and whether a surrogate decision maker can make decisions regarding the fetus, the fetus as a patient, and medical interventions of the pregnant patient. Later on in the hospitalization, the patient was refusing many aspects of her care, raising the issue of paternalism in the burn center.

Results: The patient was later deemed to have capacity for assigning a surrogate decision maker, but not for complex medical decision making. She assigned her fiancé as the surrogate decision maker, although he initially refused. Medical treatments that would significantly decrease morbidity and mortality were instituted even though some were “contraindicated” in pregnancy. A gastrostomy tube was placed through burnt tissue for direct enteral access even though the patient was alert, oriented, and could tolerate oral intake in order to enhance her nutritional status. The burn center adopted a practice of “benevolent paternalism” as a means to overcome the patient’s resistance of medical care and treatments.

Conclusions: Pregnancy in the burn patient represents a deeply ethically challenging situation which have not been discussed in previous case reports. Ethical guidelines for the management of the pregnant burn patient should be established. Guidelines for surrogate decision making must be followed. In addition, the concept of “benevolent paternalism” must be elucidated and should replace the notion that burn centers are paternalistic.
Introduction: Historically, our pediatric admission population has comprised approximately one-third of all admissions. Periodically, it is beneficial to review demographics and outcomes. This type of review aids in planning, determining needed areas of improvement, efficiency in delivery of care, and it helps develop protocols which could be applicable to our other centers within the burn network. Moreover, it also establishes safety and adequacy of care for this specialized patient population in the face of potential life-threatening injuries. The purpose of this study is to create a demographic and clinical outcome profile of pediatric patients admitted to this burn center over the past ten years.

Methods: This retrospective chart review study was granted exemption from IntegReview IRB. Basic demographics and clinical outcomes were reviewed from data received from the Trauma Registry of the American College of Surgeons (TRACS) data base. The data reports for the 10-yr period were obtained in two 5-yr intervals. (01 Jan 2009 – June 2015 and July 2015 – December 31, 2019). As a result, the initial 5-yr period was not as detailed compared to the second 5-yr period. The authors summarized and accounted for as many differences in this documentation as possible, as the results will demonstrate.

Results: The study data was collected from data related to all pediatric burn admissions from January 1, 2009 – December 31, 2019. There was a total of 6354 admissions during this time.

***See attached diagram for further results data***

Conclusions: This review of data has demonstrated a safe and effective model of care in a large, growing burn center. As growth and change continue, it is imperative that we maintain regular self-assessments of this type to ensure continuity of this quality of care and to identify and address any gaps that exist to safeguard the health and outcomes of future patients.
Introduction: The morbidity and mortality of the severely burned patient can be affected by multiple variables. Many of these variables are also associated with an increased likelihood of withdrawal of care. Palliative care services can aid families in difficult decision making during this time and improve the process of transition to comfort care. Despite this, palliative care services may be underutilized. The aim of our study is to assess factors associated with palliative care consultation in the setting of severe burns.

Methods: We analyzed 191 patients with a burn TBSA of ≥30% at our institution from 2007 to 2019. Univariate and multivariate analysis was performed to identify factors associated with consultation to palliative care.

Results: 17 of the 191 (8.9%) patients received a palliative care consultation. The average time to consultation was 10.3 days. On univariate analysis, age, inhalation injury, multiple comorbid conditions, and code status were associated with consultation to palliative care. Independent predictors of palliative care consult included inhalation injury, non-white race, code status, and ventilator days.

Conclusions: Palliative care consultation appears to be seldomly requested at our facility. The presence of an inhalation injury and comorbidities increase the likelihood of consultation. These factors correspond to the same factors that increase likelihood of transition to comfort care. Consult to palliative care on patients with these factors can help improve patient and family care.

Introduction: Increased job satisfaction, and nursing retention are outcomes that have been related to nursing empowerment. Empowering nurses is not always an easy task, but the nursing best practice of shared governance through unit-based councils gives nurses the ability to mobilize resources within their own groups to get things done. Couple this mobilization of resources with real-time technology that provides a true clinical picture of outcomes, and this creates a template for success.

Methods: This is a nursing Quality Improvement project. Shared governance in the form of unit-based councils created within all of our patient care units has proven to be part of the equation for improved infection rates in all units. Our number of CAUTI AND CLABIS from 2018–2019 were reduced, we significantly reduced the number of device days (hospital-wide) for both foleys and central lines, which was also a goal. Through extensive nursing education, utilizing nurse driven protocol for foley removal, increased use of bladder scanning (each unit now has their own bladder scanner) and teaching about de-escalation of central lines/PICC lines as soon as possible, we have been able to reduce our device days overall.

Alongside this nursing best practice, a new nursing data portal that allows for real time data collection to identify breaks in protocol with regards to central line and foley maintenance leading to CAUTIs and CLABIS was also implemented, which allowed nursing to have direct impact on achieving success.

Results: Percent Change 2018 – 2019

CAUTI
BU = 83% decrease, 3E burn = 100% decrease, 4W burn = 100% decrease
Overall decrease = 90%

CLABSI
BU = 85%, 3E burn = 67% increase, 4W burn = no change
Overall decrease = 78%

Conclusions: Implementation of nursing best practice efforts such as shared governance and unit-based councils, coupled with cutting edge technological resources directly contribute to improved infection rate outcomes. Another result of these efforts is the overall positivity fostered among nursing staff, boosting their sense of empowerment and creating better retention rates in all our units.
A Novel Nursing Approach in Reducing Catheter-Associated Urinary Tract Infections in a Regional Burn Center

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Introduction: Catheter-associated urinary tract infections (CAUTI) adversely affect more than 30% of patients in critical care hospital settings. Considered one of the most prevalent of nosocomial infections, CAUTI are linked to extended hospital stays, rising health care costs, and increased morbidity and mortality. CAUTI are attributed to prolonged catheter use, contaminated catheter insertion, and improper care and maintenance. Adhering to infection control guidelines is essential in preventing CAUTI in healthcare institutions. To illustrate, nearly 380,000 CAUTIs could be prevented and 9,000 lives saved, annually, with the prevention of CAUTI (Centers for Disease Control and Prevention, 2019).

Methods: Over the last nine months, our burn team has been working to reduce the CAUTI Standardized Infection Ratio (SIR) and Standardized Utilization Ratio (SUR) in the Burn Center. Efforts to facilitate this reduction include the education of nurses and providers on the indications for placement, replacement, and removal of indwelling urinary catheters. We also developed and assigned a PowerPoint presentation and post-assessment to staff members to educate and measure their understanding of the proper care for patients with urinary catheters in place. The hospital facility’s protocol was revised to reflect the specific needs and alternatives for urinary catheters in our burn patient population. The new burn specific protocol now serves as a guideline for the multidisciplinary team during daily rounds to reduce the risk of CAUTI in the Burn Center. Charge Nurses continue regular audits.

Results: The SIR benchmark for 2019 was 0.774. The SIR for the Burn Center in the third quarter of 2019 was indiscernible because the predicted number was less than one. The SIR for the fourth quarter of 2019 was 0.913. The SUR benchmark for 2019 was 1. The SUR for the Burn Center in the third and fourth quarters of 2019 were 1.035 and 1.150, respectively. This data indicated the need for a comprehensive plan for improvement. Following the implementation of our team’s comprehensive improvement plan, the SIR and number of infections for the first quarter of 2020 was zero, which is below the SIR benchmark 0.727 for 2020. The improvement plan we instituted also reduced the SUR to 0.897 for the first quarter of 2020, compared to the benchmark of one for 2020. The SUR rate for the second quarter was 1.118.

Conclusions: Instituting this simple nurse-driven protocol has resulted in a noteworthy improvement in patient outcomes. Achieving benchmark goals remains a significant priority to our burn center team as we continue to see the progress and health benefits of fostering the safest care environment for our patients, while remaining financially responsible to our institution.
A Nurse Educational Program to Promote Spiritual Care Delivery: Development and Pilot Testing

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Introduction: Spiritual Care (SC) is crucial for the holistic care of patients. Findings from a needs assessment conducted on an 8-bed burn Intensive Care Unit (ICU) (n=34, 88% response rate) revealed 90.3% of nurses believed SC was important for the overall care of their patient, but only 13% felt confident to provide the religious care. Of the respondents, 77% had come across a time when they were unable to obtain SC for their patients. The survey revealed 39% were interested in obtaining education to enhance their provision of holistic care. Based on this data, we developed and pilot tested an innovative SC educational course to examine feasibility, learning, and preliminary outcomes.

Methods: The IRB-approved study involved a two-hour evidence-informed class developed by a burn nurse and chaplain. The course was offered on a voluntary basis for all nurses in the critical care division (5 units overall). The class consisted of PowerPoint presentation, case studies and practice utilizing spiritual care assessment tools. Data was collected before and after the class at one- and two-months post class completion.

Results: Participants (n=12) were mostly female (82%), Bachelors prepared (82%), affiliated as Christian (73%) and had not had spiritual education in the past (73%). Nurses also agreed the spiritual assessment tools were useful and they were confident using them. Mean total score for Nurses’ Spiritual Care Practice increased 14% over time. Practices with the largest increases included reading/offering spiritual writings to patients (67/57%) and documentation of meeting spiritual needs (40%). The Spiritual Care Perspective scale increased 7% overall with changes in the beliefs of SC being a significant part of Advanced Nursing Practice (APN) (10% increase), the domain of APN includes SC (15% increase) and nurses should assist a patient in using his/her spiritual resources to cope with illness (9% increase). At 2-months post training, participants felt comfortable (4.25/5.0) and confident (4.0/5.0) providing SC.

Conclusions: SC is an essential element of holistic nursing practice that has become even more relevant in this pandemic year. Our 2-hour educational class was considered well organized, provided relevant education and tools for use, and increased nurses confidence, comfort, and documentation of providing SC to their patients.
A Retrospective Review Evaluating the Institution of Nurse Clinic Visits for the Treatment of Burn Patients Being Managed at Home

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Introduction: Most burn injuries can be managed at home; however appropriate follow up care is vital to prevent complications. Our center developed an outpatient dressing and care algorithm aimed at improving patient outcomes and optimizing the use of healthcare providers. The algorithm consisted of scheduling patients discharged home from the burn emergency department with a nurse visit (NV) within 3 days of discharge and a provider visit (PV) 1 week later. All NV could be converted to PV prn. The purpose of this study was to evaluate the effectiveness and safety of our nurse clinic visits.

Methods: This was a retrospective study of outpatients managed using the new care algorithm over a 1-year period. Patients whose NV was converted to PV or to a PV were compared to those who were not converted (NCV). Basic descriptive statistics were calculated.

Results: The charts of 259 patients scheduled for NVs were reviewed, mean age was 24.3 years and 51% were male. The population consisted primarily of Caucasians (47%) and Hispanics (35%). Most patients had a payor source with private insurance (40%) and Medicaid (31%) being the most common. Initial presentation to the burn ED was 1.56 days post injury, mean TBSA was 1.58% and most injuries involved the hands (36%) and arms (28%). The most common mechanism was scald (56%) followed by contact (28%). The most common dressing was petroleum gauze (41%) followed by silver impregnated foam (39%). NVs were converted to PV for 16% of the population. The most common reason for conversion was discharge from clinic (33%), followed by worsening (24%), therapy needs (24%) and change in dressing (19%). When CV patients were compared to NCV there were no significant difference in age, gender, past medical history, burn history (time to presentation, TBSA, mechanism, area of injury) or dressing type with the exception of enzymatic debriders (p=0.0226). Native Americans (p=0.0257) and patients with Workman’s Compensation (p=0.026) were more likely to be converted to a PV. Hispanic patients were less likely to be converted to PV (p=0.037). The charges for NV ranged from $120-$185/visit with an average reimbursement of $60.88.

Conclusions: Overall compliance with the scheduling of nurse visits was poor. However, when scheduled per the algorithm, nurse visits were safe and effective, decreasing provider workload while still allowing for patients to be seen in a timely manner.
The Collaboration of Burn Outreach and Wound Care Nurses

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Introduction: Certified wound care nurses perform a vital role in skin health and management in the hospital setting. During the certification process, minimal time is spent on burn wound education, despite the fact that wound care nurses are consulted for various wound etiologies; one of those being burns. This construct created a need for collaboration between the burn team and wound care nurses. Although all burns are essentially wounds, the reality is that all wounds are not burns. The management of the burn wound is often different from the management of pressure injuries or surgical wounds. In speaking with the wound care nurses at this large urban academic medical center, a knowledge gap was identified in burn wound care education as well as appropriate and timely consultation of the burn team.

Methods: This knowledge improvement project focused on educating the wound care nurses in assessment and treatment of burns, and the process for burn service consultation. Burn education was provided through in-person didactic presentations. The lecture included burn wound photos with opportunities to classify the potential depth of burn wounds as well as typical complications. Additionally, it discussed when a burn consult is needed. A basic knowledge retrospective pre-posttest method was utilized.

Results: An educational plan was tailored to meet the learning needs of the wound care nurses to address the knowledge gap. Post test data results were tracked. Post scores were increased, indicating a successful educational intervention. Also, while providing the education, the burn outreach coordinator identified an opportunity to expand the burn center’s presence among colleagues through collaboration with the wound care nurses. The wound nurses made excellent ambassadors for the mission of the burn service.

Conclusions: Provision of burn education across disciplines may improve recognition of burn wounds and facilitate definitive treatment.

Failure to Follow-Up: Implementation of a Program to Reduce Risk and Engage Patients

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Introduction: Establishing a patient-physician relationship creates a duty to meet the standard of care for inpatients and outpatients. Growth in burn ambulatory care, workforce changes, and the digital age of healthcare communications have broadened the definition of the patient-physician relationship and increased ambulatory medical liability especially when patients fail to follow-up (FTF). To mitigate this risk, many professional liability insurers have advised physician practices to implement processes to ensure appropriate follow-up and communication. Our study reviewed a multidisciplinary quality and performance improvement initiative to reduce risk from FTF with a goal to improve patient engagement.

Methods: In response to notification by our medical professional liability insurer, a multidisciplinary team of burn specialists reviewed, designed, and implemented a FTF risk reduction program at an ABA-verified burn center. Burn surgeons, physician assistants (PA), nurses, schedulers, and administrative assistants contributed to the development of the FTF protocol. Patients were discharged with follow-up date and time from inpatients stays or at the conclusion of outpatient encounters. If a patient had a FTF event, three attempts were made to contact the patient starting with the scheduler, followed by the nurse, and finally the PA or MD. Each attempt was documented in the EMR. Compliance with the FTF protocol was monitored twice monthly as a component of the burn quality and performance improvement program.

Outpatient encounters were abstracted from the EMR into three categories: completions, cancellations, and FTF over a 4-month period prior to implementation and 4-month period post implementation.

Results: Our analysis included over 2,678 outpatient physician/PA encounters. Prior to implementation, patients were intermittently contacted with no consistent processes or documentation in the EMR. Staff compliance with the FTF protocol improved from 83% the first month after implementation to 100% by the fourth month. Interestingly, the failure to cancellation rate remained stable while the failure to follow-up rate declined from 15% prior to implementation to 13% post implementation. Patients failing to follow-up commonly stated that they forgot or had transportation issues, natural disasters, and even the pandemic. This study was not designed to reduce cancellations or FTF as it is reactionary. Additional work is needed to reduce all causes of FTF and to improve outpatient engagement.

Conclusions: FTF protocols are essential to engage patients and reduce ambulatory professional liability. Patients will continue to face FTF challenges with language barriers, transportation issues, natural disasters, and even the pandemic. This study was not designed to reduce cancellations or FTF as it is reactionary. Additional work is needed to reduce all causes of FTF and to improve outpatient engagement.
Introduction: Our burn institution cares for critically ill burn patients and provides post-acute care for a large referral base. The clinic is staffed by a wound certified physical therapist, an advanced practice registered nurse and a licensed clinical social worker (LCSW), with consult access to Trauma/Burn Surgeons. The incidence of acute stress symptoms after burn injury is noted in up to 35% to 40% of patients. Therefore, it is important to identify symptoms of anxiety and depression early and begin symptom management. Burn patients have access to a multi-disciplinary team, and a licensed therapist, that can identify symptoms of acute stress and make recommendations for appropriate treatment in concert with the medical staff. This project seeks to determine the prevalence of acute stress in post-acute burn patients seen in an adult burn clinic and the benefits of utilizing a Licensed Clinical Social Worker to perform screening.

Methods: For a one-year period all burn patients in the burn clinic were screened by the LCSW. The subjects underwent initial screenings for depression, anxiety, and suicide risk at their first clinic visit. The PHQ-2 and PHQ-9 were utilized to assess depression, the GAD-7 for anxiety and the Columbia Suicide scale to assess suicide risk. Patients were initiated into multi-modal therapies based on specific scoring. These intervention strategies were based on the Depression Screening Protocol which included education on depression, and/or anxiety, with or without participation in a Trauma/Burn Peer Support Group. Patients were prescribed medication per provider discretion, and/or connected to community resources such as, counseling, and psychiatric mental health services.

Results: During the one-year assessment period screening compliance was >90%. During this period, >50% of patients’ scores were clinically significant for acute stress. Over half of those that screened positive were connected to community resources of counseling services or psychiatric care. 100% of those that screened positive were given education and connection to peer support services. An incidental correlation was noted between increased total body surface area involvement and work-related accidents with increased symptomology.

Conclusions: The inclusion of an LCSW in the burn clinic has improved the overall care of the burn injured patient. The assessment of depression and anxiety related to the burn injury has led to an increase in peer support participation and an increase in referrals to counseling and/or psychiatric services.

Introduction: Opioids are frequently prescribed after burn injury. Prolonged use of opioids can increase dependence and potential for life-threatening complications. For burn-injured children, optimizing opioid prescriptions in the outpatient setting can reduce these risks. Our aim for this study was to assess and analyze the outpatient opioid prescription use in children with burn injuries.

Methods: After approval from the institutional review board, pediatric patients admitted to our institution with ≥20% total body surface area (TBSA) burn were included. Data collected included age, gender, % TBSA burn, mechanism of injury, length of stay, surgical procedures, total morphine milligram equivalent (MME) given in last 24 hours prior to discharge and discharge pain prescriptions. 7 days after discharge, families tracked and provided daily usage of prescription opioids, acetaminophen, and ibuprofen, as well as daily pain scores. Families were given a follow up questionnaire about whether a prescription opioid was prescribed and filled, daily medication needs, pain scores, storage of opioids, quantity of medications remaining, and disposal of any remaining opioids. All mean values are mean ± standard deviation, all median values are median (interquartile range).

Results: Twenty-nine patients were enrolled with a mean age of 7±5.8 years and mean TBSA of 10±6%. Daily outpatient pain scores ranged from 0–2. 18 patients underwent skin graft surgery (SUR) and 11 did not (NOSUR). The mean % of opioids that were not used was 50±38% and 52% of families kept the left-over opioids for future use. For the SUR group, a median % of opioids that were not used was 64(14–90)% and for the NOSUR the median was 55(17.5–56)% and 56% of SUR families and 45% of NOSUR families kept the left-over opioids for future use.

Conclusions: For pediatric burn patients, opioids prescribed at discharge may be overestimating pain needs. In our study, half of the opioids were not used, and this was even more pronounced in patients who underwent surgery. More concerning is that the majority of families did not dispose the left-over opioids for future use. We recommend optimizing opioid prescribing practices to reduce over-prescribing opioids to burn injured children and educating families on the need for proper disposal of left-over opioids.
The Effects of the COVID Pandemic on Burn Clinic
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Introduction: The COVID19 pandemic has led to anxiety and fears for the general public. People were concerned about coming to a medical facility where the virus might be transmitted. Furthermore, stay-at-home orders that were implemented during the pandemic did not apply to clinic visits but contributed to people staying at home even for medical care. We hypothesized that there were delays in burn care due to the pandemic.

Methods: We queried our clinic data for number of clinic visits and new burn evaluations by month. Patients referred to our clinic from March 15, 2020 to Sept 15, 2020 were reviewed for time of presentation after injury. Days from injury date to clinic referral date and days from clinic referral date to appointment date were calculated. Patients who were referred but did not show and were not seen in our ED were not included because injury date could not be determined. Univariate analysis was performed.

Results: As seen in Figure 1, our in-person clinic volume decreased in April and May 2020 but rebounded in June 2020 as compared to the number of clinic visits for the same months last year. Similarly, in Figure 2, our new burn evaluations decreased in April and May 2020 compared to our new burn volume from 2019. However, our video telehealth visits increased in March and April then decreased in June-August.

Conclusions: Our burn clinic remained open to see patients with burn injury throughout the pandemic, however, clinic visits were delayed early in the pandemic. While we had an increase in video telehealth, it does not account for the decrease in clinic visits. This may be due to low enrollment in the electronic medical record encrypted communication platform and/or limited knowledge/access to the technology. Additional care may have been informally given via telephone but not well captured. Furthermore, burn care was delivered in the following months. Additional investigation is necessary to see if the incidence of burn injury decreased.

A Survey of Burn Care Providers Regarding the Utility of Telehealth to Provide Outpatient Burn Care
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Valleymwise Health Medical Center, Phoenix, Arizona

Introduction: Telehealth is purported to be the wave of the future, offering improved access to care by overcoming geographical and other logistical challenges while simultaneously improving efficiencies within the healthcare system. As the global COVID-19 pandemic swept through our state, we were abruptly forced to take our burn clinic to a telehealth platform for most patients. The purpose of this study was to evaluate our experience with telehealth in managing burn wounds and other complex skin defects.

Methods: A 16-item survey was developed using the framework outlined by the National Quality Forum for the development of telehealth measures. The survey was distributed to direct care providers and focused on the domains of experience and effectiveness and the subdomains of efficiency and satisfaction.

Results: There were a total of 14 respondents, including physicians, allied healthcare professionals, therapists and nurses. Seventy-seven percent of participants felt that overall, the system was efficient in the 4 categories of time required for scheduling, check-in, visit conduct and care coordination. Telehealth was deemed moderately to very effective by 80% in providing the patient access to care and the provider’s ability to educate the patient. However, providers, therapists and nurses uniformly found telehealth to be either not at all effective or slightly effective in assessing wounds, musculoskeletal function and developing a plan of care. When rating satisfaction with connectivity and overall quality of the clinic visit 70% of respondents were either dissatisfied/neither satisfied nor dissatisfied with the platform.

Conclusions: The operational aspects of our burn clinic telehealth program implemented during the COVID-19 pandemic were found to be largely satisfactory, with the exception of connectivity issues. However, the clinical aspects of the program were found to be largely unsatisfactory and, notably, were judged to be inferior to in-person visits.
Burn Care During Six Months Covid-19 Pandemic; Report of A Single Center

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Introduction:
The novel coronavirus (SARS-CoV-2) responsible for COVID-19 pandemic caused an unprecedented health care crisis. During pandemic burn centers had to preserve the ongoing burn care in a safe and ethical way. It is crucial to manage inpatients, outpatients, wards and staff carefully to prevent epidemia in burn units. Here, we aimed to report our burn care experience during the six months COVID-19 pandemic.

Methods: We retrospectively evaluated our ambulatory and hospitalized burn patients during the six months COVID-19 pandemic (from March to September 2020) with respect to the demographic data, wound care, surgery, intensive care management. Based on the model of our infection control team, we formed first to third degree prevention methods while contacting with burn patients in our outpatient clinic, semi-sterile ward (with beds) and intensive care unit (with 4 beds) which were sterilized and ventilated regularly. During hospitalization, we restricted the degree of interaction during multidisciplinary rounds. To screen for nosocomial infections, patients were routinely tested with PCR test.

Results: 402 burn patients (158 paediatric, 244 adults) were managed as outpatients (n=332;82%) and in patients (n=70; 18%) in our burn centre. Total body surface area percentage of burn in hospitalized patients were 9, 95±2, 76 % in paediatric and 25, 34±3, 49 in adult group. Majority of the burns were scald (86.7% paediatric, 60.5% adults) burns. We successfully performed 66 surgical debridement and grafting procedures. Three adult patients had mechanical ventilation support during follow up and one of them died due to multi organ failure with negative PCR. We detected COVID-19 in 2 patients and both of them were discharged successfully.

Conclusions: According to our results, when precautions are taken, burn care can be managed successfully without posing any risk to patients during the pandemic period.

Increase in Cancellation Rates with Follow-Up Telemedicine Visits in a Burn Clinic Setting

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Introduction: Telemedicine is a resource to help limit in-person contacts, which has become increasingly utilized during the Coronavirus pandemic. In the last year, most health care systems have attempted to limit in-person visits in order to help decrease Coronavirus transmission. A retrospective analysis was conducted to determine if the use of telemedicine resulted in an increase in cancellation rates. The data on cancellation rates of a burn clinic using telemedicine was collected for a seven-month period in 2020. The increased rate of cancellations for telemedicine visits compared to in-person visits was found to be statistically significant.

Methods: A retrospective analysis of patient cancellation rates for 2,463 burn outpatient visits seen in a burn clinic associated with a large tertiary referral burn center was performed covering the time period between April 1st and August 30th of 2020. Cancellations of initial visits for new or recently discharged patients were not included as telemedicine visits were only offered for established burn outpatients. Rescheduling rates for both groups were calculated to assess a potential impact on cancellations. Telemedicine visits consisted of patient encounters conducted by phone or by live video chat. Statistical significance was determined using chi-square test with an accepted p < 0.05.

Results: The study included 2,463 scheduled outpatient visits comprising 511 telemedicine visits and 1,952 in-person visits. A cancellation rate of 47% occurred for telemedicine visits and a cancellation rate of 40% was observed with in-person visits. Patient visits conducted using telemedicine were associated with a higher cancellation rate (p=0.013). The reschedule rate for telemedicine visits was 22% while in-person visits had a rate of 25% showing no significant association (p = 0.45).

Conclusions: Telemedicine follow-up visits were found to have an increased rate of cancellations compared to in-person visits. Rates of rescheduling showed no significant difference between groups.

<table>
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<tr>
<th>Table 1: Cancellation rates for clinic follow ups</th>
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<td>Apr-Aug 2020</td>
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<tr>
<td>Telemedicine visits</td>
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<td>In-person returning visits</td>
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<td>Total</td>
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<th>Table 2: Reschedule Rates for cancellations</th>
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<td>Cancel/No Show</td>
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<td>Telemedicine visits</td>
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<td>In-person returning visits</td>
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Introduction: The treatment and care of a burn injury is specialized and can be very intimidating to the patient and family. It is the obligation of the burn team to educate the patient and caregiver at a level where they clearly understand and are comfortable. It is important to be mindful of how others comprehend whether it is visual, auditory, reading/writing, or kinesthetic. When attempting to learn something new, especially when compounded by a burn injury, can be quite challenging.

Methods: Videos of burn injury cleansing techniques and various applications of dressings were produced to enhance patient and family education.

Results: Our analysis of feedback from the patient and family indicates an appreciation for other learning platforms and is a complement to written instructions.

Conclusions: We concluded that by offering video education along with other educational tools, it has enhanced the patient and family experience in the burn center.

Introduction: The assessment and treatment of pain has become increasingly important in light of the opioid epidemic. Inadequately managed pain can lead to increased risk of psychiatric illness. The numeric rating scale (NRS) is used in most ICUs and only assesses pain intensity. Although it is reliable, valid, and user-friendly, other publications have criticized this one-dimensional pain assessment tools as offering little information about the impact of the pain on the patient's life.

The defense and veterans pain rating scale (DVPRS) is a multi-dimensional tool designed to assess the patient's pain intensity as well as how the pain interferes with the patient's general activity, sleep, mood and stress. Studies have shown that it has good validity and reliability in the inpatient and outpatient military population with neuropathic and non-neuropathic pain. The DVPRS has not been evaluated in critical care patients. Thus, this study comparatively investigated ICU patients' satisfaction with the DVPRS versus the NRS.

Methods: This was a prospective pilot study performed from September 2018 to July 2019 in a 10 bed burn intensive care unit (BICU) and 10 bed surgical intensive care unit (SICU) at a university teaching hospital. This was an IRB approved study. All enrolled patients were older than 18 years of age and were CAM-ICU negative. The participating staff members were educated on the use of the scales prior to the start of the study. Routine treatment of pain was not altered by the study. Pain was assessed by staff nurses randomly assigned to use the NRS or DVPRS tool. The selected tool was used on admission, during wound care and every 4 hours or upon patient need. The patients completed satisfaction surveys on the day of discharge.

Results: 42 patients participated and 32 completed the study. 18 patients were in the DVPRS arm and 14 were in the NRS arm. Our primary outcome was patient satisfaction, ranked on a scale from 0–10, where 0 was the lowest score and 10 was the highest. Overall, patients in the DVPRS cohort had higher median satisfaction scores (median score: 10, interquartile range: 8–10) than the NRS cohort (median score: 8, interquartile range 7–9), though this difference did not reach statistical significance ($p=0.16$). However, DVPRS patients were significantly more likely to be “completely satisfied” than NRS patients (55.6% in DVPRS patients versus 21.4% in NRS patients; $p=0.04$). Furthermore, upon multivariate logistic analysis adjusting for age, gender, and ICU using the NRS pain scale conferred lower odds of complete satisfaction with pain management (odds ratio: 0.19, $p=0.04$).

Conclusions: Our study showed that ICU patients preferred the DVPRS over the NRS. The DVPRS appeared to be as effective as the NRS in pain relief and gave providers more information about patients' pain.
Introduction: Burn reconstruction with CO2 laser is now very popular. Providing adequate analgesia is imperative for large total body surface area (TBSA) resurfacing. CO2 lasers' cause significant pain during the procedure and pain similar to that of a severe sunburn post-operatively. Thus, adequate analgesia that provides peri-operative and post discharge management without delaying discharge is beneficial. At our institution, we use a multimodal analgesic preoperative and intra-operative approach to deal with this issue. The preoperative intervention utilizes a novel approach of oral methadone for older children and avoids the use of intra-operative morphine as a preemptive measure for pain management. The purpose of this outcomes review was to determine if our peri-operative analgesic practices were effective in controlling peri-operative pain.

Methods: After corporate IRB review, this project was undertaken as a quality improvement initiative and was not formally supervised by an institutional review board. A chart review of all patients who received CO2 laser treatment (CLT) was conducted. Using a Donabedian model for outcomes measure, postoperative and pre-discharge observational pain scores (scale 1–10), peri-operative analgesics, demographics, percent burn treated, incidents of rescue medication before discharge home, time to discharge and adverse reactions were collected.

Results: 74 patients were reviewed (47 male, 27 female), ages 4 to 30, average age 17. Average percent body surface area treated was 17.5%. Out of 74 cases, 18 received intra-operative morphine and 56 received oral methadone pre-operatively. All patients received routine intra-operative ketorolac and lidocaine/prilocaine cream, based on weight. In the PACU there were 2 recorded rescue doses of morphine in the morphine group and 0 in the methadone group. There was one post-operative recorded observational pain score of 5 in the methadone group and one each of 3 and 8 in the morphine group, both of which received rescue morphine. There were no differences in mean times to discharge between groups. Observational pain scores were 0 for both groups at discharge. Chi square analysis showed no statistical difference between groups. No adverse outcomes (respiratory arrest or readmission for pain) were recorded in either group.

Conclusions: Both pre-operative oral methadone and intra-operative morphine are effective in controlling peri-operative pain in our children undergoing laser surgery. Categorical age differences and low group sizes may have contributed to outcomes and should be considered in the next review.

Introduction: Pain control remains one of the major challenges in management of burn patients. Pain associated with procedural and post-procedural burn care such as excision and grafting, postoperative dressing changes, and postoperative physical therapies often requires patients to be on intravenous and oral analgesics leading to potential long-term dependence after hospital discharge. Peripheral nerve blocks (PNB) use for perioperative pain management in burn patients may present an alternative pain management modality to help decrease analgesic consumption and shorten length of stay following procedural care. Our hypothesis was tested by evaluating the outcomes from implementation of PNB with ultrasound guided catheter placement for burn procedural care in patients with ≤ 10% total burn surface area (TBSA) requiring excision and grafting.

Methods: After IRB approval, we retrospectively collected demographics, medical history, pain intensity (rated as “No Pain” [NRS=0], “Minor Pain” [NRS 1 to 3], “Moderate Pain” [NRS 4 to 6], “Severe Pain” [NRS 7 to 10]), postoperative analgesic consumption and time to hospital discharge of patients who underwent autografting procedures for burn injuries ≤ 10% TBSA from October 1, 2019 to December 31, 2019 (the start of our implementation of PNB for procedural burn care). Data was analyzed using chi square/Fisher exact test for categorical variables and t-test for continuous variables.

Results: Our preliminary data included 20 patients (10 patients had PNB) with average age of 53 years, 60% males and average TBSA of 4.8%. Patients in both PNB and non-PNB groups had unremarkable medical histories and scald and flame as mechanism of burns. There was no significant difference in TBSA (5.3% TBSA in PNB and 4.8% TBSA in non-PNB). Pain intensity before autografting procedure for both groups were reported as moderate to severe and managed with fentanyl, morphine, oxycodone, along with ibuprofen and acetaminophen. There was no significant difference in postoperative pain intensity and opioid consumptions; however, postoperative acetaminophen consumption was less in PNB group compared to non-PNB group (2762±3646 mg vs 3932±7511 mg, respectively), although not statistically significant. There was no significant difference between time from surgery to first physical therapy session; however, time to hospital discharge was shorter in PNB group compared to non-PNB group (5.7±1 days vs 10.5±9 days, respectively), although not statistically significant.

Conclusions: This evaluation shows a trend in reduction of inpatient postoperative analgesic consumption as well as time to hospital discharge with the use of PNB, although a bigger sample size is needed for further assessment.
589 Methadone in Procedural Care for Burn Injuries of 20–30% Total Burn Surface Area: A Retrospective Chart Review

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Introduction: Prolonged opioid usage remains a concern in pain management in procedural care. Recent evidence also suggests that a considerable number of patients who were prescribed opioids struggle with transitioning to non-opioid pain medications. As a continuous effort to reduce opioid consumption following burn surgical procedures, our institution recently evaluated methadone administration for burn procedural care in patients with 20–30% total burn surface area (TBSA) requiring excision and grafting.

Methods: After IRB approval, we performed a retrospective chart review of patients who underwent excision and grafting procedure for 20–30% TBSA burn injuries between January 1, 2019 and June 30, 2020. The following data was evaluated: postoperative opioid consumption, postoperative pain intensity (rated as “No Pain” [NRS=0], “Minor Pain” [NRS 1 to 3], “Moderate Pain” [NRS 4 to 6], “Severe Pain” [NRS 7 to 10]), time to physical therapy and time to hospital discharge. Data was analyzed using chi square/Fisher exact test for categorical variables and t-test/Wilcoxon rank sum test for continuous variables.

Results: Our preliminary data included 12 patients who met inclusion criteria, of which two patients received methadone administration. Our patient sample consisted of average age of 43 years, 75% male, and 24% TBSA (92% were flame burns). Patients in both methadone and non-methadone groups had no significant differences in medical histories and TBSA (23% TBSA in methadone, 25% TBSA in non-methadone). There was no significant difference in reported preoperative pain intensity between the two groups, rating moderate to severe. Postoperative pain intensity remained the same, rating moderate to severe and controlled with fentanyl, oxycodone, morphine and non-opioid analgesics. While there was no difference in postoperative fentanyl, opioid and non-opioid analgesic consumptions between the two groups, morphine consumption was significantly lower in the methadone group compared to non-methadone group (2±2 mg vs 51±54 mg, respectively, p=0.02). There was no significant difference between average time from surgery to first physical therapy session and time to hospital discharge (about 21 days after surgery) between the two groups.

Conclusions: This evaluation shows a potential trend in reduction of inpatient postoperative opioid consumption with the conjunctive administration of methadone, although a bigger sample size is needed for further assessment.

590 Nonpharmacologic Pain Management in Pediatric Burn Patients: A Systematic Review

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Introduction: Pain is a universal feature of pediatric burns that is associated with long-term mental health consequences in this population. While pharmacologic therapy can alleviate pain, it does not always provide complete control and carries its own risks. Current literature suggests nonpharmacologic treatment may provide improved pain control as an effective adjunct in pediatric burn patients. The aim of this systematic review is to summarize the literature of nonpharmacologic pain management in pediatric burn patients.

Methods: A systematic review was conducted using PubMed, Ovid MEDLINE, Scopus, and Web of Science. Keywords included: analgesia, pain, children, pediatic, paediatric, child, young, adolescent, burn, and scald. Papers were included if they were randomized, controlled, had original data, collected pain scores as a function of nonpharmacologic treatment, and were conducted on pediatric burn patients. Reviews, case reports, and opinion papers were excluded. Data were extracted on pain scale, pain score during and after treatment, and significance of results. Pain reduction was calculated as the percent difference between experimental and control pain scores, and treatments with significant pain reduction were considered effective.

Results: Sixteen studies were included, with nonpharmacologic treatments categorized as interactive (n=12) or passive (n=4). Interactive treatments required patient activity throughout treatment and included virtual reality (n=6), distraction devices (n=3), child life therapy (n=1), directed play (n=1) and digital tablet games (n=1). Passive treatments included cartoons (n=1), hypnosis (n=1), massage therapy (n=1) and music (n=1). Mean age was 8.39 years and percent total body surface area (%TBSA) burned was 5.95%. Treatment was effective in 9 out of 16 studies. Compared to controls, nonpharmacologic treatments reduced mid procedure pain by 24.3% (n=12) and post-procedure pain by 33.6% (n=5). Of the studies reporting mid procedure pain, pain reduction was greater in interactive treatments (32.3% n=10) than in passive treatments (-15.6% n=2) (p=.016).

Conclusions: Nonpharmacologic therapy can be an effective adjunct in pediatric burn pain management. Significantly greater pain reduction in interactive treatments suggests distraction may lead to greater analgesia; however, the number of passive treatments for comparison was low. This study shows promise in the application of nonpharmacologic therapy, and further research will allow standardized algorithms to integrate nonpharmacologic therapy with medications.
Introduction: Hospital-acquired burn injuries can result in significant psychological and physical consequences for patients and their families. These injuries are typically rare, but when they do occur this can lead to increased length of hospitalization, costs of stay, and potential for additional procedures. The aim of this study is to describe iatrogenic burn injuries that occurred over a 15-year period at an academic public hospital system.

Methods: After Institutional Review Board approval this study collected data on patients sustaining iatrogenic burn injuries between January 2004 and June 2019 at a large, academic public hospital system. Data was obtained from an internal database of self-reported incidents. This data included: time of injury, location in the hospital, mechanism, level of harm caused, and anatomic location of the injury. Mean and standard deviation were calculated by year, and a two-tailed t test was used to assess for significance.

Results: 122 iatrogenic burn injuries met inclusion criteria and underwent focused analysis. Incidence of burn injuries were highest between 2005–2012 (average 12.3 ± 4.1 per year) as compared to 2013–2019 (average: 2.9 ± 2.1 per year). The difference between these time periods was statistically significant (P = 0.0001). A majority (77%) resulted in harm caused to the patient, with 13.1% of cases requiring additional treatment. Most (41%) of the injuries occurred on the general medical floors, followed by the operating room (33.6%). The most common etiology was hot liquid (23%), followed by electrocautery (14.8%) and other, unspecified medical devices (21.3%). None of the burn injuries had burn consults and none of these patients required surgery for their burn injuries despite the level of harm reported.

Conclusions: Iatrogenic burns are overall rare and appear to be decreasing in number over the last six years. While a large majority were reported to have caused patient harm, none required surgery and none had a burn consult while inpatient. The majority of the injuries occurred on the medical floors with a scalpel mechanism. This review highlights an opportunity for large academic medical systems to put more emphasis prevention in these situations as these are presumably avoidable. There is also an opportunity to reach out to the hospital system about the involvement of the burn team. In addition, this highlights the limitations of self-reported inpatient injuries as there may be under-reporting.
593 Mortality of Burn patients over two decades: Improving outcomes in the elderly

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Introduction: Shifting paradigms in the care of burn patients over the past two decades have led to the improved survival of adult and pediatric patients, but the same trend has not been manifested in the elderly population. We aimed to review our patient population, particularly the elderly, for the last twenty years and examine the relationship of age to the TBSA (total burn surface area) LD₅₀ (lethal dose, 50%).

Methods: This IRB approved study retrospectively analyzed acute burn patients admitted at two academic regional burn centers from January 1, 1999 to August 1, 2019. Data collected included age, gender, TBSA, mortality, mechanism of burn, inhalation injury, and presence of full-thickness burn. The relationship between mortality and TBSA and age was assessed using logistic regression. The TBSA LD₅₀ relationship to age best fit a cubic regression model with a peak of 81% TBSA LD₅₀ at 17 years of age, rapid decrease early in the 5th decade and a general leveling out at the nadir of 27% TBSA (Figure). The LD₅₀ did not reach 30% until 78 years of age.

Conclusions: Over the past two decades, elderly patients treated at our hospitals appear to have improved survival in comparison to the outcomes reported nationally. Due the ongoing rapid aging of the population, it is important that we continue to focus on both improving survival and delivering the best care to this vulnerable part of the population. Moreover, this continuous model could be used to track improvements in care within our institution and serve as a template for a national model.

594 Racial and Ethnic Disparities in Burn Patient Outcomes: A Review of the Literature

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Introduction: Racial and ethnic disparities in outcomes for surgical trauma populations has been an expanding field in recent years. Despite this, disparities in prevention, treatment, and recovery outcomes for burn patients of racial and ethnic minority backgrounds have not been well-studied. Our study aims to review the literature regarding risk factors and burn outcomes among racial and ethnic minority populations to develop culturally-tailored burn care for minority burn patients.

Methods: A systematic review of literature utilizing PubMed was conducted for articles published between 2000–2020. Searches were used to identify articles that crossed the burn term (burn patient OR burn recovery OR burn survivor OR burn care) and a race/ethnicity and insurance status-related term (race/ethnicity OR African-American OR Asian OR Hispanic OR Latino OR Native American OR Mixed race OR 2 or more races OR socioeconomic status OR insurance status). Inclusion criteria were English studies in the U.S. that discussed disparities in burn injury outcomes or burn injury risk factors associated with race/ethnicity.

Results: 1,031 papers were populated, and 38 articles were reviewed. 26 met inclusion criteria (17 for adult patients, 9 for pediatric patients). All but 4 of the included papers were written in the last 10 years. 17 of the 26 articles describe differences in outcomes or risk factors for Black Americans, 8 discuss Latinx, 5 discuss Native Americans, 3 discuss Asian Americans, and 1 referred to “Non-White” minorities, collectively. Majority of studies showed that racial and ethnic minorities (vs. Whites) exhibited poorer burn injury outcomes such as higher mortality rates, greater scar complications, and longer duration for length of stay.

Conclusions: Few studies exist on outcomes for minority burn populations. Interestingly, most have been published in the last 10 years, which may indicate a trend in increased awareness. There is also a discrepancy in which minorities are included in each study with the least amount of data collected on Asian, Latinx, and Native American communities. More research with a larger base of minority populations will help further investigate this problem and develop better culturally-appropriate burn treatment.
The COVID Effect: Exploring the Impact of Coronavirus on an Academic Burn Center
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Introduction: Globally, medical centers have faced unprecedented times with the onset of the Novel Coronavirus pandemic. Emergency departments (ED) and burn units have had to adapt to uncertainty and new challenges. At our institution, we had to alter our daily burn practice, physically moving our burn unit to our surgical intensive care unit to accommodate staff cohorting. While some hospitals have seen patient surges, most have endured dramatic decreases in productivity. A UK burn unit documented lower ED presentations and reduced referrals from other centers, with 50% fewer patients admitted to their burn ward (Farroha).

In Israel, a 66% decrease in adult burn patients was noted (Kruchevska et al.). We sought to identify the impact of COVID-19 on burn injury epidemiology in our burn unit based in a large, urban, academic medical center.

Methods: We conducted a retrospective review of our burn database for ED visits and admissions related to burn injuries between March 1st and June 30th in the years 2017, 2018, 2019, and 2020. We looked at the age and sex of patient, type of visit, length of stay (LOS), the mechanism of injury, the setting in which injury occurred, and the details of the injury. We compare annual trends, with emphasis on comparison of 2020 to previous years.

Results: From admissions and ED data records, 215 patient encounters were reviewed. We saw a yearly rise in total burn patients seen in the ED or admitted to our burn unit 2017–2020 (39, 43, 63, and 70 respectively) with the highest volume of patients in 2020. Mean patient age ranged from 45 (2020) to 51 (2017). More males were burned in all years (male:female ratio 3.9 in 2017, 2.1 in 2018, 2.5 in 2019, 1.9 in 2020). Median LOS in 2020 was 2.5 days, consistent with 2017–2019 values (2, 3, 3, respectively). Between 2017 and 2019, 10%, 2%, and 8% respectively of patients evaluated were treated on an outpatient basis, while in 2020, 20% were outpatient. Rates of flash, scald, flame, chemical, electrical, and contact burns were stable over the period. Of those patients who were admitted, 1.8% sustained work-related burns in 2020 versus 8.9% over 2017–2019. In 2020, 23% of burns were cooking related versus 18% over the prior 3 years.

Conclusions: Despite documented decreased burn admissions in some units, our unit saw an increase in burn injuries presenting for evaluation in the first 3 months of the COVID-19 pandemic as compared to the analogous period in the three years prior. Burns were less often tied to work-related incidents and more frequently related to cooking injuries. Even with more patients treated and released from the ED, inpatient admission numbers were maintained. These findings support the importance of protecting our staffing and burn unit resources in a pandemic setting in order to appropriately treat regional patients and an increase in home-based injuries.

Homeless Tent Fires: A Descriptive Analysis of Tent Fires in the Homeless Population
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Introduction: Homelessness is a rising concern as insufficient housing and significant barriers to shelter has led to more individuals seeking shelter in tents. Within this demographic there has been an increased trend of burn injuries from tent fires in regions with large homeless populations. This represents a public health crisis given the long-term psychosocial and functional sequela of burn injuries and existing data that suggest worse outcomes in the homeless population. To our knowledge, homeless related tent fire burns have not previously been studied in the literature. The aim of this study is to describe the characteristics and outcomes of tent fire burn injuries in the homeless population.

Methods: A retrospective cohort study was conducted involving two verified regional burn centers with patients admitted for tent fire burns between January 1, 2019 to July 31, 2020. Patients were identified as either domiciled or homeless based on medical records at the time of injury. Variables recorded include demographics, injury characteristics, hospital course, and patient outcomes.

Results: A total of 45 patients were identified. The most common mechanisms of injury were by portable stove accident (29%), assault (27%), bonfire (22%), and tobacco or methamphetamine paraphernalia-related (16%). Median percent total body surface area (%TBSA) burned was 5.5 (IQR 5.5). Maximum depth of injury was second degree in 62% (n=28) of patients and third degree in 38% (n=17) of patients. Burns to the upper extremities were present in 84% of patients and burns to the lower extremities were present in 53% of patients. Median hospital LOS was 9.5 days (IQR=10) and median ICU LOS was 2 days (IQR=4.8), with inhalation injury present in 16% (n=7) of patients. Surgical intervention was required in 40% (n=18) of patients, which included debridement, skin grafting, and escharotomy. In-hospital mortality occurred in 5% (n=2) of patients.

Conclusions: Burn injuries from tent fires incur significant injury burden to an already vulnerable population, with risk factors that predispose them to poor burn outcomes. Injuries in our cohort were severe enough to require inpatient and ICU level of care. We saw a high proportion of injuries to the extremities, which pose functional and psychosocial challenges to the wellbeing of these patients. Further resources are needed to better prevent tent fires and care for this population.
Results: 81,507 and 21,442 unique paediatric burn patients were identified in the TriNetX and NBR databases, respectively. Overall non-survival rates were 0.62% and 0.52%, respectively. Boys had a higher incidence of mortality than girls in both databases (0.34% vs. 0.28% NBR, \( p = 0.13 \) and 0.31% vs. 0.21% TriNetX, \( p < 0.001 \)). When comparing age subgroups in TriNetX, burned children ages 5–9 had significantly increased frequency of non-survival, constituting 65% of all deaths (\( p < 0.001 \)). However, NBR data suggested that children 0–4 experience the highest frequency of mortality (\( p = 0.001 \)). However, NBR data suggested that children 0–4 experience the highest frequency of mortality (\( p = 0.001 \)). Comparison of ethnic cohorts between 2010–2015 and 2016–2020 subgroups showed that non-survival rates of African-American children increased relative to white children (TriNetX, \( p = 0.001 \)), however evidence was insufficient to conclude that African-American children die more frequently than other ethnicities (NBR, \( p = 0.054 \)).

Conclusions: Large sample size databases such as TriNetX and NBR afford sufficient statistical power to reflect relative non-survival rates in burned children. TriNetX also captures a unique demographic of burn patients not treated at ABA certified centers reporting to NBR, informing inferences on results. However, differences in reporting time periods must also be considered. Furthermore, potential ethnic disparities in paediatric non-survival outcomes were identified, meriting further investigation.
599 A Retrospective Outcome Analysis of the Involvement of Department of Child Services in Suspected Cases at a Major Regional Pediatric Burn Center
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Introduction: Cases of child abuse are an important manifestation of pediatric burns owing to their nature and all too common occurrence. In our institution, the Department of Child Services (DCS) is often frequently involved in minimally suspicious cases in conjunction with or even before the internal child protective team involvement. To our knowledge, there is no recent literature evaluating the outcome of DCS involvement in suspected cases in pediatric burn populations.

Methods: We performed a retrospective chart analysis of the pediatric burn patient database at our institution from 2017–2020. We identified 116 out of 565 patients who matched our criteria for the involvement of DCS. We collected the following information: age, race, address at time of injury, payer source, where DCS involvement was initiated, and the outcome of the investigation.

Results: We found that 20.5% of all the pediatric burn patients admitted from 2017–2020 had DCS involvement. Of the total admitted patients only 3.8% were removed from the previous caregivers. The factors that were found to be statistically significant were male sex, age under 3 years, Caucasian child with single parent and living in an urban setting. A higher incidence was noted in the capital city area compared to the rest of the state. There was no statistical difference noted among races, location of DCS notification, and payer source.

Conclusions: We conclude that vigilance and early reporting is essential in detecting child abuse. Involvement of the multidisciplinary child protection team at our institution may reduce the burden on DCS. Screening out high risk factors such as age less than 3 years old, male sex, and single parent of Caucasian race may assist in detecting the non-accidental burn victims. We will target prevention educational outreach programs to the community to decrease the occurrence of child abuse in the future.

600 Social Determinants and Their Impact on Burn Surgery Outcomes
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Introduction: To our knowledge, no studies have been conducted assessing the social determinants of health and the impact on the outcomes for burn patients. Such studies are needed considering burn injuries are associated with high costs, severe psychological impact, and a high burden placed on the healthcare systems. The burden is hypothesized to be aggravated by the increasing amount of diabetes and obesity seen in the general population which put patients at increased risk for developing chronic wounds. Studies have shown that several socioeconomic status (SES) factors are associated with increased risk of burns, but none have documented the outcomes of burn patients based on their social determinants of health. In our study, we will be comparing patients in the burn ICU (BICU) to patients in the surgical ICU (SICU). The purpose of this comparison is to evaluate whether the same social determinants of health have similar influences in both groups.

Methods: We performed a retrospective analysis of population group data from patients admitted to the BICU and SICU from January 1, 2016, to November 18, 2019. The primary outcomes were length-of-stay (LOS), mortality, 30-day readmission, and hospital charges. Pearson’s chi-square test for categorical variables and t-test for continuous variables were used to compare population health groups.

Results: We analyzed a total of 487 burn and 510 surgical patients. When comparing BICU and SICU patients, we observed significantly higher mean hospital charges and LOS in burn patients with a history of mental health (mean difference: $42,756.04, p=0.013 and 7.12 days, p=0.0085), ESRD ($57,812.47, p=0.0047 and 78.62 days, p=0.0104), sepsis ($168,825.19, p<0.001 and 20.68 days, p=0.0043), and VTE ($63,992.41, p<0.001 and 72.9 days, p=0.002). Also, higher mortality was observed in burn patients with ESRD, STEMI, sepsis, VTE, and diabetes mellitus. Burn patients with a history of mental health, drug dependence, heart failure, and diabetes mellitus also had greater 30-day readmissions rates.

Conclusions: This study sheds new knowledge on the considerable variability that exists between the different population health groups in terms of outcomes for each cohort of critically ill patients. It demonstrates the impacts of population health group on outcomes. These population groups and social determinants have different effects on BICU versus SICU patients and this study provides supporting evidence for the need to identify and develop new strategies to decrease overspending in healthcare. Further research to
develop relevant and timely interventions that can improve these outcomes.

### Introduction

Hair braiding that incorporates synthetic extensions has increased in popularity across all age groups. During the styling process, the ends of the braid are commonly dipped in hot water. As a result of this practice, an increasing number of patients have presented to our Burn Center after containers of recently boiled water are accidentally tipped over and spilled onto patients. Here, we report on patient demographics, outcomes, and our experience managing this injury pattern.

### Methods

A retrospective chart review was performed of all patients who sustained burn injuries associated with at-home hair braiding presenting to an ABA-verified Burn Center between January 1, 2006 and July 31, 2020. Data on patient demographics, injury characteristics, wound management, and burn outcomes was collected.

### Results

A total of 41 patients presented over the study period with burn injuries related to at-home hair braiding. The frequency of this type of burn increased over time, with 54% of injuries occurring in the last three years (2018–2020). The mean patient age was 7.5 years (range 0.7 – 32 years). Demographically, the vast majority of patients were under 18 years of age (90%), female (95%), and African American (98%). Seventy-three percent of injuries occurred at the patient’s home and 88% of incidents involved another person in the hair braiding process. The mean total body surface area of burn was 5% (range 1–20%). The most commonly involved areas were the back (54%), thigh/leg (37%), neck (24%), shoulder (24%), and arm/forearm (22%). Ninety percent were entirely partial thickness injuries with 10% of patients suffering some degree of full thickness injury. Ninety percent of patients required inpatient admission, and 36% of patients required at least one operative procedure. For those managed as inpatients, the average length of stay was 5.4 days (range 1–30 days). Three patients were reported to experience complications with one developing respiratory failure and two with delayed wound healing.

### Conclusions

Hair braiding, with the use of scalding water to seal and set the ends of braids, can lead to significant accidental burn injuries. At our institution, these injuries occur predominantly in young African-American females. These burns can result in acute hospitalization and the need for surgical intervention. This is the largest series of this injury type to date with trends towards increasing frequency in the most recent time period.
Concomitant Pediatric Burns and Craniofacial Trauma: A Pediatric Burn Center's Experience over 20 Years

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Introduction: Recent progress in pediatric burn care has reduced the mortality rate by 48.1% (Armstrong, 2020). Although it is well understood that mortality increases with increased number of systems involved, prior studies have not documented the effect of concomitant pediatric burn and craniofacial (CMF) trauma in pediatric patients. This retrospective cohort study is the first known to characterize presentation, management, and long-term outcomes of concomitant burns with CMF trauma in pediatric patients.

Methods: We performed a retrospective cohort study of all pediatric patients who presented at a tertiary care center between the years 1990 to 2010 with CMF fractures and burns. Patient charts were reviewed for demographics, mechanism of injury, burn characteristics (TBSA %, location, and degree), imaging and interventions, involvement of child protective services, and long-term outcome. Data was analyzed using two-tailed Student’s t tests and chi square analysis.

Results: Of the 2,966 pediatric CMF trauma patients (64.0% boys; average age 7 ±4.7 years) that were identified, a total of 10 (0.34%) patients were identified to have concomitant burn injuries. Patients with concomitant burn and CMF injuries were less likely to have sustained blunt injuries ($P < 0.0001$) and had longer hospital lengths of stay (13 ± 18.6 vs 4 ± 6.2 days, $P < 0.0001$). Approximately 60% of CMF fractures were upper-third injuries. The CMF fractures of all 10 cases (100%) were managed non-operatively. 40% were due to child abuse, 40% due to motor vehicle collisions, and 20% due to house fires. Of the four patients who presented due to child abuse, CMF trauma was incidentally found on imaging. One (13 months, female) child-abuse case was found to have 32% TBSA 2nd and 3rd degree burns to bilateral lower extremities after being submerged in hot bathtub water and had concomitant orbit/skull fractures. Two other child abuse cases presented with hand burns and concomitant nasal/skull fractures. All four child abuse patients presented in a delayed fashion.

Conclusions: Concomitant burns and CMF trauma is rare injury pattern in pediatric populations and is associated with longer hospital lengths of stay. Child abuse and motor vehicle accidents caused 80% of the cases.
outpatient setting. Additionally, an overall reduction in the number of autograft procedures was observed compared to NBR, and time efficiencies improved as the intervention time per TBSA decreases with TBSA increases. Both nationally and regionally, an increase in costs were observed.

**Conclusions:** The results suggest resource use estimates from NBR version 8.0 may be higher than current practices, thus highlighting the importance of improved NBR reporting and further research on burn center standard of care practices. This study demonstrates significant variations in burn center characteristics, practice patterns, and resource utilization thus increasing our understanding of burn center operations and behavior.

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### 604 Epidemiology and Microbiologic Profile of Pediatric Burn Patients: Eight-years’ Experience in a Tertiary Hospital

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**Introduction:** Burn injury is major morbidity and is the third most common cause of mortality among the pediatric population.

**Methods:** This study retrospectively analyzed pediatric burn admissions from a tertiary hospital in an 8-year period from 2009–2016. A total of 218 pediatric patients were reviewed for demographics, burn incidence, characteristics, cause of burn and microbiologic profile.

**Results:** There were 107 (49.08%) Infants, 47 (21.56%) Toddlers, 32 (14.68%) Preschoolers, 17 (7.79%) belonged to school age and 15 (6.88%) were adolescent. Most of the admitted patients were within the city 122 (56%) while 96 (44%) were from other localities outside the city. Scald burn was the most common cause of burn with 160 (73.39%) cases and was highest in the infant age group (49.8%). The mean total body surface area was 10%, the highest being caused by flame burn at 13% TBSA among toddlers and preschoolers having the highest total body surface area involved (12%). The most commonly involved body area is the chest (13.6%). The mean transfer time from injury to the admission of patients coming from within and outside the city was 8.8 and 28 hours respectively. The mean length of hospital stay was 9.08 days. There was also a decrease in mean transfer time and hospital stay from 2009 to 2016. Flame burn accounted for the longest hospital stay at 20.27 days. Microbiologic profile of burn wound cultures showed a predominance of gram-negative rods (90%) with *Enterobacter cloacae* and *Klebsiella pneumonia* as common isolates. Culture studies also showed amoxicillin-clavulanic, ampicillin-sulbactam, and cefuroxime have the highest resistance, while most isolates are still susceptible to Amikacin, Ertapenem, Meropenem, and Ciprofloxacain.

**Conclusions:** Patients belonging to the school-age group has the highest mean number of hospital days (27.3 days). On review of culture study results from wound tissue samples, Gram-negative rods were the most common and *Enterobacter cloacae* were the most common isolate. Antibiotics such as Amoxicillin clavulanic, ampicillin-sulbactam, cefuroxime, and ceftazidime had high resistance rates and therefore should not be initially used for patients suspecting of the infected burn wound.
Methods: The 5th edition of “Total Burn Care (TBC)”, 5th in the leading medical textbook of burn care. A study is to investigate the representation of diverse skin tones and recruitment into this field. The goal of this literature could affect management of patients with diverse standing of the diversity represented by burn related medical people of color. As representation matters, a better understanding of the diversity, and inclusion in preparing medical trainees. Increasing potential outcomes needs to be a component of educational materials. to ensure effective and thoughtful care.

Results: Six hundred and twelve videos were screened (153 videos in each search term category). A total of 20 (3.2%) of videos contained a demonstration of a risky behavior with fire. The most common content was four videos (20%) were involved real fire and 4 (20%) involved a hologram of fire. The “likes” on the videos ranged from 1.9 million to 189. The videos had been there from 6 weeks to 21 months.

Conclusions: TikTok is a fast way to disseminate videos a large number of viewers. The majority of videos with content of risky behavior around fire are of individuals which are bystanders or recruited participants by older minors. This study seeks to understand the content in social media which may lead to this risky behavior in minors.

Introduction: Racial and gender disparities in health care have been well described. The Association of American Medical Colleges states they are committed to diversity, equity, and inclusion in preparing medical trainees. Increasing attention is paid to representative diversity in the images and educational resources utilized during medical training. One recent example of this is the Instagram account, “Brown Skin Matters,” that focuses on the representation of dermatologic diseases in the skin of people of color. Nearly 40% of the population of the United States identifies as a person of color, and patients of color reflect 41% of the total burn population seen in the United States. In comparison, national data on providers suggests about 5% of the Burn Team would be people of color. As representation matters, a better understanding of the diversity represented by burn related medical literature could affect management of patients with diverse backgrounds and recruitment into this field. The goal of this study is to investigate the representation of diverse skin tones in the leading medical textbook of burn care.

Methods: The 5th edition of “Total Burn Care (TBC)”, 5th ed, DN Herndon editor, was reviewed from cover to cover. All photographs that contained people were evaluated for the number of people present and the depicted role of person present (i.e.: provider, patient or other). Each picture was considered as an isolated image, regardless of whether it was part of a series. Diversity count was assessed in a binary fashion - was the individual represented a person of color or not? Additional information was collected on the gender of providers present.

Results: 690 total individuals were identified in images in TBC. There were 3 providers of color identified in TBC images out of a total of 63 (5%); 24 providers were women (38%), of whom none were women providers of color. People of color were represented in 107 of 627 non-providers shown in TBC (17%). There were 29 patients whose skin color was unable to be evaluated due to the nature of the injury, the quality of the image or the surface area of dressings visualized in the image (5%).

Conclusions: Both patients and providers of color are under-represented in the leading textbook of burn care. Proper representation must be included in modern educational materials to better prepare providers for a diverse population of burn injured patients and appropriately address injury identification, wound healing properties, and scar outcomes. Diverse and proportional representation of potential outcomes needs to be a component of educational materials. to ensure effective and thoughtful care.

Introduction: Burn injuries in adolescents in the United States continue to occur at significant rates despite the many different programs focused on burn education and prevention. With the introduction of social media earlier in life and more social media targeting younger populations, our burn center has experienced a new class of burn injury: risky behavior promoted or encouraged as part of gaining social media popularity. Adolescents are likely the most vulnerable population in this type of risky behavior because of their access to social media and their willingness and ability to attempt the challenges, but younger children can also be burnt as bystanders or recruited participants by older minors. This study seeks to understand the content in social media which may lead to this risky behavior in minors.

Methods: We performed a term search in a popular social media application (TikTok) which included “burn”, “fire”, and “fire challenge”. We screened the top 50 most popular videos for each word search. Only videos which included footage of a person or body part being set on fire whether real or through a hologram or filters. We excluded videos showing professionals use fire (i.e. cooks, entertainers, welders, artisans), video game characters, videos with no body parts on fire. Metrics included in the social media were number of likes and number of views, as well as date posted.

Results: Six hundred and twelve videos were screened (153 videos in each search term category). A total of 20 (3.2%) of videos contained a demonstration of a risky behavior with fire. The most common content was four videos (20%) were the subject was setting one hand on fire. Two videos were pranks involving burning the pranked. Sixteen videos (80%) involved real fire and 4 (20%) involved a hologram of fire. The “likes” on the videos ranged from 1.9 million to 189. The comments ranged from 0 to 11,200. All of the authors were young adolescents or young adults. The videos had been there from 6 weeks to 21 months.

Conclusions: TikTok is a fast way to disseminate videos a large number of viewers. The majority of videos with content of risky behavior around fire are of individuals which are playing with fire or simulating playing with fire and often have no other overt agenda but to want attention and popularity. A minority of these videos are purposefully spreading risky behavior around fire as a “challenge” or “trend” to be copied by other TikTok viewers.

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Characteristics of Pediatric Burn Patients with Child Protective Services Involvement at an Academic Children’s Hospital

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Introduction: Pediatric burns are typically accidental, but burns caused by caregiver abuse/neglect represent a significant proportion of patients. Literature on risk factors most associated with these injuries include younger age, male, African American, and larger burns. This study examined child and burn injury factors that were associated with Child Protective Services (CPS) involvement at an urban, academic children’s hospital.

Methods: At this institution, decision to report a burn patient to CPS is determined by a multi-disciplinary medical team. Criteria for referral is multifactorial and may include burn patterns consistent with forced immersion, a reported mechanism that does not match the burn pattern or the patient’s developmental capabilities, concern for lack of supervision, or a delay in seeking medical care. Data from inpatient admissions over a 3-year period (July 2016 – June 2019) were extracted from hospital charts, and analyses (chi-square, t-tests) examined age, sex, total body surface area (TBSA), burn severity, length of stay, insurance type, race/ethnicity, and whether a CPS report was made (i.e., yes/no). Records for the outcome and disposition of the CPS case, such as whether the CPS investigation confirmed the abuse/neglect allegations, were not readily available as the law requires confidentiality.

Results: 389 children were admitted for burn treatment. 80% had partial-thickness burns; 33% White, 43% Black, 62% male; 10% had CPS involvement. 72% had Medicaid/government insurance, 23% had private/commercial, 4% were uncovered, and 1% insurance status unknown. Medicaid/government insurance was overrepresented among burns compared to other inpatients at the hospital (72% vs 51%). Consistent with previous findings, CPS reports involved children who were younger (2.8 vs 4.8 years), had greater TBSA (8.4% vs 4.9%), and had longer admissions (7.5 vs 3.0 days). Children with Medicaid/governmental or no insurance were more likely to have CPS reports than commercial/private insurance (97% vs 3%). Importantly, contrary to prior findings, child sex, child ethnicity, and burn thickness were not significantly different between children with and without CPS reports.

Conclusions: Younger children with bigger burns and longer admissions were most associated with CPS involvement. Historical findings on risk factors of male sex, African American ethnicity, and greater burn thickness were not replicated. Prior literature may not be generalizable to many settings; the current study provides an important update. Further research is needed to examine outcomes of CPS involvement and long-term patient health outcomes. Findings are limited to only urban, inpatient pediatric burns.
**608 Perceived Burnout among Burn Surgeons: Results from a Survey of American Burn Association Members**

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**Introduction:** Burnout is a significant and increasingly recognized issue. We aimed to investigate burn surgeons’ (BSurg) perceptions regarding burnout, contributing factors, and implications to better identity possible targeted interventions.

**Methods:** A 42-question anonymous online survey was distributed by the ABA to BSurg members. Respondents included BSurgs in university or non-university hospital settings.

**Results:** Experience of burnout was reported among 89.8% of university and 84.6% of non-university hospital affiliated respondents. After adjusting for confounders, university BSurgs exhibited higher risk of perceived burnout compared to non-university settings (aOR 1.081, 95%CI:0.237,4.937). Women BSurgs were at 5 times higher risk of reporting burnout compared to men (aOR 5.048, 95%CI:0.488,52.255). BSurgs aged 40–44 had twice the risk of reporting burnout as ≥50 (aOR 1.985, 95%CI:0.018,216.308). Practicing for 21–30 years had 12 times higher risk of reporting burnout than practicing >30 (aOR 12.264, 95% CI:0.611,246.041). Those working < 50 hours/week reported burnout more frequently than those who work ≥80 hours/week (aOR 2.469, 95% CI:0.80,76.662).

**Conclusions:** Overall reports of burnout were high amongst burn surgeon respondents. Those with 21–30 years of clinical practice were at significantly higher risk of reporting burnout despite believing that their colleagues’ burnout was more frequent than their own. Interventions addressing perceived burnout in younger burn surgeons may be limited by lack of participation due to fear of repercussions from administration or peers. Future administration-led burnout initiatives should acknowledge the differences between burn surgeon groups and offer resources unique to the individual physician’s needs for burnout prevention to be successful.

**609 Combined Physical, Occupational, and Psychotherapies in the Holistic Care of the Burn**

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**Introduction:** Burn patients often experience pain and fear of the recovery process, negatively impacting their engagement in necessary treatments for maximal functional outcomes. Patients routinely exhibit aversions toward physical and occupational therapies (PT and OT). As a result, therapists have been tasked with managing the patient’s psychological reactions while simultaneously providing rehabilitation. We developed a program for our psychologist to co-treat patients with burn physical and occupational therapists to directly address the painful or feared aspects of burn recovery. These multidisciplinary visits offer in-vivo interventions for managing patient distress and allows therapists the ability to focus solely on their specialized interventions.

**Methods:** This program has been active for 12 months and was created during therapy to aid a patient with high distress during PT and OT. Therapists now work with psychology to co-treat improving patient engagement in rehabilitative interventions. During co-treatment, the patients are able to engage in PT and OT more effectively and achieve short-term goals. The burn center psychologist and therapists have developed an interventional method to explore potential generalization of co-treatment effectiveness. Patients are identified based on high need for psychological support during therapy sessions. Each patient case is reviewed and discussed to develop individualized treatment plans and establish goals. Through qualitative review of each co-treatment visit, common barriers have been identified as well as strategies to improve engagement and compliance.

**Results:** The common barriers encountered had a high association with a history of traumatic experiences and avoidant coping/low distress tolerance. The most effective co-treatment interventions included: collaboratively setting patient goals with PT, OT and psychology; scheduling patient therapy with burn psychology in advance; teaching distress tolerance skills to manage anticipatory and in-vivo distress related to rehabilitation.

**Conclusions:** Treating the emotional aspects of burn recovery during moments of acute distress is integral for holistic patient care. This multidisciplinary approach offers patients increased involvement through collaboratively tailored treatment planning and improved ability to tolerate distressing aspects of recovery. Additionally, therapists were taught various approaches to improve patient engagement and adherence.
Effects of Burn Related Factors on Pediatric Burn Survivors’ Quality of Life: A Review of PROMIS Peer Relationship Survey Scores

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Introduction: Care of the burn injured child is complex and highly individualized as no two burn injuries are exactly alike. In order to assess our outcomes in treating these children we have integrated the use of the Patient Reported Outcomes Measurement Information System (PROMIS), a standardized, valid and reliable PRO tool funded by the National Institute of Health (NIH) into our clinical practice in order to evaluate aspects of the patient’s health-related quality of life. The PROMIS pediatric assessment was developed to capture self-reported anger, depression, peer relationships, pain, and physical function. This study specifically assessed the PROMIS Pediatric Peer Relationship summary scores in burn survivors to assess quality of life. The goal of this study is to examine the relationship between such quality-of-life outcomes and burn injury related factors.

Methods: Following IRB approval, we performed a retrospective review of children with burn injuries who had completed the PROMIS at our institution between 2017 and 2019. Data collected includes patient demographics, burn injury information, PROMIS peer relationship T-scores and time since injury. Statistical analysis was conducted using chi-square, t-test, ANOVA, or Pearson’s correlation coefficient. The PROMIS Peer Relationships Pediatric Item Banks assess self-reported quality of relationships with friends and other acquaintances. A standardized score, or T-score, of 50 is the average for the United States general population with a standard deviation of 10. A peer relationships T-score of 60 is one standard deviation (SD) above the average while a T-score of 40 is one SD below the average. A higher T-score correlates to a better social health.

Results: 164 pediatric burn patients completed 159 initial surveys. Burn injuries (n=164) consisted of the following types: contact (n=16), electrical (n=10), fire/flame (n=75), and scald (n=63) with approximately equal representation of females (n=81) and males (n=83). The mean age at injury was 6.9 years (median 6.4) with a mean burn TBSA of 21.8% (median 15.0). On average, the initial peer relationship score was 50 (median 49). Gender, type of injury, injury age, total TBSA, hospital days, ICU days, ventilator days, OR visits, and months since injury did not significantly affect the initial PROMIS score measurement.

Conclusions: This study of pediatric burn patients from a single US burn center during follow-up demonstrates that burn injury related factors appear to have no statistically significant effect on initial PROMIS Pediatric Peer Relationship score measurements. In addition, on average survivors have a quality of life as it relates to peer relationships that is on par with the US general population.

Measuring Health Outcomes in Pediatric Burn Survivors: A Systematic Review

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Introduction: Acute burn injuries often result in chronic sequelae that affect functional and psychosocial outcomes. Few prior reviews on pediatric populations report on outcomes across multiple domains. The aim of this systematic review was to identify study characteristics and design of published burn literature that focus on the impact of burns on physical and psychosocial outcomes.

Methods: We included literature published after 1980, focusing on multifunctional burn outcomes in children aged 5–18 years. PubMed and Web of Science were searched with keywords covering broad and domain specific terms (e.g., “pediatric burns”, “outcomes”, “psychosocial recovery”) along with a manual reference check. After screening 751 potential abstracts, each eligible study was systematically reviewed using the McMaster Critical Review Form and assigned a score by two coordinators. Dyad discussions resolved inconsistencies. Extracted data elements included study designs, participant types, measurements, outcomes, clinical and demographic information, and main findings of each study.

Results: Sixty-two studies met inclusion criteria, and outcomes were classified into physical (n=31), psychological (n=53), and social (n=38) domains. The majority of studies were cross-sectional designs (n=33) and received a complete critical review score on all applicable categories (n=42). Study population ranged from six to 678 patients. Half of the studies did not have a comparison group. Patient- and parent-report measures were used in 43 and 41 studies respectively, with 25 studies using both types of measures. Across 62 studies, 85 different measures used, with only nine used in more than three studies. Parents and children generally reported better functioning in social and physical domains compared to age-matched groups, and worse psychological outcomes compared to non-burned population. Physical disabilities were associated with psychosocial functioning in 16 studies. Physical and social functioning improved where follow-up data was reported in six studies. Examples of selected factors that significantly impacted physical and
psychosocial outcomes across domains included burn size, pain and itch, visible scars, body image satisfaction, athletic competence, peer relations, and adjustment skills.

**Conclusions:** This review demonstrated important associations with physical health and psychosocial status as outcomes. Additionally, there is a need for a standardized burn-specific measurement tool. These findings are relevant to burn clinicians and researchers to understand pathways and outcomes that affect quality of life in pediatrics post-burns.

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**612 Non-burn Injuries in the Emergency Department as Indicators for Future Burn Abuse**

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**Introduction:** Thermal burns are a common form of child abuse. They account for up to 20% of all abuse cases reported and are a significant cause of morbidity and mortality. It is imperative that healthcare professionals maintain a high degree of vigilance recognizing signs of abuse, however subtle they may be. This is necessary to protect these vulnerable patients and prevent further injury. Our study seeks to identify predictors of future abuse in patients presenting to the emergency department. This might allow us to identify at-risk patients and employ earlier interventions to prevent future harm.

**Methods:** A retrospective data review was conducted on all pediatric patients admitted to our burn center between 2008–2018 who were also suspected victims of abuse. Data collected included patient demographics, length of stay, size of the burn, type, degree and location of burn, number of previous emergency room visits, and patterns of injury during previous emergency room visits. Abuse was suspected and investigated if the history was inconsistent with the injury or if it changed, if there was an unreasonable delay in seeking medical care, or if the patient was discharged to an alternative caregiver. Data was analyzed with SPSS Statistics version 10.

**Results:** Out of the 5915 total burn admissions between 2008–2018, abuse was suspected and investigated in 297 cases and confirmed in 131 of those suspected. Patients admitted for suspicious burn injuries had an average of 1.82 (SD=3.15, Min=0, Max=25) previous ED visits. Of these patients, 93.6% had medical insurance, 80.5% had a primary care physician, and 72.7% were up to date with their immunizations. The majority presented with 2nd degree burns (86.5%) and the most common mechanism of injury was scald (60.1%). Pediatric patients with confirmed abusive burn injuries had longer hospital length of stay (9.23 days vs. 3.90 days, p< 0.001), and had greater total body surface area burned (9.24% vs 4.71%, p=0.001). Significant indicators of abuse included burn injuries to the bilateral lower extremities (thigh and legs) (p< 0.001), bilateral feet (p=0.030), buttocks (p=0.047), and genitalia (p=0.018), as well as signs of abusive non-burn injuries during previous emergency room visits (p=0.005).

**Conclusions:** Non-accidental burns should be highly suspected in children presenting with injuries to the bilateral lower extremities, bilateral feet, buttocks, or genitalia, or those with a history of previous non-burn injuries suspicious of abuse. Furthermore, patients with non-burn injuries had more extensive burns and longer lengths of stay in the hospital.
Introduction: Bibliotherapy is the use of books as a therapeutic intervention for structuring interaction between facilitator and participant based on the mutual sharing of literature. Bibliotherapy has been utilized to address childhood teasing, healthy lifestyles in children, and eating disorders. With the dramatic improvements in survival of burn patients over the past decades, bibliographies and novels featuring pediatric burn survivors have emerged. These patients often face significant barriers in accessing psychosocial support. Our team hypothesized that bibliotherapy could benefit pediatric burn patients. In order to test this hypothesis, as a first step, our team conducted an assessment of the available burn survivor literature.

Methods: WorldCat book database was queried using the terms “Burn Patient Fiction” (45 results) and “Burn Patient Biography” (53 results). The authors identified 12 books out of these 98 results likely to be appropriate for adolescent and teenage burn patients based on the brief summaries. The 12 books were then read by the research team and analyzed for burn patient demographics and relevant clinical data when available. Simple descriptive statistics were utilized for numerical data.

Results: Out of 12 books read, 5 were biographies & 7 fictional novels. Protagonists mean age at time of injury was 8.7±5.1 years (range 2–16), with 5 males and 7 females. Average injury size was 57±21% TBSA (range: 14–85). 10 of 12 protagonists suffered facial burns; 7 of 12 suffered hand burns. Oral health/dental issues were described in 4 of 12 books. Geographically, these English language novels spanned Australia (1), Canada (92), and the U.S. (9). Average page length was 237±88 pages (range: 64–372).

In 11 of 12 books, mechanism of injury involved flame from car accidents (2), house fires (4), and campfires (2). With regards to sources of positive support during the recovery phase, family was the most commonly cited source (11 novels) followed by friends (10), spiritual/religious support (5), sports (3), burn survivor groups (3), hospital psychiatrists (3), and performing arts (2).

Appropriate audience group for most books were teenagers (11) with 5 books deemed also appropriate for adults (only 1 book judged appropriate only for adults), and 2 books appropriate for adolescents.

Conclusions: Several novels and biographies with pediatric burn survivor protagonists have been written over the past 20 years. Commonalities across these books include flame burn etiology, relatively large TBSA, and burn injuries to visible body areas (face and hand). Family and friends were the most common emotional support for these protagonists. Most books were appropriate for teenagers.
The Effects of the COVID-19 Pandemic on Implementation of a Psychological Distress Screening Program after Burn Injury

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Introduction: The relationship between psychiatric conditions and burn injury is complex, as disorders in thought or mood can both predispose to as well as result from thermal injury. We sought to describe our center's experience with implementation of a psychological distress screening program in the run-up to and during the COVID-19 pandemic.

Methods: We undertook an analysis of de-identified data as part of a quality improvement review focusing on the results of psychological screening of our outpatient burn population. In the spring of 2019, our verified burn center implemented an outpatient screening program consisting of a registered nurse administering three validated test to screen for Post-Traumatic Stress Disorder screen, depression and anxiety, and problematic alcohol consumption to all patients at the time of physically checking in for their first burn clinic appointment. All outpatients triggering a positive screen are subsequently referred to the burn unit PsyD while a negative screen results in monthly repeat screenings until discharge from the burn clinic or a positive screen, whichever comes first. We analyzed data from the last twelve months of normal outpatient workflow. Loess regression was used to analyze the monthly proportions of patients screening positive.

Results: During the peak of COVID-19 in our region, clinic staff were reduced, and screening procedures suspended for the months of March and April 2020. Therefore, the study period consisted of 01 July 2019 to 31 August 2020. A median of 36.5 screens were conducted per month [interquartile range 27.75, 44.75]. Of these screens, 26.5% were positive, with 94.2% successfully referred to the burn unit's postdoctoral fellow. The Loess regression showed the proportion of patients screening positive for psychological stressors from July 2019 until a peak in November 2019. A downtrend was then noted in the proportion screening positive from December 2019 to date (Figure).

Conclusions: Psychological stressors are prevalent in burn outpatients. We attribute the decrease in positive responses beginning in December 2019 to a combination of a decrease in the frequency of repeat administrations of the screening test in patients after screening positive, and a reluctance of anxious patients to present to the burn clinic for fear of COVID exposure while at the facility.
Young Adults Burn Survivors - Key Challenges They Faced While Growing Up

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Introduction: There is a paucity of research regarding the challenges faced by young adults (YA) who matured with burns. It is well documented that acute burn care is laden with painful surgeries/dressing changes, gruesome physical/occupational therapies, anxiety and time away from family & friends. However, the specific issues young adults burned as children find most challenging remain largely unknown. This study sought to provide YA survivors with an opportunity to describe the difficult issues they endured.

Methods: Burn surviving youth responded to the open-ended statement “The hardest thing about being burned is…” Seven themes were derived from their responses: People Staring at Me, Being Bullied, Remembering When I was Burned, Having Additional Surgeries, My Scars, Getting Questions About My Burn, & the Pain & Itching. Young adult survivors were asked to rate each item on a 4-point scale from (1) Not at all to (4) Really a lot.

Results: Participants were YA survivors (n=64) mean age 19.1 years, female (62%) male (38%), average age at burn of 6.4 yrs. Sixty-eight percent reported both visible & hidden scars; 25% had a TBSA > 50%. Sixty-six percent were minority race/ethnicity. More than half of respondents reported issues with My Scars (65%), Remembering the Burn (52%) and Pain & Itching (50%). People Staring and Bullying has been bothersome for over 70%, 72% reported Being Bullied and 71% noted People Staring. The highest 5 means among YA subgroups included: Participants with hand scars- Being Bullied (2.6), those with visible scars - My Scars (2.6). Those reporting both facial & hand scars endorsed People Staring (2.4), youth with a TBSA ≥ 50% - Being Bullied (2.4) and with visible scars - Remembering the Burn – (2.4). Youth with both facial & hand scars had greater issues with Pain/Itch (p=0.03).

Conclusions: This study provides insight into problems encountered by maturing burn survivors and discloses the more challenging issues they endured. These data can assist burn centers, camps, and psychotherapists in discussing potential survivor issues and suggest interventions to help burn-injured youth respond to challenges. Special consideration should be given to girls, those with facial/hand scars, large TBSAs and visible scarring.

Who Benefits the Most from Burn Camps?

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Introduction: Burn camps provide a unique environment and activities for children that have experienced a burn-injury. Positive outcomes from attending burn camp include increased self-esteem, decreased feelings of isolation and a greater sense of self-confidence. In a 3-year retrospective review of camper evaluations from one of the largest and longest running week-long burn camps in the nation for ages 5–17, we aimed to assess if a child’s gender, age, TBSA or ethnicity affected the impact that burn camp had on a child.

Methods: A 3-year retrospective review of a Burn Camp’s camper evaluation forms was conducted for campers that attended burn camp between 2017–2019. Camp rosters were reviewed to determine the camper gender, age, TBSA and ethnicity. Camper self-evaluation forms completed at the end of each camp session were reviewed to record camper responses to questions regarding their opinions on the impact camp had on them as well as how camp will impact their lives once they return home. Categorical variables were summarized as frequency and percentage, and continuous variables were described as median and range. To check the relationship between two categorical variables, Chi-square test was used. To compare the continuous variable among groups, Kruskal-Wallis ANOVA was used. Statistical significance was declared based on a p value< 0.5.

Results: Within 2017–2019, there were 413 camper records. Participants’ demographic characteristics are summarized in Table 1. There were 208 males (50.3%) and 205 females (49.6%). The median age of campers were 11.86, 12.44 and 12.45 for 2017–2019, with the range from 5.16 years to 17.96 years. The median TBSA were 20, 20 and 18 for 2017–2019, with the range from 0.08 to 90. Collectively there were 47.7% Hispanic (n= 197); 24.2% Whites (n=100); 13.1% Black (n= 54); 4.6% Asian (n=19) and 7.7% Other (n=32). There were 395 camper self-evaluation forms submitted. Results of three questions there we were interested in are summarized collectively in Table 2. 57% of campers responded, “Yes, Definitely” to the question “After going to burn camp will help you when you return home?” and 51% responded “Yes, Definitely” to the question “Did you learn anything that will help you when you return home?”

Conclusions: In analyzing the camper responses, there was no statistically significant difference in responses comparing gender, age, TBSA or ethnicity.
Clinical and Humanistic Burdens of Pediatric Burns: A Systematic Literature Review

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Introduction: Children face long-term clinical and psychological sequelae from burn injuries. This review summarizes the scientific literature on the clinical and humanistic burdens of pediatric burns.

Methods: A systematic review of literature published between Jan 2015 and Jun 2020 was conducted based on PRISMA guidelines in Embase, Biosis, and MEDLINE to identify publications examining the clinical, humanistic, economic, and/or epidemiologic burdens of illness associated with pediatric burns in the US.

Results: Of 2,286 unique articles identified, 28 met eligibility criteria. This analysis focused on studies relating to the clinical (n=8) and humanistic (n=9) burdens of pediatric burns. Across all studies, flame and scald were the most common burn etiologies. Among the 8 clinical studies, several evaluated outcomes (n=2) or treatments (n=3) in predominantly graft recipients. One study found that 64% of pediatric split-thickness autograft recipients exhibited hypertrophic scarring (HTS) at the donor site. Other variables (time to re-epithelialization, donor-site harvest depth, harvest in an acute burn care setting, thigh donor-site location) were associated with increased risk of HTS. An increase in percentage total body surface area (%TBSA) burned corresponded to increased number of autograft procedures, risk for HTS, and viral infection risk. Other reported outcomes included infections (eg, healthcare-associated, wound, viral), pain, inhalation injury, and sepsis. One study found that while the frequency and intensity of pruritis decreased over time, 63% of children continued to report symptoms at 2 years after injury. Among the 9 humanistic studies, 4 reported larger %TBSA corresponded to worse health-related quality of life assessed by various instruments. In a study of patients under age 5 with burns, Burns Outcomes Questionnaire (0–4) scores improved over time in multiple domains. In youth with a history of burn injuries, patient-reported pain interference with daily living was significantly associated with decreased physical functioning, depression, and impaired peer relationships. Two studies assessed caregiver burden, with one study finding that 19% of caregivers self-reported clinical or at-risk levels of distress following the child’s burn injury.

Conclusions: Pediatric burns place a substantial clinical and humanistic burden on patients and their caregivers. While outcomes appeared to improve over time, clinical and humanistic consequences of pediatric burns endured. More research on novel treatment products and procedures is needed to reduce the burden of burns for this population.
Introduction: 2020 brought numerous challenges for burn survivors and their families. This project assessed the impact of two major global / national phenomena, specifically the impact of a) COVID-19 and b) local / community / national actions around racism and policing on child and youth burn survivors and their families.

Methods: Our burn camp program moved to a virtual format for 2020. Campers (ages 8 – 18) and their caregivers / parents completed questionnaires about their year, rating and specifying the personal impacts of these phenomena. They rated how their year has been overall and selected "what has helped you get through tough times". 47 campers and 47 caregivers / parents participated.

Results:

Impact of COVID-19
The majority of youth rated the impact of COVID-19 as "somewhat" to "highly" (78%), while the majority of caregivers rated "somewhat" (64%). Campers and caregivers identified the following impacts most often and to similar degrees: Online school/virtual learning, Friends/Social, Sports/Activities, Quarantine, Isolation, Worries, Quality time with family. Caregivers also highlighted: Getting creative at home and Uncertainties.

Impact of local / community / national actions around racism and policing on you and your family
The majority of campers and caregivers rated the impact as "Somewhat", "Very Little" or "Not Impacted" (86%), although participants rating higher impact also provided moving personal experiences.

What has helped you get through tough times this year
Over 85% of campers and caregivers / parents rated their year overall as "OK" or "Pretty Good".

Campers and caregivers endorsed Family, Friends, Faith, and What I learned recovering from my burn injury as factors helping them get through tough times.

Conclusions: Children, youth, and families who have experienced a burn injury report both negative and positive impacts from the global and national phenomena of COVID-19 and local / community / national actions around racism and policing. Not all youth and families are equally impacted. Family and friends were the greatest sources of support during tough times. One burn survivor family indicated that what they learned recovering from burn injury has helped them through this challenging year – "I have learned to just adapt and change because anything can happen at any point." Most burn survivors and their families indicate the year has been "OK" or "pretty good". Connection through burn camp provided the opportunity to share the impacts, but also the strengths and resiliencies in our burn community.

Introduction: In the wake of Hurricane Maria, many US hospitals experienced massive drug shortages requiring substitution with alternative therapies. Our regional center experienced an increased incidence of Carbapenem-Polymyxin-Quat-Resistant Acinetobacter baumannii (CPQRA) infections, compared to a previous year of no infections. Here we describe a successful interdisciplinary approach to its eradication.

Methods: We conducted a retrospective review of CPQRA outbreaks for November and December 2018 in the burn ICU. De-identified data was collected and analyzed. In collaboration with the state's department of health and epidemiology section, whole-genome sequencing was carried out on bacterial isolates. In addition, we instituted adenosine triphosphate (ATP) monitoring on all surfaces, a process of rapidly measuring actively growing microorganisms.

Results: Resistant Acinetobacter was isolated from five ICU patients, two of whom died with CPQRA bacteremia, producing a case-fatality rate of 40%. The two cases that died both suffered traumatic injuries with multiple fractures in addition to an average TBSA of 58%. Non-fatal cases suffered no other traumatic injuries and had an average TBSA of 51%. During this period, gentourinary irrigant (neomycin-Polymyxin B) and polymyxin ointment were the primary topical agents for wound care. Whole genome sequencing revealed a qacEdelta1 positive strain and identified the primary source as a patient that returned from a long-term care facility carrying the converted A. Baumannii infection. ATP testing also showed increased levels in patient rooms and surgical suite.

Conclusions: As a result of these findings, we achieved eradication by developing new and reinforcing traditional practices of infection control. This included UV light therapy to all ICU rooms and surgical suite, oversight of environmental services procedures, rigorous enforcement of hospital infection control procedures, auditing hand hygiene, increased efforts in antibiotic stewardship and discontinuing Polymyxin containing topicals. By January 2019 there were no new cases of CPQRA in the ICU. This study shows that the resistance and rapid spread of CPQRA can be controlled with the cooperation of hospital staff, environmental services, infection control, pharmacy, and the state’s department of health. With the coordinated efforts of all parties, we were able to successfully eradicate a virulent and fatal resistant A. baumannii strain.
Introduction: Follow-up appointments are important after a burn injury to minimize adverse sequelae. A retrospective study at our institution revealed that over 25% of patients never attend a follow-up appointment. Failure to follow-up was associated with homelessness, drug use, and distance to the clinic. The purpose of this study was to design and administer a survey prior to discharge that seeks to identify patient-perceived barriers to follow-up.

Methods: A multidisciplinary team consisting of a burn surgeon, medical student, discharge planner, and social worker developed an 18-question survey that examined areas that might influence following up in burn clinic. There were questions regarding transportation, living situation, motivation to return for follow-up, homelessness, drug use, and social determinants of health. As a quality improvement project the surveys were administered to patients discharged following a burn injury by either the discharge planner or social worker from September 2019 to July 2020. Statistical analysis included descriptive statistics of survey responses.

Results: There were 473 patients discharged during the study period. A total of 342 patients completed surveys (72.3% response rate). Most patients (208, 60.8%) were very confident that they would come to a follow-up appointment and stated they had no obstacles to keeping their appointment. The most common obstacles stated were: transportation (143, 41.8%), cost (100, 29.2%), and time off work/school (70, 20.5%). The planned mode of transportation to appointments was being driven by someone else in a personal car (234, 68.4%), the second most common response was that they were unsure of their transportation (29, 8.5%). Patients traveled a great distance to come to the clinic with 188 patients (55%) traveling more than one hour. The most frequent discharge location was the patient’s home (169, 49.4%), with the second most frequent being the home of a friend or family member (95, 27.8%). Sixty-two patients (18.1%) were homeless at the time of admission. When asked about their motivation for following up in clinic the most common response was concern about their injuries/healing (269, 78.7%). The most common levels of educational attainment were high school (149, 43.6%) and College (114, 33.3%). The most common employment status was unemployed (131, 38.3%) and 141 patients (41.2%) made less than $25,000 per year. With respect to substance use, 171 (50%) patients used alcohol, 151 (44.2%) patients smoked, and 82 (24%) patients used illicit drugs.

Conclusions: Many patients are motivated to come to their follow-up appointments but face significant difficulties in coming to appointments due to distance to the clinic, transportation, and cost issues.
Enhanced Recovery After Surgery for Fractional CO2 Laser Treatment of Burn Scars

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University Medical Center New Orleans, New Orleans, Louisiana; University Medical Center New Orleans, New Orleans, Louisiana; University Medical Center of New Orleans Burn Center, New Orleans, Louisiana; University Medical Center New Orleans, New Orleans, Louisiana; University Medical Center New Orleans, New Orleans, Louisiana; University Medical Center New Orleans, New Orleans, Louisiana; University Medical Center- New Orleans Burn Unit, New Orleans, Louisiana; Louisiana State University Health Science Center & University Medical Center New Orleans, New Orleans, Louisiana; Louisiana State University Health Science Center & University Medical Center New Orleans, New Orleans, Louisiana; Louisiana State University Health Science Center, River Ridge, Louisiana

Introduction: Healthcare systems have adopted enhanced recovery after surgery (ERAS) programs as evidence-based, multimodal, and multidisciplinary perioperative approaches to mitigate complications and improve early recovery. ERAS programs modify psychological and physiological response to surgery with standardized care pathways that range from preoperative assessment and education through pharmacologic and surgical interventions. Our study demonstrates a burn scar specific ERAS protocol with pre- and post- intervention outcomes.

Methods: As part of a quality and performance improvement initiative, a multidisciplinary panel at an ABA-verified burn center consisting of burn nurses, burn surgeons, burn physician assistants, burn therapist, clinical pharmacist, certified medical laser safety officer, and anesthesiologist reviewed the available literature regarding pain, laser treatments, and medication histories of prior fractional CO2 laser treatments. The ERAS program was designed with preoperative, perioperative, and postoperative interventions to reduce pain and complications defined as unscheduled visits/admission to the ER or burn center, narcotic administration >1 hour post procedure, or wound complications secondary to laser treatment requiring dressing changes >1 week post-procedure. Quality and performance metrics were collected as a component of the burn registry program and reviewed twice monthly. The ERAS protocol preoperative phase included standardization of outpatient screening, assessment, and electronic medical record documentation. The perioperative phase included standardization of preprocedural medications including multimodal analgesia. The intraoperative phase included standardization of medications and dressing application. Post procedural phase included standardized instructions for wound care and follow-up.

Results: Pre-implementation complications over a three-month period included one patient requiring wound care >1 week post laser treatment and 4 patients requiring narcotic administration >1 hour post procedure (16% of laser cases). Post-implementation of the ERAS program no complications were identified in 62 cases over a three-month period.

Conclusions: At our institution a burn scar specific ERAS protocol reduced perioperative complications following fractional CO2 laser procedures. While many opportunities exist to improve scarring and pain, the multidisciplinary approach in burn care is as essential for outpatients as it is for inpatients at reducing avoidable complications.
623  Procedural Pain Management in Burn Patients – A Quality Improvement Project
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Introduction: Achieving adequate burn pain control in patients is paramount as inadequate control can lead to PTSD, suicidal ideation, and depression. The pain accompanying hydrotherapy can be extreme and challenging to manage. The purpose of this quality improvement project was to assess our burn center’s current nurse-driven procedural pain control protocol during hydrotherapy.

Methods: Burn patients admitted from June to August 2020 who underwent hydrotherapy were observed during the procedure. Demographics, comorbidities, injury related data, and pain and sedation medication data were collected. Pain scores (1–10), patient and nurse satisfaction scores (1–10) were collected before, during, and after hydrotherapy. A single patient could be surveyed for up to three times. Paired t-tests and one-way ANOVA were performed to assess significant differences between pre- and post-procedure patient pain scores and satisfaction ratings across encounters, respectively. P < 0.05 was considered significant.

Results: Twenty-eight patients and 48 hydrotherapy events were surveyed. Patients were predominately male (23, 82.1%), middle aged (44.8 ± 19.6), and had a TBSA of 11.9 ± 10.5%. Analyzing only the first hydrotherapy sessions, time from initial opioid dose to hydrotherapy varied greatly as did the opioid morphine equivalent dose (OME) provided prior to hydrotherapy (Table 1). Only 13 (46.4%) subjects received versed during hydrotherapy. Pain scores post-procedure significantly increased compared to pre-procedure scores (5.39 vs. 6.32; p = 0.035). There was no significant difference in patients’ or nurse’s satisfaction scores regarding pain control nor with nurse’s rating of ease of procedure when comparing scores across the three encounters (Table 1). No adverse events (SaO2 < 92% or deep sedation RAS < 2) were observed across all encounters.

Conclusions: Our results suggest that procedural pain control during hydrotherapy, while safe, has opportunities for improvement. Pre-procedural medication timing remains imprecise and widely divergent. Satisfaction scores, while high, also have room for improvement. Finally, pre-procedural pain control is unacceptable (mean 5.39) and requires attention.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Population (n = 280)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-hydrotherapy OME (median, range)</td>
<td>16, 1.6-37</td>
<td></td>
</tr>
<tr>
<td>Time from pre-hydrotherapy opioid to hydrotherapy (min, median, range)</td>
<td>66, 26-193</td>
<td></td>
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<td>Patient satisfaction Encounter</td>
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<td>0.18</td>
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<td>1 (n = 28)</td>
<td>2 (n = 14)</td>
<td>3 (n = 6)</td>
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<tr>
<td>Nurse satisfaction Encounter</td>
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<td>0.06</td>
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<td>1 (n = 28)</td>
<td>2 (n = 14)</td>
<td>3 (n = 6)</td>
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<tr>
<td>Nurse Ease Score Encounter</td>
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<td>0.09</td>
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<tr>
<td>1 (n = 28)</td>
<td>2 (n = 14)</td>
<td>3 (n = 6)</td>
</tr>
</tbody>
</table>

624  A Simple Survey for Tracking Burn Wound Assessment Skill
Brian C. Wengerter, MD, PhD, Christina Lee, MD, Angela Rabbitts, MS, RN, James Gallagher, MD, FACS
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Introduction: The assessment of burn wound surgical need is a critical skill of a burn provider. In an attempt to determine whether burn wound reading by physical exam is a skill that can be measured, this article describes a simple, survey-based method developed and employed at a single, high-volume urban burn center for gauging and tracking success at predicting surgical need.

Methods: This study was conducted from August 8, 2019 to October 31, 2019. Study participants were care team providers, including attending physicians, fellows, residents and physician assistants. They were divided into expert and novice groups according to prior burn wound care experience. After in person examination of the burn wounds, participants were sent an electronic link to a de-identified survey. Survey answer choices included: 1 (surgical excision not required), 2 (unsure need for excision), and 3 (clear need for excision). Correctness was judged by whether or not the patient ultimately required surgery. Evaluation surveys that were unanimous among all expert and novice providers were excluded, as these were deemed inadequate for assessing wound reading skill. Weighted group mean success rates were calculated, and statistical analysis of the means was performed using a weighted, two-tailed t-test.

Results: During the study period a total of 112 survey events were recorded, 23 of which met exclusion criteria. The percentage of correct responses was 63±3% in the expert group (n=440 votes) and 48±15% in the novice group (n=304 votes). Weighted, two-tailed t-test analysis revealed a statistically significant difference between the expert and novice groups (p < 0.01).

Conclusions: This pilot study demonstrates that the current survey method of assessing burn wound surgical need was able to discriminate the wound reading skill of a group of expert providers from that of a group of novices, suggesting that burn wound reading is a skill that can be quantitatively measured. Further development of a formative assessment could aid in the formulation of an educational module to improve wound reading skills.
Introduction: The COVID-19 pandemic has had a profound global impact, not least on hospital functioning. Institutions have all had to prepare and adapt to a large number of admissions, and the influence on elective and emergency surgical services, including burn care, has been significant; it may be some time before we know the full extent of this. While many centers were able to commence more normal activities for a while, we are now seeing an exponential rise in cases again, with potentially catastrophic consequences for the provision of burn care.

Methods: A review of all admissions, operative cases and clinic visits between 1 April and 31 August 2020 was undertaken at an American Burn Association verified burn center. These data were compared with the same five-month period in the preceding two years.

Results: Selected data highlights are tabulated (Table 1). During the five months in question, fewer patients were admitted than the previous two years (N=81 versus 121). The mean total body surface area was slightly higher this year (13.7%), and the mean length of hospital stay longer (18 days). The male-to-female ratio of admitted patients was greater during the five months of 2020, at 2.9:1, compared to 1.7:1. No significant differences in terms of etiology were detected, however. As expected, clinic visits reduced dramatically from a mean of 160 patient visits per month to just 81 per month, with the majority conducted virtually. During 2020 the operative cases were similar in number to previous years (N=176), but the mean duration was significantly longer (190 minutes). The total time utilised for burn surgery was similar to previous years (572 hours).

<table>
<thead>
<tr>
<th>Year</th>
<th>Admissions (N)</th>
<th>Male to Female Ratio</th>
<th>Age Mean (Years)</th>
<th>Mean TBSA (%N)</th>
<th>Mean Surgery Time (Hours)</th>
<th>Mean Hospital Stay (Days)</th>
<th>Clinic Visits (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>81</td>
<td>2.86</td>
<td>47.3</td>
<td>13.7</td>
<td>176</td>
<td>190</td>
<td>18</td>
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<tr>
<td>2019</td>
<td>117</td>
<td>1.72</td>
<td>46.7</td>
<td>13.1</td>
<td>184</td>
<td>171</td>
<td>15.5</td>
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<tr>
<td>2018</td>
<td>126</td>
<td>1.74</td>
<td>46.4</td>
<td>12</td>
<td>305</td>
<td>167</td>
<td>13.6</td>
</tr>
</tbody>
</table>

Table 1. Selected burn center data comparing 2020 with 2019 and 2018.

Conclusions: This study demonstrates that although total admissions were slightly reduced, the demands on Burn ICU bed resources and burn operating time were similar. The data supports the notion that removing scheduled operating time for our service resulted in less efficient execution of acute burn surgeries and longer hospital stays. Although formal clinic visits were significantly reduced and were mainly conducted virtually, several patients were satisfied by a novel and user-friendly email service conducted by our clinic nurse specialist.

626 Female External Urinary Collection Device Utilization in a Female Burn ICU Patients: A Quality Improvement Project

Introduction: A significant portion of intensive care unit (ICU) patients require a Foley catheter during their admission. Foley use has become more criticized as nationwide quality improvement processes attempt to reduce catheter associated urinary tract infections (CAUTI). Burn patients in the ICU have a higher rate of catheter utilization due to difficult fluid management, need for accurate volume measurements, and significant wound care. Males may have a condom catheter exchanged once they are stabilized. Historically, a noninvasive alternative to the Foley has not been available for females. While the female external catheter has existed for quite some time and hospital systems are increasingly encouraging their use, there is no standard of practice for when they are best utilized. Specific to the burn population, potential barriers include body habitus, perineal burns, and pain on frequent changing of the device. Our study aims to evaluate the current female external catheter use in our burn ICU in order to develop a standard protocol to increase utilization while thoughtfully delineating the contraindications.

Methods: A quality improvement project for guidelines on the use of a female external urinary collection device was conducted. All female patients admitted to the burn ICU during 2019 were included. Data was collected on burn TBSA, anatomic location, ICU days, ventilator days, and Foley catheter days. Foley catheter days, external urinary catheter days, urinary tract infection (UTI) rates, and incidence of failure of external device were collected.

Results: Of the 46 total female burn patients, 31 required a Foley catheter at some point during their stay. 11 patients used an external urinary collection device. Of the 11 users, one urinary device had to be removed due to skin breakdown. One other patient required replacement with a Foley catheter as a result of oliguria and the need for closer fluid management. 5 of the successful users of the external catheter were clinically obese. No patients contracted a UTI while using the external catheter. 3 UTI’s developed in women while using a Foley catheter. Patients who had altered mental status and perineal wounds were not eligible to use the external catheter.

Conclusions: In our practice, we found contraindications to external female catheter use to include altered mental status and perineal wounds. Obesity was not a contraindication and device usage may be most beneficial in incontinent patients. Further investigation is needed to better optimize female external urinary collection device usage within the burn ICU setting. This may help minimize CAUTI’s among female burn patients.
**627 Strategies for Reducing Emergency Department Lengths of Stay for Admitted Pediatric Burn Patients**
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**Introduction:** Various strategies to reduce emergency department (ED) lengths of stay (LOS) for admitted pediatric burn patients may be employed as a quality improvement project. Decreasing ED LOS may promote patient outcomes and reduce morbidity. Initial discussions were brought forth during trauma and burn multidisciplinary peer review rounds in March 2019 and have persisted to present day.

**Methods:** Several strategies, such as preparation of the burn unit staff within one hour of patient arrival in ED, notification to the burn unit by the burn attending of an incoming pediatric burn patient, allowing the PICU charge nurses or advisors to assist with room set up and admissions, and creating a checklist to assist PICU nurses and advisors in helping prepare for anticipating inpatient admissions. These strategies were designed and enforced in March/April 2019. In addition to these action plans, trauma activation alerts were added in December 2019 to the burn charge nurse phone for pediatric burn trauma one and trauma alerts for more expedient communications. These strategies were designed and enforced in March/April 2019. In addition to these action plans, trauma activation alerts were added in December 2019 to the burn charge nurse phone for pediatric burn trauma one and trauma alerts for more expedient communications. Finally, communication efforts between ED and burn leadership teams were conducted in June 2020 to help with additional mitigating of ED LOS, such as discussing the appropriateness of specialty consults while in the ED.

**Results:** Initial ED LOS was reduced from 209 minutes in March 2019 to 150 minutes in June 2019. Increased trends were noted in early 2020, with a peak at 244 minutes in July 2020. Additional interventions, such as trauma activation alerts and ED/Burn team communications, did not provide sustainable long-term reductions.

**Conclusions:** Recent strategies to reduce overall ED LOS trends have been beneficial, but not consistent, in sustaining downward trends. Action to perform a gap analysis to discover persistent barriers and to introduce additional structure, such as a burn trauma one algorithm, may provide stability to this metric.

**628 Venous Thromboembolism Prophylaxis in Burn Patients: Analyzing the Effectiveness of a Standardized Protocol**
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Vanderbilt University Medical Center, Mount Juliet, Tennessee; Vanderbilt, Nashville, Tennessee; Vanderbilt University Medical Center, Nashville, Tennessee; University of Utah Health, Salt Lake City, Utah; Vanderbilt University Medical Center, Franklin, Tennessee

**Introduction:** Burn patients have a high risk of developing venous thromboembolism (VTE) due to extensive immobilization, surgical interventions, endothelial injury, and the presence of polytrauma. Studies have shown VTE rates ranging from 0.25% to 23.3% in this patient population. Although burn patients have a greater risk for VTE compared to other hospitalized patients, there are no standardized guidelines on how to approach VTE prophylaxis in the burn population. In March 2018, the Burn Intensive Care Unit (BICU) implemented a new VTE prophylaxis protocol that stratified patients based on risk factors for VTE. Patients were started on enoxaparin 30mg every 12 hours or 40mg every 12 hours depending on body mass index (BMI). The purpose of this study was to examine compliance with the new protocol and overall rates of VTE in the burn population.

**Methods:** A single-center, retrospective analysis was conducted from March 1, 2018 to July 31, 2018. Patients included were admitted to the BICU with a documented burn injury for at least 48 hours and were ≥ 18 years of age. The primary outcome was compliance with the VTE prophylaxis protocol. Secondary outcomes included reasons for non-compliance and incidence of VTE events.

**Results:** Out of 105 patients that met inclusion criteria (median age, 53 years [36 to 63]; BMI 27.1 kg/m2 [25.7 to 33.2]; total body surface area 6% [3% to 18%]), the protocol was correctly utilized in 81 patients (77%). The most common reason for non-compliance was incorrect dosing (60.9% [14/105]). Of 105 patients, 1 (0.9%) developed a VTE.

**Conclusions:** Overall, the compliance to the Burn Intensive Care Unit VTE pharmacologic prophylaxis protocol has room for improvement. Despite following the protocol, one VTE event occurred during the five-month study period. To improve compliance, additional education and training regarding the dosing of and monitoring anti-coagulants was provided to nursing and medical staff.
Introduction: A review of patients who sustained 20% or greater TBSA burns (n = 33) found 58% of the sample to have a stage 1 (n = 5), 2 (n = 4), or 3 (n = 10) acute kidney injury (AKI). Of those who sustained an AKI, 63% did not survive their injuries. An inquiry into the current, resuscitation protocols used at this facility was subsequently conducted. Protocol dictated the Parkland Formula/method as the standard of care for resuscitation needs of the sample. While information for net-totals of inputs and outputs (I&O) and hourly I&O values was easily obtainable, presenting these numbers in table-form was both cumbersome to create and difficult to quickly convey to both clinical and non-clinical staff. Thus, a visual approach was chosen to better understand how each patient was resuscitated in the first 24-hours of burn injury. 

Methods: The software package R (R Core Team, 2020) was used to clean/analyze data, as well as create a graphical illustration of the data via an interactive dashboard using these variables: urine output (UOP); nurse charting of I&Os; fluid orders by provider; pre-hospital fluids; lab values; and vital signs. Using this software an interactive dashboard was created to allow users to interact with the graphs and visualize not only the numerical values associated with resuscitation, but to also see how each of these numbers relate to one another in an hourly timeline (e.g., reducing fluids by half is followed by a decrease in UOP).

Results: A trend of over-resuscitation in the first 24-hours of burn injury, as compared to the calculated requirements based on the Parkland Formula was observed. Also, irregularities of hourly administration of fluids (e.g., frequent/over blousing) and inadequate hourly charting were observed.

Conclusions: While this method for assessing resuscitation is a new approach at this facility, the ability to visually recount the resuscitation efforts of each patient has opened the conversation about best practices. Also, more disciplines can participate in the resuscitation efforts due to the ease with which the presented information can be disseminated and explained to both seasoned and novice staff. This has allowed for more stakeholders to participate in the burn program. Finally, further uses and applications of interactive dashboards are being explored for other aspects of burn care management.
630 A Multidisciplinary Approach to Decrease Infection using Visual Management
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Introduction: Burn patients are at high risk for infection secondary to skin loss from their wounds. These infections come at great risk for patient safety and are known to increase length of stay, morbidity, and mortality. Due to these factors, we used a multidisciplinary approach to maintain the environment in our Regional Burn Center using visual management. The purpose of this project is to improve communication and follow-through between the Environmental Services Team (EVS), Facilities Management department and the Burn Center Team to initiate and complete repair work and improve cleanliness in patient rooms. The goal is to decrease risk for infection from environmental factors through collaboration with multiple departments and improve patient experience and care.

Methods: Each room in the Burn Center is mapped out on the Visual Management Board (VMB). Anytime a staff member notices that EVS and/or Facilities Management repair work is needed, they can take the appropriate magnet from the board (see legend) and place it on that room square. Unit leadership will round each morning to see what needs are indicated on the board and initiate work orders or communication with designated unit EVS to meet that need. The issues indicated by the magnets will be logged into a printed spreadsheet (placed on VMB). Each day unit leadership will round to facilitate completion of needed work and will place a date of completion on the spreadsheet when that work is finished as well as remove the magnet from the rooms space. Every Monday, Unit leadership will round at the VMB with EVS and Facilities Management Leadership to address any further needs that were unable to be completed at the unit level that need escalated. EVS/Facilities Management will round back with unit leadership when these items are completed.

Key Stakeholders
4. Environmental Services Staff (housekeeping) and Leadership
5. Facilities Management (carpentry) Staff and Leadership
6. Burn Unit Staff and Leadership

Additional Resources
• Legend for needed work
• Communication Tracking Tool
• Picture of VMB workspace for this project

Results: Maintenance and daily cleaning improved. Increased staff engagement in facilities issues in each patient room and the autonomy to notify someone and get escalation of issues when needed. Improved communication and collaboration with multidisciplinary teams for increased awareness of unit-based needs and improved patient safety.

Conclusions: Upon completion of this presentation, learners will be prepared to discuss multidisciplinary ways to collaborate with the partners that support your Burn Center to enforce patient care and safety.

631 Burn Unit Design – The Missing Link for Quality and Safety
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Introduction: The relationship between infrastructure, technology, model of care and human resources influences patient outcomes and safety, staff productivity and satisfaction, retention of personnel, and treatment and social costs. This concept underpins the need for evidence-based design and has been widely adopted to inform hospital infrastructure planning. The aim of this review is to establish evidence-based, universally applicable key features of a burn unit that support function in a comprehensive patient-centred model of care.

Methods: A literature search in medical, architectural, and engineering databases was conducted. Burn associations’ guidelines and relevant articles published in English, between 1990 and 2020, were included, and the available evidence is summarized in the review.

Results: Few studies have been published on burn unit design in the last thirty years. Most of them focus on the role of design in infection control and prevention, and consist primarily of descriptive or observational reports, opportunistic historical cohort studies, and reviews.

Conclusions: The evidence available in the literature is not sufficient to create a definitive infrastructure guideline to inform burn unit design, and there are considerable difficulties in creating evidence that will be widely applicable. In the absence of a strong evidence base, consensus guidelines on burn unit infrastructure should be developed, to help healthcare providers, architects and engineers make informed decisions, when designing new or renovated facilities.
Introducing: Our institution has utilized the suspension epidermal autograft solution since its first application with FDA compassionate use protocol. We have since used this commercially available technology for the management of deep partial thickness and full thickness burn wounds. There is a non-adherent dressing in the commercially available kits to cover the suspension in a semi-porous fashion. We often would have beautifully dressed extremities and trunks only to find that in positions of function the non-adherent layer would pop through the intact staples. We then investigated the source of this discrepancy and found the non-elastic property of the dressing the likely culprit. We then began the process to determine an alternative dressing that could work more efficiently.

Methods: In an effort to determine if the institutional standard of care could be benefitted by this patient-based observation, the charts of patients that underwent simultaneous application of the epidermal autograft suspension and the poly lactic acid polymer dressing were interrogated. The data was identified by the institutional tissue tracker. Once the patient was identified, the chart was then reviewed to determine the desired data points. We evaluated the charts of patients that were recorded as utilizing the suspension epidermal autograft charge as well as charges for the poly lactic acid skin substitute. The charts were then evaluated to determine if there were any deviations from our expected outcomes using the suspension alone.

Results: Our preliminary results indicate that the patients were able to discharge sooner as the wound care associated with the polymer skin substitute is more streamlined. It did not reflect any areas of graft loss but did in 2 instances remained in place longer than our standard. The wound was healed beneath but the skin substitute remained adhered.

Conclusions: The simultaneous use of suspension epidermal autografts and poly lactic acid skin substitutes has become common place for our institution. A quick review as a QI project has resulted in the desire to delve further into comparative data points. A formal retrospective review of the charts will be undertaken for a case series of about 20 patients.
Simulation based training (SBT) is an experience meant to replace real-life events with guided simulated clinical scenarios. The goal is fully interactive training that closely replicates the real world. SBT is well known in military and aviation and has been well integrated into the education of new nurses and physicians however, it has not been fully integrated into the ongoing development of skills for clinicians practicing in hospitals that are learning new technologies. Following FDA approval of a regenerative medicine platform that prepares autologous skin cell suspension (ASCS), an opportunity was identified to augment conventional training with a SBT educational program giving clinicians the opportunity to practice wound care in a simulated learning environment.

A prototype was developed alongside experts from a university-based experiential learning center. It included an anatomical silicone mold of a thigh (model) with silicone cartridges of ASCS treatment areas (excised deep partial-thickness burn with dermis and excised full-thickness burn with wide meshed split thickness skin graft). The cartridges fit in a depressed area of the thigh and can be exchanged between case scenarios. The cartridge allows for moulage to be applied, enhancing the life-like appearance of the model. The initial prototype was tested during a pilot with burn center staff. A total of 4 case scenarios related to ASCS aftercare were evaluated. Following the pilot, the program was demonstrated to our internal clinical team to gain additional insight. The feedback was incorporated into a final design.

There were 17 participants in the pilot training (6 hands-on/11 observers). All hands-on participants either agreed or strongly agreed that SBT was useful to their clinical practice. Comments included: “Very realistic”, “really liked the hands-on”, “confidence booster”, “these are the most common scenarios we see”. One participant commented that even though she had never participated in an ASCS dressing change, she has the confidence to do so now. Soliciting feedback from our internal team on the design and portability of the model was an important step to ensure barriers to use were removed. To date, 11 training systems including models, cartridges, case scenarios, debrief tools and dressing kits have been distributed with a total of 30 systems expected by the end of 2020.

During development of the SBT program, input from clinicians and educators helped gain insight to the program and ensured the scenarios were relative to real-world experiences. Early findings suggest SBT is a value add for clinicians caring for patients post ASCS application.
Subcutaneous Contracture Band Release in Burn Scars

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Introduction: Contracture scars post-burn injury often develop in areas near joints and can restrict movement as well as cause cosmetic deformities. The goal of subcutaneous scar release is to maximize mobility and minimize the need for invasive procedures which can require more recovery time and cause less aesthetically pleasing outcomes, although this new minimally invasive technique may also be used in conjunction with invasive procedures or after more invasive reconstructions to yield the best functional and cosmetic outcome.

Methods: Retrospective data from May 2016 to July 2019 were collected and analyzed for 28 patients ranging from ages 6 to 68 years old that were diagnosed with a subcutaneous contracture in one or more areas of their body. The data recorded included demographics, procedure specifics and outcomes, patients’ assessments, and areas of which the procedure was most frequently done on.

Results: Of the data available, range of motion per site improved by 19.1 degrees. Average pain scores reported directly after the procedure were relatively low at 1.5 on a 10-point scale. Vancouver Scar Scale scores decreased by 0.6 from pre-operatively (10.7) to post-operatively (10.1). The most frequently occurring areas that subcutaneous scar release was done on was the neck (15), axilla (7), and shoulder (7). Overall, 83% of patients reported being very satisfied or satisfied with the outcome of their procedure.

Conclusions: Subcutaneous scar release improves burn patients’ range of mobility with less residual scarring and less recovery time than standard of care treatments for scar contractures.

Free Abdominal Tissue Transfer and Utilization of the Umbilical Stalk for “Tubular” Reconstruction in Ear, Nose and Throat Defects: A Case Series

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Introduction: Head and neck defects, whether from burns or cancer resections, are complex and often require free flap reconstruction. Radial forearm and anterolateral thigh (ALT) flaps are commonly used due to their thin and versatile nature. However, abdominal based free tissue transfer is one valuable alternative that can cover large defects and may become a more appropriate option on the reconstructive ladder when the defect includes reconstruction of a tubular structure, such as the external auditory canal, a neck tracheostomy/stoma site or an external nasal opening. We present a novel utilization of abdominal free tissue transfer for coverage of large ear and scalp burn defects as well as neck and midface defects with usage of the umbilical stalk for tubed reconstruction.

Methods: Four patients presented for reconstruction: two patients had sustained large ear and scalp burns resulting in complete ear loss; one had a large neck defect resulting from recurrent cancer resection which necessitated a laryngectomy and stoma creation; and one patient had a large central face defect post-cancer resection. All four patients underwent an abdominal based free tissue transfer with reconstruction of the external auditory canal in the ear and scalp burns, stoma creation in the neck defect, and the external nasal opening in the central face defect, all utilizing the vascularized umbilical stalk for the tubed reconstruction.

Results: All patients recovered post-operatively without any reported complications such as tubular stenosis or contracture while maintaining umbilical stalk tubular patency.

Conclusions: Reconstruction of a tubed structure in head and neck defects, whether the external auditory meatus, an external nasal opening or a neck stoma post burn or cancer resection, can be a difficult and challenging operation fraught with potential complications. We present a novel method of reconstruction of large defects employing the use of the uniquely thin and vascularized umbilical stalk for tubular reconstruction.
Biodegradable Temporizing Matrix in Combination with Wide Meshed Graft and Autologous Spray Cell Suspension (ASCS) Graft Can Be Used for Reconstruction of Extensive Necrotizing Infections: A Case Report

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Introduction: Background: A necrotizing infection of the left upper extremity underwent extensive debridement with remaining exposed muscle, tendon, and bone. BTM was used to provide an acceptable temporizing matrix in conjunction with wide meshed split thickness skin graft (STSG) 3:1 ratio and ASCS graft for successful reconstruction. This left a functional limb and avoided arm forequarter amputation.

Methods: Case Presentation: We present a 67 y/o male with necrotizing infection who underwent extensive surgical debridement of skin and subcutaneous tissues of the left hand, forearm, and upper arm. BTM was applied for coverage over muscle, tendon, and bone to salvage his arm and avoid forequarter amputation. Following maturation of the BTM a 3:1 ratio STSG was placed along with application of an ASCS graft. A vacuum assisted closure (VAC) dressing was successfully used to stabilize the grafts. One month post grafting the wound was approximately 94% healed, with good range of motion, and limited but improving function of his arm.

Results: Conclusion: Necrotizing infection extremity reconstruction can be achieved with BTM, wide meshed STSG, and ASCS grafting. A wound VAC provided a safe and effective dressing over these grafted mediums.

Rehabilitation

Maximizing Safe Positioning of Upper Extremities after Axillary Burn Injuries to Prevent Contractures and Maintain Function

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Introduction: Burns crossing over a joint can result in a contracture of that joint. Axillary burns and subsequent contractures are common and may impact negatively on burn survivor rehabilitation. Positioning of burned extremities at the most lengthened position is ideal for maintenance of function and contracture prevention. 90 degrees of abduction is the most accepted position for axillary burn injuries. However, many activities of daily living require shoulder range of motion (ROM) greater than 90 degrees. The primary objective of this study was to describe and examine the incidence of paresthesia, pain, and intolerance in healthy subjects when the shoulder was placed in a position of 90 degrees or greater of shoulder abduction.

Methods: The subject’s nondominant upper extremity (NDE) was randomly placed in a series three of positions, including: (1) 90 degrees shoulder abduction, 30 degrees horizontal adduction, elbow extension, forearm neutral; (2) 130 degrees shoulder abduction, 30 degrees horizontal adduction, 30 degrees elbow flexion, forearm neutral; (3) 150 degrees shoulder abduction, 30 degrees horizontal adduction, 30 degrees elbow flexion, forearm neutral. Each position was maintained for a maximum of 2 hours. Subjects experiencing subjective symptoms including paresthesia lasting longer than 1 minute, pain rated greater than 3/10, and/or intolerance 2/5 was removed from the position. All subjects received at least 30 minutes of rest between positions.

Results: A total of 25 subjects were enrolled, mean age was 25.8 years, the majority were female (60%) and 20% had a history of NDE shoulder injury. The right arm was the dominant extremity (DE) in 88% of subjects. There were no significant differences in ROM between the DE and NDE extremity with the exception of external shoulder rotation, 94.96° vs 84.8° (p=.0142). Average total splint time was 136 minutes with a range of 40 – 360 minutes. Only 1 subject successfully completed all 3 splinting periods. There were 75 individual splinting events over the 3 splinting periods, and 90% of the time the splinting was stopped early. The most common reason for stopping early was paresthesia (88%) followed by pain (7%).

Conclusions: The positions selected represent the routine and usual care at our burn center. Patients are routinely positioned from hours to days depending on patient need. This study demonstrated that healthy subjects were unable to tolerate positioning for even two hours.
**Introduction:** It is well-established that burn severity is determined by size of surface area affected, temperature of source and duration of exposure. Patients with impaired mobility, regardless of etiology, are less capable of avoiding and escaping traumatic injuries. Additionally, patients with impaired mobility frequently suffer from other co-morbid conditions and have specialized needs which can complicate their acute illness/injury, prolong their hospital length of stay, and impact recovery.

**Methods:** This was an IRB-Exempted retrospective electronic medical records review of all adult patients, aged 18 years and older with pre-existing mobility impairment, admitted as inpatients for treatment of burn-related injuries from January 1, 2009 to December 31, 2019.

**Results:** The 10 year review of 1648 adult burn admissions meeting the initial criteria of inpatient admission and burn injury, 178 were found to have documentation supporting pre-existing functional mobility impairment (11%). Rolling walker use (33%) was most common, followed by cane (28%). Contrary to the initial hypothesis, patients actually had overall lengths of stays consistent with all burn populations at 0.81 days per % total body surface area, with average length of stay being 6.7 days. The demographic data was also consistent with national burn registry data as primarily male, Caucasian population, though older, with mean age of 61.1 years. Regression analysis identified relationships between burn size and discharge disposition. Additionally, statistically significant relationships were identified between BMI and the pre-existing co-morbid illness Diabetes and Chronic Obstructive Pulmonary Disease.

**Conclusions:** There is a paucity of literature describing the needs of this unique burn population. Burn-injured patients with pre-existing impaired mobility suffer from similar mechanisms of injury, although the source for the thermal burns is more likely to originate from smoking on home oxygen, are treated conservatively and return home without home health.

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**Introduction:** Facial burns can be complicated by the development of scar tissue and contractures, resulting in decreased flexibility of the tissue involved in swallowing, facial expression, and verbal communication. Maximizing functional range of motion is an important preventative measure for improving functional outcomes for swallowing, communication, and for the prevention of microstomia. A range of therapy interventions including stretching, massage, compression, and use of appliances has been reported in the literature; however, there is limited to no information on current practice patterns amongst North American providers (MD, DO, PA, NP, etc.) or therapists (PT, OT, and SLP).

**Methods:** A RedCap survey was developed by a Speech-Language Pathologist and Occupational Therapist involved in burn care. The survey consisted of 18 total questions, with participants responding to between 12–13 questions due to branching logic. Questions were related to demographic and service provision related to facial massage and stretching. Survey questions were multiple choice, multiple answer multiple choice, or contained text boxes. The survey was distributed to Providers and Therapists from the United States of America and Canada who were members of the American Burn Association (ABA).

**Results:** A total of 69 surveys were collected, with 57 surveys meeting criteria for inclusion. Respondents consisted of therapists 68%, providers 23%, and other health professionals 9%. Forty-six ABA burn centers from across the United States and Canada were represented. The majority of respondents had over 10 years of experience working with burn patients. 91% of respondents reported that facial massage and stretching was used as a tool at their facility. Respondents, who report facial massage is utilized at their facility, report OT as being the primary discipline responsible for assessing (67%) and completing (65%) facial massage, with 85% reporting additional discipline(s) also participating in facial massage. 9% of respondents report that facial massage and stretching is not utilized at their facility following facial burns. Of those who responded that facial massage and stretching is not utilized following facial burns, 40% felt this would be beneficial to patients, while 60% were unsure.

**Conclusions:** Facial scar management is an important part of burn care, with the majority of respondents reporting completion of facial massage and stretching as part of the services provided to patients who have suffered facial burns. OTs are the primary service providers for facial massage and stretching post facial burn. Practices for facial massage varies greatly, with the majority of respondents reporting no specific protocol for facial massage and stretching is followed.
**642 Orthotic Fabrication of the Upper Extremity Survey**
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**Introduction:** Designing and fitting orthoses is an essential component of burn care. Burn therapists fabricate and fit orthoses at a high rate due to continuing changes in patient presentation. The purpose of this survey was to assess the current level of comfort with orthosis fabrication of burn therapists, identify trends about management and quality assurance regarding orthoses, and determine areas that may be improved through a directed educational initiative.

**Methods:** An anonymous, internet-based, 31-item survey was developed to evaluate training and comfort level of practicing therapists. The survey was distributed to burn therapists at North American burn centers. Descriptive statistics were performed.

**Results:** There were 44 respondents to the survey. Most were occupational therapists (75%), followed by physical therapists (25%). The majority of respondents had more than 15 years of burn experience (61%). Most respondents reported education at a master's degree level or higher (59%) and 13% were certified therapists. A large majority of respondents indicated that they received orthotic instruction as part of their academic curriculum (91%), and 80% indicated instruction lasted a semester or less. Since graduation, 89% reported that they had further orthotic instruction, with the most training occurring on the job (92%). One hundred percent of respondents indicated that they received orthotic training during post-graduate orthotic training. Most indicated they were very comfortable with fabricating both static (90%) and static progressive (69%) upper extremity orthoses. Elbow extension orthotics received the highest very comfort rating at 92%, while shoulder abduction splints received the lowest relative rating at 56% reporting very comfortable. Despite these confident scores, 51% of respondents reported complications due to orthoses at least sometimes or more often, and these are seldom or never (55%) reviewed through a formal process.

**Conclusions:** Unanimously, therapists are involved with fitting orthoses. The majority of respondents do not have advanced certifications and receive limited post-graduate orthotic training. Complications occur at least sometimes according to most respondents and appear only modestly integrated into peer review. Given the potential consequences of orthotic induced complications and the high reported comfort levels fabricating orthotics by primarily veteran burn therapists, there is concern that these issues are underexamined through formal processes.

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**643 The Latest Rendition of the Ring Neck Collar Formally Known as “Watusi”**
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**Introduction:** The “Watusi” neck collar originally described by Koenig has gone through a few renditions since it was introduced in 1976. Our facility adopted its use as described by Nosanov et. al, but have since made modifications to the construction that have improved positioning of the neck, patient comfort, and tolerance.

**Methods:** We used the construction design of the “Watusi” collar as described by Nosanov et. al. in 2017
- Measure patients neck length and circumference
- Cut 3/8” plastic tubing
- Cut a strip of 2”loop Velcro and sew a piece of hook Velcro to the underside of the loop Velcro for adhesive closure
- Cut horizontal strips along the remaining loop Velcro and thread plastic tubing through

Here we divert from the previously published design:
- Cut - 8” piece of betapile and thread Velcro through (this is to pad the back of the neck).
- Using 1 1/8” and 7/8” cylindrical foam tubes, cut a slit along the length of cylindrical foam to allow for insertion of the plastic tubes. This allows for ease of application and removal for hygiene/cleaning.
- Lay the betapile pad on the posterior neck and apply the rings w/ cylindrical foam inserts (using clinical judgement regarding number and location of foam inserts until optimal neck position is achieved).

**Results:** We have used this method on 15 patients since 2017 and have found improved neck extension with use of foam inserts as well as pressure along cervicomental region (see attached photos). It continues to allow for some neck movement while applying targeted pressure over anterior/lateral neck bands. The removable foam inserts make cleaning easier compared to earlier versions. The application process of our modified ring neck collar is not as straightforward as alternative neck positioning devices and staff require additional training on proper application and management, however we find that when applied with adequate tension, the ring neck collar provides excellent targeted pressure to the cervicomental region as well as lateral neck bands to reduce banding and soft tissue contractures. Many patients report improved comfort with use of ring neck collar when compared to hard orthoplast anterior neck conformers and the associated risk of pressure injury is less than that of a hard neck conformer.

**Conclusions:** The modified ring neck collar can provide targeted pressure to soft tissue bands of the neck and should be considered as a tool to use to reduce risk of soft tissue neck contractures. Our facility will continue to utilize this device as well as seek ways to improve the design and patient tolerance.
Use of Plantar Foot Plate Splints and High-Profile Leg Net Devices for Prevention of Plantarflexion Contracture following Placement of Cultured Epidermal Autograft to Lower Extremities

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Introduction: Burn Therapists strive to prevent burn scar contracture through positioning strategies beginning in the acute phase of burn injury. This task is even more challenging when paired with posterior offloading and joint immobilization required for the viability of cultured epidermal autograft (CEA). High profile leg net devices are the standard for posterior offloading after application of CEA circumferentially to lower extremities but can result in poor positioning of the ankle. Custom foot plate splints were designed and fabricated to preserve ankle dorsiflexion during the initial stages of CEA healing.

Methods: The high-profile leg net devices were assembled using 3/4 inch PVC piping and PVC fittings (45 degrees, 90 degrees, and tees) with double layered elastic tubular netting to allow proper wound ventilation while supporting the lower extremity with the patient in supine. The plantar foot plates were custom molded to the patient’s foot using thermoplastic material and lined with medium density temper foam for pressure relief. The foot plate was attached to the frame using Velcro and straps. Instructions with photographs were posted in the patient’s room for nursing staff to reference. Netting was exchanged daily and frames were disinfected using standard techniques.

Results: Goniometric measures were taken for ankle dorsiflexion on day of CEA application with lower extremities positioned on high profile nets (in alignment with cutaneous functional unit modified position): -6 degrees right ankle, -2 degrees left ankle. Repeat measures were taken after one week period of bilateral lower extremity immobilization per CEA protocol: -1 degree right ankle, 2 degrees left ankle. One month follow-up at the discontinuance of leg net devices showed bilateral ankle dorsiflexion preserved with 3-degree right ankle dorsiflexion and 5 degrees on the left.

Conclusions: The use of custom foot plates on high profile leg net devices appears to improve ankle dorsiflexion range of motion while maintaining adequate posterior offloading required for CEA precautions for a burn survivor with extensive lower extremity burn wounds.
Introduction: We present a case of a 23-year-old woman with primary-onset peroneal nerve impairment following diagnosis of purpura fulminans involving 30% total body surface area, who was treated in our burn center. Medical complexity required a unique rehabilitation intervention. The purpose of this case study is to demonstrate the effectiveness of a dynamic ankle-foot orthosis (AFO) to recover functional ambulation.

Methods: Upon initial evaluation and during weekly re-evaluations, a physical therapist (PT) and an occupational therapist (OT) measured active range of motion (AROM), passive range of motion (PROM), and strength. Absent to trace common peroneal nerve function was identified bilaterally 8 days after admission. The patient underwent 41 surgeries and spent 231 days in the burn intensive care unit. Medical complications included 3 episodes of acute respiratory distress syndrome and septic shock, acute renal failure requiring 150 days of continuous renal replacement therapy, and 51 ventilator days. Due to post-operative restrictions and/or medical complications, lower-extremity ROM was restricted for 63 days and supine position was restricted for 49 days. Rehabilitation interventions included PROM, AROM and continuous passive motion. Weight-bearing activities included a tilt table, Moveo®, standing frame, transfer and gait training with a rolling walker (RW). Positional interventions were sitting in a Total Lift Chair, serial casting, and custom AFO fabrication.

Results: On hospital day 215 the patient ambulated 15 feet using a platform walker and required assistance of 4 staff to support the ankle and foot. On hospital day 229, static custom AFOs were implemented and the patient ambulated 325 feet with contact guard assist (CGA). The static AFOs required frequent re-fabrication due to daily ROM progress. Adjustable dynamic AFOs were fabricated to decrease resource burden. With the dynamic AFOs, the patient progressed to 745 feet CGA on hospital day 258. The patient discharged to an acute rehabilitation center on hospital day 260.

Conclusions: Extensive medical, surgical and positional restrictions required innovative interventions by a multidisciplinary team. This resulted in the fabrication of dynamic custom AFOs for gait training. Utilization of these AFOs significantly increased activity tolerance and ambulation distance, and enabled eventual discharge to a rehabilitation center.
Introduction: The COVID-19 pandemic thrusted many burn therapists into the world of telehealth overnight. While telehealth has been widely utilized since and has played a vital role in burn care overall, adaptation of platform has been minimal amongst burn therapists. As more hospital systems integrate telehealth as a service delivery mode, there is a need for guidelines on how to capture data collection and recommended documentation language which indicates progress and justifies therapy.

Methods: The following virtual visit documentation and objective data collection guidance form was created in an effort to capture ability, disabilities, limitations and barriers of the burn survivor participating in the burn rehabilitative virtual visits. The guidance form is intended to demonstrate examples of data collection can be captured in the virtual environment along with pointers to enhance the experience and recommended documentation language. It is not all inclusive, nor are all the tests listed necessarily required for a successful virtual interaction. (Attachment A)

Results: Despite the inability to perform formal standardized objective measurements, a burn therapist is still able to measure and document gains and losses. Posture, gait, range of motion, skin integrity, strength, motor control, body mechanics, coordination, ADL’s, functional mobility, transfers are a few of the many categories which a burn therapist can focus their documentation.

Conclusions: When appropriately administered and thoroughly documented telehealth can not only provide quality care to burn survivors but also demonstrate gains to optimal outcome goals and return to baseline levels of independence with ADLs, IADLs, mobility, transfers, range of motion, strength and sensation.
647  The Superhero in You: Engaging Pediatric Patients in Therapeutic Exercises
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Introduction: Engaging pediatric burn survivors in necessary range of motion exercises can be challenging. For younger children, difficulty understanding the reasoning behind prescribed exercises, fear and anxiety can all lead to refusal to participate. Traditional rote range of motion exercises do not engage the child's sense of curiosity and adventure and seem more like medicine than play. We have developed a range of motion exercise program based on well-known superhero actions. For children who need to address active wrist extension and digit extension, they become “Iron Man” (Example included). “Hulk Smash” lets us work on grip and active composite flexion while becoming “Spiderman” encourages digit isolation. “Superman”, “Wonder Woman” and “Batman” allow utilization of total body movements but can be focus on shoulder flexion or abduction and cross body movements.

Methods: Traditional superhero movements were assessed to determine similarity to traditional therapy exercises. Exercises were drawn with the extremities performing the desired movements. Pediatric patients are introduced to these exercises and encouraged to act out the superhero movements with therapist directing the desired end range and directionality of movements.

Results: These characters are well known and loved by pediatric patients. In many instances, a fearful patient may become an active therapy participant through these engaging activities. Goal attainment becomes more fun and less when children are engaged in a purposeful play task. Caregivers can carry these exercises well beyond the therapy session to encourage daily exercise which is essential for contracture prevention and remediation. A recent feedback comment from the parent of a 4-year-old burn survivor specifically focused on these exercises. “Absolutely phenomenal. The therapist did “superhero” moves with my son and got him to open and close his hands. I was so relieved that the movement was normal”

Conclusions: Modifying instruction methods to include familiar and fun techniques can increase therapy participation and can decrease the fear experienced by young burn survivors when faced with moving an injured extremity.

648  The Negative Impression Makes a Positive Impact
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Introduction: Providing timely and appropriate pressure to prevent/address hypertrophic scarring for burn survivors is an ongoing challenge. From time of measurement to obtaining a custom compression garment can be several weeks requiring creative solutions to providing interim pressure, particularly in the pediatric population and even more challenging for a facial burn scar. Historically, fabric custom garments were ordered, then with the advancement of silicone lined materials, clear facial masks could be fabricated. This process started with taking a plaster cast of the survivors’ face, frequently using sedation to allow for optimal fitting, but sedation can change the tone of the facial muscles adding to the challenge. With the advancements in technology, less invasive, more accurate, and more timely fabrication of face masks is possible.

Methods: A 3D picture was taken of a 14-month-old pediatric burn survivor with hypertrophic scarring on the face. This image was uploaded to a 3D printer and a positive print (facial surface down) was completed. The positive print was used to make an alginate mask and plaster was poured to create a casting of the positive printed face. A check mask was pulled from this positive plaster cast (+ mask). This check mask was too large for the patient’s face. To have a better fitting mask, another approach to the mask fabrication was completed. From the same 3D picture, a negative print (facial surface up) was completed. Plaster was poured directly into this negative print to create a casting of the negative printed face. A check mask was pulled from this negative plaster cast (- mask). Both check masks were fit to the patient to assess for accuracy of fit and estimation of required adjustments for optimal fit.

Results: There was a significant difference in the fit of the two masks created from the same 3D picture. The mask pulled on the positive casting was too large. The required adjustments to have the mask fit properly to provide appropriate compression to the hypertrophic scarring on the face would have been extremely difficult and time consuming to complete. The mask pulled on the negative casting fit well and only required small adjustments to ensure adequate pressure would be provided to the focused areas of hypertrophic scars on the face.

Conclusions: With advances in technology, 3D photography partnered with 3D printing allow for significant improvement in the accuracy of fitting facial masks, improve timeliness of compression, and improve the patient experience in the process of obtaining a facial mask.
The Quality of Survey Research in Burn Care: A Systematic Review

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Introduction: Burn care is a relatively small field with contributions from many healthcare disciplines. Further, the practice of burn care varies considerably from center to center and between regions. Given these factors, survey studies are frequently used to better understand practice variations, establish guidelines, and direct future research questions. If survey research is poorly designed or reported, it limits the ability to form meaningful conclusions. Given the prevalence of clinician surveys published in burn care, this study aims to evaluate its quality and to determine which approaches lead to a more successful survey.

Methods: A systematic review was performed by two independent reviewers using PubMed, Scopus, and Web of Science databases for the dates January 1, 2000 to March 19, 2020. Articles were included if they were published in English and surveyed providers on a topic related to burn care. Surveys of patients, those that evaluated an intervention or included other research designs were excluded. Data related to survey content, methodology, and quality was extracted independently by two reviewers.

Results: The search identified 7351 non-duplicate citations, of which 247 underwent full text review, and 144 met inclusion criteria. The number of published surveys increased by an average of 21% annually over the study period (P<0.001). The majority of surveys originated in the United States (40%), United Kingdom (19%) and Canada (7%) and were either national (47%) or international (37%) in scope. The most common themes were education/training/workforce (21%), resuscitation/critical care (17%) and wound care (14%). Burn surgeons/physicians (45%) were the most frequently surveyed population, but all disciplines were represented. The majority of surveys were electronic (51%) and sampled all members of a defined group (72%). Few studies reported the use of reminders (29%) or incentives (2%) to improve survey completion. In terms of quality, the majority did not report any survey development steps (71%) or survey validity/reliability (92%), and half did not include the questionnaire in the manuscript or appendix. A response rate was calculated in 82% of studies. The median (IQR) response rate of all studies was 54% (32–83). A subgroup analysis of national and international studies sent electronically to burn surgeons/physicians (N=28) had a response rate of 40% (26–50).

Conclusions: Survey research is increasingly published in the burn care literature and covers a range of themes and populations. Despite the limited use of reminders and incentives, survey participation is relatively high. The quality of survey reporting is generally poor, limiting the ability to apply this research into practice.
**Introduction:** Donor site morbidity (DSM) is a major patient dissatisfier due to pain and scarring leading to aesthetic and functional limitations acutely and over time. Many of the recent advancements in burn care such as autologous skin cell suspension (ASCS), cultured tissues, and engineered tissues are driven to reduce DSM. One of the most important advancements in reducing DSM has been the approval of ASCS. Our study assesses donor site (DS) location using real-world data after ASCS procedures with an inconspicuous surgical approach for DS.

**Methods:** An IRB approved, retrospective chart review of all burn patients undergoing ASCS at an American Burn Center verified burn center between January 2019 and August 2020 was completed. Patients were excluded who received ASCS in combination with widely meshed skin graft or who died during their hospitalization. Demographics were reported including age, gender, % total body surface area (TBSA), length of stay (LOS), ASCS size in cm² and % TBSA, and location of burn. All DS were harvested at 0.004–0.008 inch after clysis of the prep site with injectable saline and 0.25% Marcaine with a dermatome or Weck knife. Photographs of the DS and burn wounds were uploaded to the EMR by the surgeon of record and assessed by two experienced burn center surgeons. Photographs taken adjacent to the burn wound without risk of delayed re-epithelization, infection, or hypertrophic scarring. Placing ASCS DS adjacent to the burn wound is a more patient-centered approach with indistinguishable pain from the burn wound, a more pleasing cosmetic outcome, and potential greater patient satisfaction.

**Results:** 83 patients underwent ASCS with 25 patients meeting inclusion criteria. The average age was 33 years (range 15 months to 88 years). 68% of patients were male with an average TBSA of 11% (range 2.5–40). The mean LOS was 5.8 days (range 1–16). Burn locations included face/neck (n=9), torso (n=16), extremity (n=20), hand (n=10), and two patients had single site involvement. The adult patient average size of ASCS applied was 1700cm² (range 250–6200) while pediatric patients had an average size of 13% TBSA (range 6–32). 21 of the 25 patients had DS adjacent to the burn. No significant difference was noted in healing time, infection rate, or hypertrophic scarring. None of the patients complained of DS pain that was distinguishable from the burn wound. Blinded observers were unable to discern the DS in 56% of the patients from the initial burn wound.

**Conclusions:** DSM is an iatrogenic insult to non-burn skin and a significant cause of morbidity. ASCS DS may be taken adjacent to the burn wound without risk of delayed re-epithelization, infection, or hypertrophic scarring. Placing ASCS DS adjacent to the burn wound is a more patient-centered approach with indistinguishable pain from the burn wound, a more pleasing cosmetic outcome, and potential greater patient satisfaction.

**Introduction:** Over the past three decades, it has been repeatedly demonstrated that early surgical intervention is associated with improved outcomes in burns, however, large-scale studies regarding the incidence of operative treatment in burn patients are lacking. We conducted a retrospective study using the TriNetX database, a global, real-time electronic medical record driven index of patient populations, analyzing the incidence of grafting procedures in burned patients related to age and % total body surface area (TBSA) burned.

**Methods:** The population of burn patients and operative treatments were indexed using ICD-10 codes T31.0-T31.9 and 1013913, respectively. Queries were structured as sequential events allowing analysis of burn diagnosis to be followed by a subsequent operation. The patient population was partitioned by TBSA burned, and the number of grafting procedures were assessed. All patients were included and stratified by ages of 0–17, 18–34, 35–64, and 65–89. The data includes information collected between 2000–2020 from over 35 healthcare organizations comprising the Research network in TriNetX. Extracted data were analyzed using chi-square statistical analysis with p < 0.05 considered significant.

**Results:** Of 116,325 burn patients identified, 11.14% underwent at least one grafting procedure. Of surgeries performed, the majority occurred in the 35–64 years age group (45.3% p < 0.001). Additionally, the incidence of grafting procedures was directly proportional to patient age: age groups of 0–17, 18–34, 35–64, and 65–89 years received grafting procedures in 6.5% (p < 0.001), 9.8% (p < 0.001), 12.9% (p < 0.001), and 15.9% (p < 0.001) of cases, respectively. When stratified by TBSA burned, those with 40–49% TBSA burns had the highest incidence of operations (50.7% p < 0.001). Large TBSA burns correlated with increasing incidence of grafting procedures until 50–59% TBSA burned, where incidence begins to decrease, likely related to referral patterns which did not capture grafting procedures performed at specialized burn treatment centers or institution of palliative care.

**Conclusions:** This study reveals the incidence of operative treatment increases with both age and percent TBSA burned. The data corroborate a referral pattern for burns that demonstrates a decline in operative treatments beginning with 50–59% TBSA, inconsistent with referral guidelines to specialized burn care centers published by the ABA.
Resourceful Surgical Planning for Coverage of Large Burns: Optimizing Cultured Epithelial Autografts (CEAs) Outcomes by Combining with a Modified MEEK Procedure

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Introduction: We previously reported a modified MEEK technique providing reliable skin transfer using a specific adhesive called, “The Rule of Sevens”. This innovative approach is now part of our practice and we have experienced good outcomes as a result. With that technique perfected, we have also begun incorporating this method as part of the surgical plan for coverage of large TBSA burns with CEAs. This study is a report of our initial experiences utilizing a combination of our modified MEEK procedure and CEA grafting for larger TBSA burns.

Methods: This retrospective study was granted exemption by IntegReview IRB. Demographic data was reviewed. In some cases, incomplete documentation related to percentage take was noted. To account for this limitation, we agreed with other investigators in the literature and applied the “clinically relevant” assessment to this study analysis. This approach assumed that final coverage was successful when re-grafting was not required by the time of discharge or death.

Results: Nineteen (19) patients total were treated with MEEK/CEA from April 2016 – February 2020. One patient was an outlier, acquiring infection, requiring additional surgery to close the wound, and did not meet criteria to evaluate. There were 4 females (25%) and 14 males (74%), age range 9–71, Mean 37, Median 34, Mode N/A. TBSA was 30–92%, Mean 62 Median 60, Mode 55. Length of stay was 20–188 days, Mean 89, Mode 136. This is approximately 1.5 days’ stay, per percent of burn in this group of patients with larger burns. MEEK meshing ratio was documented on 16 patients, range from 6:1 - 9:1 ratio. Five patients had a 6:1 ratio, 11 patients had 9:1 meshing ratio used.

There were 6 deaths in the total group of 18 evaluable patients (33%). Of these, all had MEEK performed initially; however, 3 did not live long enough to have CEA placed. One patient died before initial takedown of CEA could be performed. The other two died during treatment, both had documentation supporting 70% and 90% take, respectively.

To determine overall take, we determined whether any of the surviving patients treated needed further grafting. None of the remaining patients required further grafting. This met our criteria of successful take and gave us a 100% success rate. There were 9 patients with documentation clearly stating a percent take rate. In this group, the documented percent take range was 60–97%, Mean 84%, Median 85% and Mode 96%,80%. Again, none of these patients required additional surgery.

Conclusions: A modified MEEK technique in providing coverage of larger burns with CEA has offered our center better options of expansion thus perfecting the technique of transfer. Most importantly, the MEEK/CEA has resulted in excellent outcomes with a documented mean take rate of 84%.

Successful Wound Closure in Patients with Large Total Body Surface Area Calciphylaxis with Aggressive Multi-modal Therapy Including Excision and Skin Grafting

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Introduction: Calcific Uremic Arteriolopathy (CUA), commonly known as Calciphylaxis, is a rare disorder characterized by ischemic necrosis of the skin and histologically by arteriolar calcification. CUA is most commonly seen in patients with end-stage renal disease (ESRD) but can be seen in other patients as well. CUA carries an extremely high mortality rate, with up to 80% in some studies, even in patients with limited disease. In light of this, many surgeons have adopted a “do-not-touch” practice with these patients. Over the past several years, our institution has seen an increase in referrals for the management of large total-body-surface-area (TBSA) CUA.

Methods: Retrospective review of all patients with biopsy-proven (by dermatopathology) large TBSA (>=5% TBSA) CUA admitted to a Verified Adult and Pediatric Burn Center from 2015 to present. Demographics, laboratory data, treatment modalities and outcomes including mortality and wound closure were recorded.

Results: A total of 8 patients with large TBSA CUA were admitted after being transferred from outside hospitals. Average TBSA affected was 13.76% (SD 7.27). 6 of these patients (75%) were noted to have non-uremic calciphylaxis. All patients had positive wound cultures on admission, and 1 patient (12.5%) developed a bacteremia in hospital. There were no central line associated bloodstream infections, catheter associated urinary tract infections or ventilator associated infections. All patients underwent surgical debridement (average 4.125, range 2–5), and 5 patients (62.5%) underwent grafting, (average 1.6, range 2–5) and subsequently proceeded to wound closure. In-hospital mortality was 25% and another patient was referred to a hospice facility after being readmitted with medical complications of her calciphylaxis. Secondary findings included 50% of the patients recently experienced significant weight loss (>100 lbs). On admission, 2 patients (25%) had abnormal serum calcium, 3 patients (37.5%) had abnormal serum PO4, and 4 (50%) patients had abnormal PTH levels. 2 patients (25%) had a recent exposure to warfarin (within 6 months).

Conclusions: Utilizing a multi-modal management strategy that includes surgical debridement and skin grafting, patients with calciphylaxis can progress to wound closure.
657  Bilayer Dermal Substitute in Management of Deep Hand Burns
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Introduction: Bilayer dermal substitutes, composed of bovine collagen cross-linked with glycosaminoglycan and silicone, have become increasingly integrated into the algorithm for management of complex burns. In complex hand burns, dermal substitutes improve functional and aesthetic outcomes while also allowing early excision in high percentage TBSA burns. We detail the outcomes of 17 patients with 25 cases of complex hand burns managed at our center using a staged procedure of cadaveric allografting followed by dermal substitute placement and early definitive STSG.

Methods: Between Jan 2018 and Aug 2019, all patients who sustained deep partial/full thickness burns to their hands managed with dermal substitution were identified. Patients less than 18 yo, with additional non-burn trauma to the hands, and with initial operative management at another center prior to transfer were excluded. A retrospective chart review was used to collect data regarding time to operative excision, placement of allografts and substitutes, definitive STSG, and functional outcome.

Results: 17 patients from 18 and 89 yo presented with 25 deep partial/full thickness hand burns. TBSA varied from 0.75 to 78% (mean 17.7%). On average, patients underwent first excision 5.3 (2–16) days after initial burn or 4.2 days after presentation. Our protocol often uses allografting prior to placement of the dermal substitute, therefore, 22 of 25 burned hands received cadaver allografts at initial excision. Dermal substitute was placed an average of 9.2 days later. 3 of 25 burns had immediate application of dermal substitute at first excision. Following substitute, non-meshed, split-thickness autografts were placed on 18 hands. 5 of the burns did not require STSG and two hands were not further evaluated due to loss of patient follow-up. Of the 25 cases, all had near complete incorporation of the substitute without need for revision. In follow-up, patients who did not require STSG have shown no major limitations in ROM/scarring. Of those who underwent STSG, 6 hands underwent contracture release, with 2 of these progressing to amputation.

Conclusions: Dermal substitutes assist in the closure of complex deep hand burns. Cadaveric allografting prior to placement of the substitute ensures an appropriately excised wound base, allowing for near complete integration without need for reapplication. Autografting following dermal substitution placement may be initiated earlier than previously pursued and occasionally allows for healing without STSG.

660  Decreasing Burn Excision Time by Using a Circular Dermatome
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Introduction: Excision of burn-injured tissue can be accomplished by a variety of means. The most commonly used tools in the burn community are straight blades of varying lengths fitted to guards of different depths. A traditional straight dermatome can also be used for excision. We describe here the use of a circular dermatome, which in addition to allowing curvilinear excision holds the promise of expediting burn excision as well.

Methods: IRB approval was obtained for a prospective study of the use of a circular dermatome device for the excision of burns. Patients with deep partial- and full-thickness burns were eligible for inclusion in the study. Eight patients undergoing nine procedures were included. The excisions were performed exclusively with the dermatome, with use of standard equipment only for smaller areas (hands/feet). The size of the dermatome, depth of excision, and time of excision with the dermatome were noted. Total operative time (recorded as “procedure start” to “procedure end”) was also recorded, as was the subsequent wound coverage material.

Results: A total of nine cases were included. The four-inch diameter blade was most commonly used, typically at depths of 25 or 30/1000th inch. The sizes of the areas excised ranged from 392cm² to 4694 cm². The total time of excision was short (2 to 10 minutes), and total case times varied greatly (31 to 262 minutes) due to differences in wound coverage. Excision time per cm² was calculated in seconds due to the brevity of the excision and typically fell between 0.1 to 0.3 seconds per centimeter squared. The outlier (0.7s/cm²) was encountered early in the study and represented a challenge of technique. Cases where wound coverage was achieved with allograft or with standard split-thickness skin graft had case times of 2 to 5 seconds per square centimeter; the outlier (11s/cm²) was the result of a use of an unrelated new technology.

Conclusions: Rapid excision of a large area of burn can be accomplished with the circular dermatome. The device can also be used of course to take autograft. When the case consists completely of excision and allografting or conventional split-thickness skin grafting, the total operative time can be very short indeed. The dermatome may be beneficial additionally for longer cases where operating room time saved in excision may be used for other purposes.
**661** Burns in the Time Of COVID: The Use Of a Poly Lactic Acid Polymer Skin Substitute Helped A Combined Adult/Pediatrics Burn Unit Change Clinical Practice During the Coronavirus Lockdown
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**Introduction:** As a verified burn center, we prepare for mass casualty & constantly strive to remain at the forefront of the burn technology & research. There was nothing that prepared us for a statewide stay-at-home order nor the hospital lockdown that would come with the coronavirus pandemic. The hospital lockdowns resulted in disheartening loneliness that would prohibit the visitation of family to the ill or injured patients. The difficulty of locking down well parents proved challenging. Our new hospital policy restricted parent movements & their anxiety of exposure also heightened the desire to discharge. We questioned whether the pediatrics patient was better suited in the hospital or at home. This shifted our usual practice. During March-May, our hospital restricted parent movements out of the patient’s room, no visitors, no swap outs during the day. This resulted in early debridements, often at the bedside, & application of the polyactic acid polymer substitute. This allowed for a discharge within 24 hrs & return to clinic in 48 hrs.

**Methods:** We reviewed the charts of 10 pediatric patients that normally would have remained hospitalized pre-COVID & these patients were admitted underwent debridement & early application of a polyactic acid polymer skin substitute. The charts were reviewed to determine if there were any readmissions, ER visits, delays in wound healing, delays in OR time, if needed, opposition from parents or nurses from about readiness for discharge.

**Results:** The charts indicated there was one return admission. The readmit was from a planned split thickness skin graft & the polyactic acid polymer was used to stage the deeper area while allowing the majority to heal. Charts demonstrated satisfaction of the parents that didn’t want to be in the hospital during COVID. No nurses felt uncomfortable & all patients demonstrated stable vitals & good UOP at the time of discharge. This indicates several initial application on admission & was discharged within 24 hours.

**Conclusions:** This could at face value be a simple means to an end. The review of records indicates this was successful by most definitions of outcome. The limitation discovered was the ability to optimize outpatient therapy. Burns in the time of COVID, made use reexamine how we have cared for burns & whether there was room to perform more without an inpatient or a decreased inpatient stay. This change in practice also illustrated the ability to the wounds we initially thought may be deeper & possibly need excision actually healed well with no current development of hypertrophic scarring. Our institution will consider the early practice of debridement & lactic acid polymer application even when the restriction are eased. It also forced us to reevaluate how much we are grafting & reexamine what can heal on its own.

**662** Single Surgeon Experience Using a Polyactide-based Copolymer Dressing to Over and Secure Split Thickness Skin Grafts in Burn Patients.
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**Introduction:** In both partial thickness burns and skin graft donor sites, coverage with Polylactide-based copolymer dressing (PLBC dressing) has been shown to result in expedited healing and improved pain outcomes when compared to more traditional techniques. These advantages are generally attributed to the way in which PLBC remains as an intact coating over the wound bed throughout the healing process, protecting wounds from the contamination and microtraumas associated with changes more conventional dressings. At our institution, we began selectively utilizing PLBC as a means of securing and protecting fresh skin graft, in hopes that we would find similar benefits in this application.

**Methods:** Clinical Protocol-- The PLBC dressing was used at the attending surgeon’s discretion. In these cases, meshed STSG was placed over prepared wound beds. Staples were not utilized. PLBC dressing was then placed over the entirety of the graft surface, securing graft in place by adhering to wound bed through intercises. (Staples were not used.) The graft and PLBC complex was further dressed with a layer of non-adherent cellulose based liner with petroleum based lubricant, and an outer layer of cotton gauze placed as a wrap or bolster. Post operatively, the outer layer (“wrap”) of gauze was replaced as needed for saturation. The PLBC and adherent “inner” liner were left in place until falling off naturally over the course of outpatient follow-up.

Retrospective Review-- With IRB approval, patients treated PLBC over STSG between April 2018 to March 2019 were identified via surgeon’s log and pulled for review. Documentation gathered from operative notes, progress notes (inpatient and outpatient) and clinical photography was used to identify demographics, mechanism of injury, depth, total body surface area percentage (TBSA%), size of area treated with PLBC dressing, graft loss, need for re-grafting, signs of wound infection, antibiotic treatment, and length of stay.

**Results:** Twenty-two patients had STSG secured and dressed with PLBC. Median patient age was 36.5 years. Median TBSA was 5.1%, and median treated area 375 cm2. Follow up ranged from 21 to 232 days post-operatively, with two patients lost to follow up. All patients seen in outpatient follow up were noted to have “complete graft take” or “minimal” graft. None of the areas treated with PLBC dressing required re-grafting. There were no unplanned readmissions, and no wound infections were diagnosed or treated. Practitioners in in-patient setting and in follow up clinic reported satisfaction with the PLBC dressing.

**Conclusions:** The PLBC dressing was a feasible solution for securing and dressings STSGs. Future work is needed to determine whether its use is associated with an improvement in patient outcomes.
Introduction: In patients with larger burns, treatment with CEA has proven to increase survival.1 CEAs, while useful, are not without some disadvantages. For instance, if the injury involves burns to posterior surfaces, the challenge is inherent in that these fragile sheets are easily sheared, and pressure can cause disruption and graft loss. CEA grafting must be managed with specific care and with specialized protocols that help address these challenges. Graft loss due to these and other factors can delay healing, increase hospital length of stay, and increase the cost of care. The purpose of this study is to evaluate the success for graft take in patients with posterior burns treated with CEA and to discuss the techniques, protocols and approaches to managing these patients within our burn network.

Methods: This retrospective study was granted exemption by IntegReview IRB. Take rate for each application of CEA was not always found for some cases. For purposes of this study, we agreed with methods of other researchers in the literature and adapted the “clinically relevant” assessment that take and final coverage was successful when re-grafting was not required by the time of discharge or death.2

Results: Study dates was March 2016 - December 2019 and at this time, is being reported from among 3 of 6 participating centers. Our approach is to provide CEA prep the day before initial placement and then to ensure strict protocols are followed at the bedside post-op and thereafter. Total number of patients considered was 68, 41 were deemed evaluable. See tables for other demographics and results. 31 patients were discharged to rehab (75%), 6 were discharged home (15%) and 4 died (10%).

Conclusions: Meticulous attention to wound bed preparation and ensuring that post-op care is clearly stated and understood by all clinicians involved in the care of patients with larger burns with posterior trunk involvement is the key to successful coverage with CEA to this challenging anatomical location.

Introduction: Minimally invasive surgery is increasingly becoming standard of care across numerous subspecialties. However, burn surgery has lagged behind; as the mainstay of reconstruction still involves wound excision with a knife, a commensurately sized skin graft, and a painful donor site.

Methods: This study is a single site review of patients treated the continued access study protocol for bromelain-based enzymatic debridement and with ASCS per the FDA-approved instructions for use. Enzymatic debridement was performed over a 4-hour period with appropriate analgesia. Deep partial-thickness burns with residual dermis were treated with ASCS after enzymatic debridement and superficial dermabrasion. Wounds were dressed with a small pore non-adherent film and layered gauze. Full-thickness burn injuries were treated with conventional STSG.

Results: Two patients were treated over a 2 week period. One was a 51 yr old male with 17% TBSA superficial and deep partial thickness flame burns, of which 11% were deemed deep enough to warrant treatment with enzymatic debridement. 15% TBSA was treated with ASCS including the arms, back, and posterior neck with a 24 sq cm donor site. Wound closure was noted post-operative day 7 with complete re-epithelialization. The second patient was a 21-year-old male with several comorbidities impairing wound healing (diabetes [HgbA1c of 9.9], scurvy, and zinc deficiency. He had deep-partial and full-thickness burns to bilateral feet. The dorsum of the right foot was reconstructed with ASCS only and a 6 sq cm donor site, and the left foot was treated with a 3:1 meshed STSG and ASCS overspray with 100% take.

Conclusions: Enzymatic debridement and ASCS can be utilized to treat deep partial-thickness burns with a
“minimally invasive” reconstruction. The donor sites in both patients were much smaller than had they been treated with a conventional meshed STSG. Further study is needed to determine which subsets of patients and burn wound characteristics are optimal for this combination of technologies. More data regarding outcomes such as length of stay, costs, and scar formation compared to standard of care is also warranted.

665 Blood Loss in Burn Surgeries: Prediction and Its Related Factors
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Introduction: Blood loss is a common and important problem in burn surgery, and patients often require blood transfusions. Preparation of estimated blood transfusions needed prior to surgery is essential. Some studies have devised formulas that can predict blood loss during burn surgery. However, there were many different factors in each study that may influence the amount of blood loss, which were not included in the formulas. Until today, there is no standardized formula that is widely used.

Methods: We searched the Cochrane Central Register of Controlled Trials (CENTRAL) and MEDLINE database for cohort and trial studies that investigate blood loss in burn surgeries. Studies should have clear quantitative blood loss outcome.

Results: We included 15 studies from 1982 to 2018, 13 of which are cohort studies and 2 RCTs, with a total of 1613 subjects; all studies calculated blood loss and assessed possible relating factors, four of them proposed formulas to predict the volume of blood loss, 13 studies mentioned efforts used to reduce blood loss, and 6 studies assessed the timing of surgery. We found trends of blood loss within each variable and summarized them in tables.

Conclusions: From the studies included, there were a variety of results in the amount of blood loss and its related factors. This was due to confounding factors and dissimilarities between studies. However, several studies proposed blood loss prediction formulas, which pose promising benefits to betterment in burn surgeries.
Introduction: Split-thickness skin grafting (STSG) is the standard of care for the treatment of full thickness skin injuries. Skin grafts are associated with long-term morbidity including graft loss, adjacent structural injury, anesthetic complications, scarring, and scar contractures. Large surface area burns are additionally challenging due to limited donor site availability. Autologous skin cell suspension (ASCS) is a new adjunct for STSG using device that provides a suspension of non-cultured, autologous skin cells applied overtop of STSG. Dermal matrix templates are placed on wounds after burn excision and induces dermal regeneration in preparation for STSG, allowing for a thinner graft to be harvested and applied. This technique has been shown to require both smaller areas of donor skin as well as thinner skin harvest which improves both healing time and aesthetic outcomes of donor sites, enhancing the time-tested and well accepted technique of STSG.

Methods: We present the case of a 5-year-old African American female who suffered 18% TBSA deep partial thickness burns and full thickness burns to her abdomen, trunk and left back after her shirt was accidentally lit on fire at home. She was transferred from a local hospital to our burn center for further evaluation. She was evaluated by both the burn surgery and pediatric teams and admitted for wound cares and surgical planning.

Results: On hospital day five she underwent burn excision and placement of acellular dermal regeneration template. She returned to the operating room on hospital day 22 after daily wound cares for autografting with autologous skin cell suspension application to anterior and posterior torso and left arm, as well as to back and thigh donor sites. Her takedown on hospital day 29 showed excellent graft take. She was ultimately discharged on hospital day 47. She continued to undergo wound care in the outpatient burn clinic and daily physical and occupational therapy.

Conclusions: This case illustrates the use of dermal matrix and ASCS on a large burn with excellent aesthetic outcomes and improved healing time. This case is unique in highlighting the versatility of this therapy in a darker skinned patient. There are significant challenges with long term morbidity from STSG and the use of both dermal regenerative matrix and ASCS may provide surgeons with new approaches to decreasing depth and size of donor sites, as well as improving the length of hospital stay and overall aesthetic outcomes of donor and graft sites, specifically in darker skinned patients.
Introduction: We report a case of a patient with a burn injury who developed a devastating necrotizing soft tissue infection (NSTI) early in the post-burn period.

Methods: An elderly male was admitted to an ABA verified burn centre after sustaining a 20% scald burn to his back and right upper extremity. He was found in the bathtub; a fall was suspected based on his history of Parkinson's disease and a finding of bruising to his bilateral knees. Initially, his hospital course was uneventful apart from an elevated creatine kinase, which decreased with adequate resuscitation without signs or symptoms of compartment syndrome. Thirty-six hours following his admission, he developed rapid onset of progressively worsening renal function, respiratory requiring intubation, mechanical ventilation, and circulatory failure requiring vasopressor support. After ruling out other causes of shock and upon re-examination of his burns there were clinical signs of a rapidly advancing necrotizing soft tissue infection. He was taken urgently to the operating room for aggressive debridement of nonviable tissue. He underwent a right shoulder disarticulation and extensive debridement of the right chest, abdomen, and back. Intra-operative tissue samples and preoperative blood cultures were positive for Group A Streptococcus. The patient was predicted to require multiple operations and a prolonged hospital stay. Despite these interventions, his prognosis was poor. The family and the treatment team, in the context of the patient’s previous independent functioning, revised his goals of care on his first post-operative day. Life-sustaining treatment was withdrawn, and comfort care measures were implemented. The patient passed away two days later.

Results: We report a case of a patient with a burn injury who developed a devastating NSTI early in the post-burn period within 36–48 hours of presentation to a burn center. Soft-tissue infections in the immediate post-burn period are rare unless there is subsequent contamination. Burned tissue contains a large amount of necrotic tissue and protein-rich wound exudate, which provides a rich growth medium for bacteria. This, in addition to the immunosuppression secondary to the burn insult, favors the development of infection. NSTI in the context of thermal injury is a rare phenomenon and in the few reported cases in burn patients, necrotizing infections occurred closer to two weeks following the initial injury.

Conclusions: Necrotizing soft tissue infections are entities with a rapid and devastating course. The diagnosis is challenging, and occlusive dressings may contribute to a delay in diagnosis in burns. Acute hemodynamic compromise without any obvious cause should raise the suspicion for a necrotizing soft tissue infection and lead to early exposure of wounds in burn patients.

Introduction: A critical component of split-thickness skin grafting is the fixation of the skin graft to the wound site. Graft displacement can result in graft failure, especially during the initial 48–72 hours following application. The most common method of securing grafts is with the use of staples, sometimes with the addition of fibrin glue in order to aid both graft adhesion and homeostasis. The use of staples, however, is associated with significant levels of patient discomfort, especially during staple removal. A possible alternative to staples is the use of liquid adhesives, in combination with steri-strips, to anchor the edges of skin grafts to intact skin. Certain liquid adhesives, such as gum-based resins, are cheaper to use than staples and offer the potential to secure small split-thickness skin grafts without the associated pain of staples. In this pilot study, we examined the effectiveness of using a combination of gum-based resin (Gum Mastic-Stora-Res-Alcohol), fibrin glue, and steri-strips to secure partial-thickness grafts in 8 patients without the use of staples or sutures.

Methods: Patients were included in the study who required split-thickness skin grafts to treat wounds involving less than or equal to 15% total surface body area and whose wounds were not located in areas prone to graft displacement, such as the axilla and groin. For each patient, skin grafts were secured using fibrin glue (sprayed over the entire wound), and a combination of liquid adhesive and steri-strips applied around the wound perimeter. The success of each graft was determined by the percentage of graft take.

Results: From January 1st, 2020 to April 30th, 2020, 8 patients were identified who fit the inclusion criteria. Five of the patients received grafts to their lower extremities, two patients received grafts to their upper extremities, and one of the patients received a graft to the torso. The average wound site that was grafted was 116.7 cm². Average graft take among the 8 patients was 96.9%, with a range of 90%-100%. No complications at the graft site were noted, such as hematomas or any other event that resulted in graft displacement or failure.

Conclusions: The results of the study demonstrate that a combination of liquid adhesive, fibrin glue, and steri-strips, can be used as an effective alternative to staples in small split-thickness skin grafts. The use of liquid adhesive in place of staples was advantageous because it eliminated the need for staple removal, which resulted in less discomfort for the patient and less work for the nursing staff.
**Introduction:** Traditional Western blotting (WB) may not reflect true target protein amount due to interference from enzymic activity during sample preparation. In-Cell Western (ICW) blotting has proved to have advantages over the traditional WB. However, ICW has not been used to study burn-induced cardiac dysfunction. This study will explore the efficacy of ICW in the study of burn-induced cardiac dysfunction.

**Methods:** Human cardiomyocytes (Ac16) were cultured in serum from rats with/without 60% of total body surface area (TBSA) burn injury. Cultured cells were permeabilized by Tritons-100 X, 1° anti-targeted protein antibodies were added and incubated, and, finally, two fluorescence-conjugated 2° antibodies (one red and one blue) were added and incubated. LI-COR Odyssey CLx scanner was employed to obtain images and LI-COR Image Studio 4.0 software was used to analyze image and GraphPad Prism 8.0 software was used to determine image density.

**Results:** ICW proved to be a good tool to study burn injury. Our ICW data showed that burn serum resulted in 1) increased cardiomyocyte PARP1 (leading to increased protein acetylation); 2) increased damage of cardiomyocyte mitochondrial DNA replication (via increase in mitochondrial Fis1and BCBN proteins and decrease in parkin and POLG proteins); and 3) a decrease of cardiomyocyte mitochondrial biogenesis (with increase in inflammation-related proteins, apoptosis-related proteins, and decrease Brf2-ARE-related proteins).

**Conclusions:** This study provides preliminary evidence that ICW may be a novel tool to study burn injury and confirms that burn-injury induced cardiomyocyte mitochondrial dysfunction occurs via damage of mitDNA replication, involving inflammation, apoptosis, and mitochondrial biogenesis pathways.

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**Introduction:** Thermal burns account for 5–10% of casualties sustained in present-day conflicts and are expected to be one of the most common wounds to occur in future conflicts. In prolonged field care (PFC) situations, medical evacuation could be delayed for days. During this time, burn wounds can become infected, detrimentally impact neighboring tissue, and cause systemic immune responses. Therefore, it is essential to test and evaluate non-surgical debridement agents that could be implemented prior to reaching a Role 3 military treatment facility. This work details how the proprietary proteolytic gel SN514 impacts burn debridement when applied within a PFC-like timeline. SN514 contains an enzyme formulation that is thermostable, easy to apply, and selectively degrades non-viable tissue in vitro and in vivo.

**Methods:** Deep-partial thickness contact burns were created using an established porcine model and covered with gauze or an antimicrobial incise drape. Four days later, the burns were treated with one of five treatments: 0.2% SN514, 0.8% SN514, a vehicle control, gauze, or an antimicrobial silver dressing. Treatments were re-applied every 24 hours for 72 to 96 hours. The effects of the treatment regiments were compared histologically. Biopsies were also taken to monitor bacterial contamination levels.

**Results:** Burns treated with SN514 were partially debrided and visually distinct from those treated with gauze, the silver dressing, or the vehicle control. Preliminary analyses suggest that SN514-treated burns that had been covered with “dry” gauze had a much lower debridement efficiency than those treated with the incise drape. This suggests that SN514 debridement efficiency may depend on the presence of a moist eschar. Preliminary analyses also suggest that there was little difference in burn wound bacterial counts among the five treatment groups.

**Conclusions:** SN514 is able to debride burns that experienced delayed treatment, without any evidence of harm to the surrounding tissue or evidence of exacerbating the original burn injury. SN514-treated wounds displayed little to no blood loss and did not increase burn wound infection levels compared to wounds treated with gauze or an antimicrobial silver dressing.
**671 Burn Wound Healing Effect of Bromelain-loaded Chitosan Nanofibers**

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**Introduction:** Bromelain is a mixture of proteolytic enzymes present in all tissues of pineapple (Ananas comosus). It is known as an efficient debriding agent in burn treatment and has been shown to effectively and selectively debride burn eschar. In this study, the efficiency of bromelain-loaded chitosan nanofibers for burn wounds repair was investigated in animal model.

**Methods:** Chitosan nanofibers containing bromelain were prepared by electrospinning method. The physicochemical characteristics of the synthesized nanofibers, release profile and activity of bromelain loaded in nanofibers were evaluated. The burn healing effect of bromelain-loaded nanofibers were studied in the induced burn wounds in rats for 21 days. The efficacy of treatment was assessed by evaluating changes in wound closure and histological analysis at different time point.

**Results:** Successful electrospinning of bromelain-loaded chitosan nanofibers resulted in uniform and bead-less nanofibers which released bromelain up to 48h. The formulation kept bromelain enzyme activity after 6-month storage at 4 °C and did not show any cytotoxicity on human dermal fibroblasts. Moreover, in vivo study in a rat burn model confirmed the safety and efficacy of applying bromelain loaded nanofibers in burn wound healing when a significant improve in wound closure was observed in bromelain loaded group and histopathological studies showed more effects on re-epithelialization, debridement and more reduction of necrosis compared to chitosan alone.

**Conclusions:** Together, these results suggest that bromelain chitosan nanofiber possesses great wound healing activity and could be considered as an effective natural topical burn wound healing treatment.

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**672 An Investigation of Antibiotic Loading and Release in Acid-precipitated Keratin Proteins to Treat Topical Burn Infections**

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**Introduction:** Human-hair derived keratin (KOS) protein has been selected in this investigation for its ability to bind antibiotic compounds and provide sustained release while withstanding harsh proteolytic environments such as inflamed, damaged tissue. The need to control local flora has been recognized as an imperative for wound healing, as recovery is significantly hampered by infection. This study investigates the synthesis of KOS-based particulate matter, developed using acid-precipitation, to load and release the water-soluble antibiotic ciprofloxacin (CIP). We hypothesize that ionically bound CIP release is tied to the degradation of KOS, therefore, bacterial metabolism, which produces proteolytic enzymes, will trigger CIP release thereby creating a novel self-extinguishing delivery system for contaminated skin wounds.

**Methods:** Ciprofloxacin hydrochloride was solubilized in deionized water (pH 5.3) under constant stirring. Freeze-dried KOS powder was added for an ultimately 5% w/v and 0.8% w/v solution of KOS and CIP, respectively. To improve the stability of KOS a water-soluble diglycidyl ether crosslinker was added to solutions and stirred for 24 hours. CIP-loaded protein was precipitated out by a hydrochloric acid induced pH reduction. Samples were collected and frozen at -20 °C prior to lyophilization, thus forming the stable product. Degradation of KOS and commensurate release of CIP were measured using a bicinchoninic acid (BCA) assay and fluorescent measurements of hydrated material supernatant. The reduction of bacterial colonies was validated by a broth inhibition assay whereby CIP-loaded KOS or unloaded KOS controls where hydrated in bacterial-laden broth cultures of Pseudomonas aeruginosa or Methicillin-resistant Staphylococcus aureus. Cultures were sampled at 24, 48, or 72 hours and plated to quantify colony-forming units.

**Results:** The presence of CIP in the KOS protein was confirmed and release rates follow similar patterns to that of KOS degradation. CIP-loaded proteins significantly reduce bacterial colony presence in concentrated inoculant solutions up to 72 hours.

**Conclusions:** CIP release does appear to coincide with KOS degradation, which is bolstered in the presence of infectious levels of bacteria. Ongoing studies aim to observe more robust models of infection and more controlled antibiotic release.
**673** Effect of Subcutaneous Topical Ozone Therapy on Second Degree Burn Wounds in Rats: An Experimental Study

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**Introduction:** Burn is one of the most severe traumas that causes coagulative destruction of the skin. The use of various products that accelerate wound healing in patients with burn may affect the patient's survival and reduce the complications that may be seen. In the present study we aimed effects of subcutaneous ozone injection on second degree burn wound.

**Methods:** A total of 72 Sprague-Dawley male rats included in the study were divided randomly into three groups (control group (CG), silver sulfadiazine group (SG), ozone group (OG)) and each group was divided randomly two subgroups (as sacrificed on d7 and on d14). A deep second degree scald burns were created on the lower back. In CG subcutaneous 0.9% serum saline was injected daily into the burn area. In SG, burns were dressed with silver sulfadiazine daily and in OG subcutaneous ozone was injected daily into the burn area. Tissue hydroxyproline level measurement and histopathological evaluation were done.

**Results:** When the groups were compared in terms of weight change, no significant difference was found on the 7th and 14th days. In the evaluation made in terms of tissue hydroxyproline, tissue hydroxyproline level in OG was found to be significantly higher on both the 7th and 14th days (p < 0.001). In histopathological evaluations, it was determined that wound healing in OG was significantly higher than in the other groups.

**Conclusions:** According to the results, subcutaneous ozone therapy is more effective than silver sulphadiazine in the healing process of second-degree burn wounds and it can be safely used in the treatment of burn wounds.

**674** Machine Learning and Automation in Burn Care: A Systematic Review

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**Introduction:** Current methods of burn evaluation and treatment are subjective and dependent on surgeon experience, with high rates of inter-rater variability leading to inaccurate diagnoses and treatment. Machine learning (ML) and automated methods are being used to develop more objective and accurate methods for burn diagnosis and triage. Defined as a subfield of artificial intelligence that applies algorithms capable of knowledge acquisition, machine learning draws patterns from data, which it can then apply to clinically relevant tasks. This technology has the potential to improve burn management by quantitating diagnoses, improving diagnostic accuracy, and increasing access to burn care. The aim of this systematic review is to summarize the literature regarding machine learning and automated methods for burn wound evaluation and treatment.

**Methods:** A systematic review of articles available on PubMed and MEDLINE (OVID) was performed. Keywords used in the search process included burns, machine learning, deep learning, burn classification technology, and mobile applications. Reviews, case reports, and opinion papers were excluded. Data were extracted on study design, study objectives, study models, devices used to capture data, machine learning, or automated software used, expertise level and number of evaluators, and ML accuracy of burn wound evaluation.

**Results:** The search identified 592 unique titles. After screening, 35 relevant articles were identified for systematic review. Nine studies used machine learning and automated software to estimate percent total body surface area (%TBSA) burned, 4 calculated fluid requirements, 18 estimated burn depth, 5 estimated need for surgery, 6 predicted mortality, and 2 evaluated scarring in burn patients. Devices used to estimate %TBSA burned showed an accuracy comparable to or better than traditional methods. Burn depth estimation sensitivities resulted in unweighted means >81%, which increased to >83% with equal weighting applied. Mortality prediction sensitivity had an unweighted mean of 96.75%, which increased to 99.35% with equal weighting.

**Conclusions:** Machine learning and automated technology are promising tools that provide objective and accurate measures of evaluating burn wounds. Existing methods address the key steps in burn care management; however, existing data reporting on their robustness remain in the early stages. Further resources should be dedicated to leveraging this technology to improve outcomes in burn care.