INTRODUCTION
It is a widely accepted premise: health is so highly correlated with physical activity that clinicians are constantly encouraging more physical activity from their patients (Siegel, 1995). Lower limb amputees, who often present with numerous comorbidities, are no exception, particularly when one considers their activity levels are far below their non-amputee cohorts (Tudor-Locke, 2009; Klute, 2006). While many believe the expensive technology in next generation limbs (Goldfarb, 2013) will result in greater activity levels that may amputee health disparities, what if there is another, less expensive way?

One approach to encouraging greater activity involves simply wearing an activity monitor; doing so has increased activity, promoted weight loss, and decreased blood pressure in other patient populations (Bravata, 2007; Richardson, 2008).

The aim of this research is to determine if evidence supporting the use of inexpensive, smart activity monitors to increase activity levels extends to the lower limb amputee population and to determine if lower limb amputees are willing to use smart activity monitors as part of their daily life.

METHOD
Subjects: 21 lower limb amputees provided informed consent to participate in this IRB-approved protocol (16 transtibial, 5 transfemoral; 13±13 years post-amputation; n=10 trauma, n=1 diabetes, n=4 secondary to infection, n=6 other causes).

Smart activity monitor: Fitbit Zip (Fitbit Inc., San Francisco, CA).

Procedures: Participants received a smart activity monitor (and replacements or new batteries when needed) and taught how to use and sync it. Subjects were blinded to feedback for the first two weeks to establish a baseline activity level. Afterwards, subjects could get activity level feedback from the smart activity monitor display and access their historical data on the Fitbit website. Participants also received virtual achievement awards with a target activity level set at 10,000 steps/day. Other important milestones, such as the greatest number of steps taken in a day and incremental lifetime distance achievements (e.g., 100 miles, 250 miles, etc.), were awarded.

Data Analysis: Participant data was downloaded from the Fitbit website to calculate baseline and post-baseline activity levels (steps/day), and use patterns. A habitual user was defined as someone who wore the smart activity monitor for at least 75% of the days enrolled in the study.

RESULTS
The median duration of participation was 5 months (range: 2 to 20 months) in this on-going study. The baseline (no feedback) and post-baseline activity levels (steps/day) are shown in Table 1. After the baseline period, transtibial amputees increased their activity 1%, transfemorals increased their activity 14%, while the entire sample population taken together increased their activity 4%. Fifteen of the 21 participants met the criteria for habitual use.

<table>
<thead>
<tr>
<th></th>
<th>BASELINE</th>
<th>POST-BASELINE</th>
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<tbody>
<tr>
<td>Transtibials</td>
<td>5331±2123</td>
<td>5380±1754</td>
</tr>
<tr>
<td>Transfemorals</td>
<td>5617±2423</td>
<td>6392±1507</td>
</tr>
<tr>
<td>All</td>
<td>5399±2138</td>
<td>5621±1720</td>
</tr>
</tbody>
</table>

Table 1. Activity levels (steps/day; mean ± standard deviation) of amputee participants.

DISCUSSION
Blinded studies (no feedback to the wearer) have shown that lower limb amputees take less than 6,000 steps/day (Klute, 2006; Stepian, 2007), a result comparable to the baseline data of this study. As observed in other populations (Bravata, 2007; Richardson, 2008), providing feedback resulted in additional activity among lower limb amputees.

CONCLUSION
Lower limb amputees appear to be willing to use smart activity monitors as part of their daily lives, resulting in higher activity levels.

CLINICAL APPLICATIONS
An inexpensive device (~$50) may increase the activity levels, and perhaps health, of lower limb amputees.

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REFERENCES