Title: 10759 - Commercial Activity Monitor For Assessing Free-Living Limb Salvage Outcome In Pediatric Lower Extremity Bone Cancer

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Background: Commercial activity monitors are growing in popularity. These low-cost, patient worn devices provide an opportunity to objectively assess outcomes of limb salvage, with advantages over previously validated accelerometers.

Question/Purpose: The purpose was to assess the activity level of pediatric patients who underwent limb salvage for primary bone tumors. The hypothesis was that average daily steps would correlate with patient-reported outcome (PRO) measures.

Patients and Methods: At a single tertiary children's hospital patients presenting to clinic for a new or previously treated primary bone tumor were offered enrollment prospectively. Dates of enrollment for this study were January 2014 through February 2015. After obtaining informed consent, participants were trained in the use of a FitBit One (FitBit Inc., San Francisco). A fully charged device was provided, with instructions to wear daily until the battery died and then return the device via prepaid postage. Details of device usage, steps taken and intensity were recorded. During the time of usage, participants also completed the Toronto Extremity Salvage Score (TESS) and Short-Form 36 version 2 (SF-36). SF-36 data was modeled to SF-6D health state preference data via the nonparametric Bayesian method. Demographic and tumor characteristics were abstracted. Statistics were performed with Stata version 11 (College Station, Texas). Parametric regression analysis was utilized as primary outcomes approached a normal distribution. Means were compared with two-tailed t-test.

Results: Twenty evaluation periods with a total of 304 days of activity monitor data were included in the analysis. In patients with an average age of 16.5 (range 12-22), there were 12 osteosarcomas, 7 Ewings sarcoma, and 1 adamantinoma. A minimum of 4 usage days was included for each evaluation. Average daily steps overall was 4299 (STD 3298, range 134-18924), of which 1944 steps were of moderate intensity (STD 2103, range 0-13427). Only 60 of 303 (20%) monitored days recorded any 'very active' minutes. The mean TESS was 86 (range 66-100) and SF-6D preference value mean was 0.58 (range 0.46-0.66). For each evaluation period, average daily steps was positively correlated with the SF6D preference value ($r=0.46$, $p=0.04$) and the SF-36 physical component scale (0.45, $p=0.04$), but not the TESS ($p=0.38$) or the SF-36 mental component scale ($p=0.64$). Time from surgery was strongly correlated with daily steps ($r=0.66$, $p=0.001$).

Discussion: In a population of lower extremity pediatric primary bone malignancies, the amount and intensity of free-living activity was evaluated with a low-cost, commercial activity monitor that is worn on the waist (FitBit One). A positive correlation with the time since surgery and a health state utilities measures (SF-6D) support the validity of this device. There was not a correlation with the TESS in this cohort. Mean TESS and SF-6D preference weights were similar to prior studies, yet the average steps-per-day was under 5,000 and few participants obtained high intensity activity. Some participants scored maximum TESS scores yet averaged fewer than 2,000 steps a day, suggesting that measurement of free-living activity may provide additional information on functional outcomes that is not captured by PRO measures alone. Although a research-oriented accelerometer was previously validated, expense limited its widespread use, and the requirement to wear it on the ankle was less acceptable to study participants. Understanding the amount and intensity of free-living activity after limb salvage may aid in patient education and assessing treatment options. A commercial activity monitor appears a valid and feasible means to further investigations.

Level of evidence: II