INTRODUCTION
People with trans-tibial limb loss typically experience changes in residual limb volume while performing activities such as standing, walking, and sitting (Sanders 2014). The resulting fluctuations degrade prosthesis fit and require accommodation strategies such as donning prosthetic socks. The purpose of this study was to examine how normal activities and self-reported outcomes relate to daily changes in residual limb volume and volume accommodation.

METHOD
Subjects: Volunteers with trans-tibial amputation wearing a normal prosthesis participated.

Procedures: Over a two week interval of normal daily activity, subjects documented their daily sock changes (D’Silva 2014). Subjects then completed a three-part, in-lab session over a single day.

On the morning of the in-lab session, subjects completed the SCS (Hanspal 2003) and select subsections of the PEQ (Legro 1998). Next, subjects underwent a 35-minute controlled protocol while limb fluid volume was measured by a bioimpedance analyzer (Sanders 2015). Two 3-axis accelerometers (wGT3X+, Actigraph) were then attached to the subject’s prosthesis, and they left the lab to conduct their normal daily activities for at least three hours. Subjects then returned to the lab in the afternoon, and the morning bioimpedance protocol was repeated.

RESULTS
Twenty-seven subjects were classified into two groups using their self-reported sock use. Accommodators (n=12) changed socks at least once, while non-accommodators (n=15) made no changes. During the monitored period between in-lab sessions, accommodators spent 6% more time weight bearing (walking or standing), while non-accommodators spent 10% more time with the socket doffed. Further, non-accommodators reported higher scores in each survey category with the highest difference of 1.1 (0-10 scale) in the SCS (Figure 1).

In-lab bioimpedance data showed that about 80% of participants in each group lost volume over the day. Doffing during the three hour period between sessions produced the strongest correlation to volume change (r=0.49). Bouts of sitting and standing were negatively correlated to anterior volume change, while ambulating was negatively correlated to posterior volume change. SCS, PEQ-satisfaction, and PEQ-ambulation subscales positively correlated with volume change (mean 0.17 ± 0.09, Table 1).

DISCUSSION
Participants who accommodated with prosthetic sock adjustments were not significantly more active and did not report higher satisfaction, comfort, or ambulation scores. The difference in time doffed between the two groups suggests that those labeled as non-accommodators may have been choosing to compensate volume loss in an alternative fashion. The positive correlation between doffing and volume change may help explain why non-accommodators spent more time doffed while choosing not to make sock adjustments. The correlation between SCS and volume change also suggests that minimizing volume loss throughout a day may lead to increased user comfort.

CLINICAL APPLICATIONS
While prosthetic socks are commonly used to improve socket fit, previous studies have shown that it can be difficult to predict the accommodation they provide (Cagle 2015). This may explain practical differences seen in self-reported scores between accommodators and non-accommodators. Results from this study suggest that integrating doffing as a normal accommodation strategy may increase user comfort and satisfaction.

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