Feasibility and Utility of a Fitbit Tracker Among Ambulatory Children and Youth With Disabilities

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Purpose: To examine the feasibility and utility of the Fitbit Charge HR to estimate physical activity among ambulatory children and youth with disabilities. Method: Participants (4–17 y old) with disabilities were recruited and asked to wear a Fitbit for 28 days. Feasibility was assessed as the number of participants who adhered to the 28-day protocol. Heat maps were generated to visually examine variability in step count by age, gender, and disability type. Between-group differences for wear time and step counts by age, gender, and disability type were assessed by independent sample t tests for gender and disability group, and a 1-way analysis of variance for age group. Results: Participants (N = 157; median age = 10 y; 71% boys; 71% nonphysical disabilities; 29% physical disabilities) averaged 21 valid days of wear time. Wear time was higher in girls than boys (mean difference = 18.0; 95% confidence interval [CI], 6.8 to 29.1), and in preadolescents (mean difference = 27.6; 95% CI, 15.5 to 39.7) and adolescents (mean difference = 21.2; 95% CI, 33.6 to 8.7) than children. More daily steps were taken by boys than girls (mean difference = −1040; 95% CI, −1465 to −615) and individuals with a nonphysical disability than a physical disability (mean difference = −1120; 95% CI, −1474 to −765). Heat maps showed peaks in physical activity on weekdays before school, at recess, lunchtime, and after school. Conclusion: The Fitbit is a feasible tool for monitoring physical activity among ambulatory children and youth with disabilities and may be useful for population-level surveillance and intervention.

Keywords: physical activity, wearables, fitness tracker

Physical activity guidelines recommend that all children and youth, including those with disabilities, engage in at least 60 minutes of moderate to vigorous physical activity each day (9). Existing evidence demonstrates that the majority of children and youth are not meeting the 60-minute per day guideline (2,10), and unfortunately, children and youth with disabilities are even less active, when using this guideline, than their peers with typical development (6,26). Despite the 60-minute per day recommendation, evidence suggests that children and youth with disabilities will likely benefit from 120 to 180 minutes per week of moderate to vigorous physical activity (32) and newly released UK recommendations state that children and youth with disabilities should engage in at least 20 minutes of daily physical activity of any intensity (31). Regardless of which guidelines are followed, there is a critical need to intervene on the physical activity levels of children and youth with disabilities.

The World Health Organization (WHO) recognizes research as one of 10 target areas for advancing inclusive policy and practice in physical activity (7). This target includes having mechanisms to gather data on participation in physical activity to monitor progress in participation on local, national, and international levels (7). However, to test intervention effects and conduct population-level surveillance of physical activity among children and youth with disabilities, we need to be able to measure physical activity using tools that are not only valid, but also acceptable and effective as assessed by people with lived experience of disability. Further, it is essential that monitoring tools be easy to use and provide useful information for practitioners, researchers, and children and youth.
with disabilities (and their families) to effectively track and inter-
vene on physical activity levels.

Accelerometers are considered the gold standard for measur-
ing physical activity among children and youth with and without
disabilities (27,38). Yet, research-grade accelerometers are cost-
prohibitive and require specialized software to collect and analyze
the data; thus, they are not accessible to the general population or
most practitioners for daily monitoring. Over the past decade, there
has been an increase in the availability and uptake of wearable
activity monitors, such as the Fitbit. Previous work has demon-
strated acceptable validity of wearable activity monitors among
adults and children without disabilities (15). Research regarding
the measurement properties of wearable activity monitors among
children and youth with disabilities is limited. However, recent
research from our team indicates that step counts measured by the
Fitbit Charge HR demonstrate acceptable concurrent validity with
accelerometry among ambulatory children and youth with disabilities
in free-living conditions (5).

Beyond validity, it is important to understand whether mea-
suring physical activity using a wearable activity monitor is
feasible among ambulatory children and youth with disabilities
and whether it provides useful data for interpreting activity pat-
terns. Data regarding the feasibility of wearable activity monitors
are limited. While a few studies have indicated feasibility of the
Fitbit among children and youth with chronic health conditions
(18), no studies have specifically examined the feasibility of
using a wearable activity monitor, such as the Fitbit, to track daily
physical activity among ambulatory children and youth with disabil-
ities (25). It is important to establish the feasibility of these
devices, particularly for long wear periods in free-living conditions,
to understand whether children and youth with disabilities will
be accepting of a wearable activity monitor. Feasibility studies
include a range of outcomes and provide a critical step in inter-
vention optimization (4,22). In this regard, examining the feasibil-
ity of wearable activity monitors will help to inform measurement
decisions for enhancing existing population-scale surveillance
systems of physical activity, as well as intervention studies, among
ambulatory children and youth with disabilities.

While determining feasibility will help to inform whether the
Fitbit will be accepted as an intervention and surveillance tool
among children and youth with disabilities, it is also important that
we understand the usefulness, or utility, of wearable activity
monitors for measuring step counts and exploring patterns in
physical activity levels. There has been a growing call for more
precise measurements of physical activity using shorter time scales
(eg, minute by minute; [3,23]), which the Fitbit may be able to help
address. Such a measurement approach will allow us to better
explore how physical activity is accrued over the day, leading to
increased precision in intervention development and resource
delivery. Thus, regarding the utility of the Fitbit, we are interested
in testing whether the Fitbit can differentiate group effects typically
seen in physical activity data (eg, age and sex differences), and how
useful it is for exploring intraday variability in physical activity
among ambulatory children and youth with disabilities.

The primary objective of this study was to examine the
feasibility of the Fitbit Charge HR to be worn by ambulatory
children and youth with disabilities over a 4-week measurement
period. A secondary objective of this study was to explore the
utility of the Fitbit to measure physical activity levels, differentiate
group effects that we would expect to see with physical activity
data, and provide insight into intraday patterns of physical activity
among ambulatory children and youth with disabilities.

Methods

Design and Participants

This study was part of a larger cross-sectional study on the
movement behaviors of children and youth with disabilities living
in Canada called the National Physical Activity Measurement
study (1). In the current study children and youth with disabilities
between the ages of 4 and 17 years were recruited from across
Canada between January 2019 and March 2020 (1). Inclusion
criteria for this feasibility and utility study were as follows: (1) aged
4–17 years; (2) have any type of disability, as identified by their
parent; (3) able to ambulate with or without a mobility aid (eg, cane,
walker, and ankle-foot orthotic); and (4) be willing to wear a Fitbit
device over a 4-week (28-d) period. Participants were excluded
from the current study if they used a wheelchair as their primary
mode of mobility. Parental written informed consent and screening
for study eligibility were completed online using the research
electronic data capture (REDCap) data management platform
(16). Institutional research ethics board approval was obtained for
the larger National Physical Activity Measurement study from the
University of Toronto (#31862; [1]).

Measures

Demographic Characteristics

Age, gender, and disability group were reported by parents. Dis-
ability group was categorized as either physical (eg, amputa-
tion and cerebral palsy), developmental (eg, autism spectrum disorder
and intellectual disability), sensory (eg, visual impairment), other
(eg, anxiety), or a combination of these categories, as per national
databases (eg, Health Behaviour in School-aged Children [HBSC]
and Canadian Health Survey on Children and Youth [CHSCY])
and consistent with the United Nations conceptualization of dis-
ability in the 2008 Convention on the Rights of Persons with Dis-
abilities (35). Parents indicated whether their child used a mobility
aid (ie, walker, cane, and ankle-foot orthotic). Body mass index (BMI; kilogram per meter square) was calculated using
parent-reported weight (kilogram) and height (centimeter). BMI
values were converted to age- and sex-specific BMI percentile
scores based on WHO 2007 growth charts (12) using the WHO R
macro package (39). WHO BMI z-score cut points (thickness <−2
SD; normal −2SD to +1SD; overweight >+1SD; overweight >+2
SD) were used to categorize weight status.

Fitbit

Anonymous Fitbit accounts (ie, initials only and dummy date of
birth) were created for each participant to minimize the provision of
personal information shared with Fitbit, Inc. Participants’ dummy
year of birth matched their actual year of birth for those who were
13 years of age and older. For participants under 13 years old, the
dummy date of birth was set so that they would appear to be
13 years of age to meet Fitbit guidelines. Each participant’s minute-
by-minute step count and heart rate data were extracted to REDCap
using a custom-built application programming interface (API)
plugin, as previously described (1,5).

Procedure

Participants were mailed a package that included a Fitbit Charge
HR and an information guide to familiarize participants and their
parents with how to wear the device. Participants were instructed

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to wear the Fitbit on their nondominant wrist at all times, and to only remove the device for water-based activities. At the end of the 28-day monitoring period, participants’ individual intraday data were extracted from Fitbit servers onto REDCap.

Feasibility and Utility Indicators

Feasibility: Wear Time

Presence and absence of heart rate provided a physiological indication of whether the Fitbit device was worn or not due to its optical heart rate sensor that must be in contact with skin to detect heart rate (14). Minute-by-minute wear time data were included if a heart rate value was present (ie, the device was being worn). A person-day data set was created, and we applied well-established accelerometer wear time criteria of ≥600 minutes (≥10 h) per day (24,33) to define valid days. We restricted our wear time analyses to usual waking hours (5 AM–11 PM). For each person, aggregate summary values were computed based on valid days for the following: sum of valid days and median of wear time minutes per day (across an 18-h period between 5 AM and 11 PM). Device wear time was the primary feasibility indicator with 14 or more days of valid wear time (ie, 50%) as the criterion for success.

Utility: Step Counts

Participants with at least one valid day of data, based on wear time, were included in the utility analyses. For each person, aggregate summary values were computed based on valid days for median of steps per day (between 5 AM and 11 PM). Daily step counts provided the primary utility indicator by examining between-group differences that are expected to occur with physical activity data (eg, gender- and age-based differences). A secondary utility indicator was intraday step counts, visualized through heat maps, to explore the usefulness of hourly step counts for more detailed analyses or identifying points of intervention.

Statistical Analyses

Descriptive statistics were calculated for demographic variables, wear time, and step counts (frequencies, mean and SD, or median and interquartile range [25th to 75th percentile]), and distribution of normality was visually assessed. Disability groups were collapsed and classified into participants who had a nonphysical disability or a physical disability (including nonphysical disability combinations). Between-group differences for wear time and step counts were assessed by independent sample t-tests for gender and disability groups (physical vs nonphysical) and a 1-way analysis of variance for age group (children [≤9 y]; preadolescents [10–12 y]; adolescents [≥13 y]). Tukey HSD post hoc tests were used to decompose significant differences between age groups. Significance was set at $P < .05$, and all analyses and data visualization were conducted in R (version 4.0.2).

Results

Participant Flow and Demographic Characteristics

A flowchart of eligible participants for the study and reasons for participant exclusion are presented in Figure 1. The final sample included 157 ambulatory children and youth with disabilities. The primary disability category reported was developmental (50%), and the sample was predominately boys (71%). One participant identified as transgender; this participant was included in all group-based analyses and subanalyses for age and disability groups but excluded from gender-based analyses due to the small cell size. Table 1 presents complete demographic information for the sample.

Feasibility Indicator—Wear Time

A histogram of the number of valid days of data is presented in Figure 2. The vast majority (83%) of participants wore the Fitbit more than 14 valid days. There were 3318 valid person-days of data for the complete sample (N = 157). The average number of valid days of wear per person was 21 (SD = 7), and, on average, participants wore the device for 947 (SD = 125) minutes per day. On weekdays, participants had an average of 15 (SD = 5) valid days of wear time, with 950 (SD = 123) minutes of wear time per day. On weekends, participants had an average of 6 (SD = 2) valid days of wear time, with 938 (SD = 129) minutes of wear time per day.

Differences in device wear time by gender, age, and disability group are presented in Table 2. For device wear time, gender and age differences were found with the device being worn for more minutes per day overall by girls than boys (mean difference = 18.0; 95% CI, 6.8 to 29.1), and by preadolescents (mean difference = 27.6; 95% CI, 15.5 to 39.7) and adolescents (mean difference = −21.2; 95% CI, −33.6 to −8.7) than children. The device was worn more by girls than boys on weekdays (mean difference = 23.5; 95% CI, 10.5 to 36.4; Supplementary Table S1a [available online]), but there were no gender differences in wear time on weekends (Supplementary Table S1b [available online]). The device was worn more by preadolescents and adolescents than children on both weekdays (Supplementary Table S1a [available online]) and weekends (Supplementary Table S1b [available online]). No differences in wear time were found by disability group.

Primary Utility Indicator—Daily Step Counts

Overall, participants (N = 157) took an average of 9953 (SD = 4773) steps per day. Participants took 10,004 (SD = 4743) and 8379 (SD = 4651) steps per day on weekdays and weekend days, respectively (P < .001). Differences in step counts by gender, age, and disability group are presented in Table 2. More steps were taken per day by boys than girls (mean difference = −1040; 95% CI, −1465 to −615). Step counts differed significantly by age group (P < .001) with children (mean difference = 1245; 95% CI, 770 to 1721) and preadolescents (mean difference = 1163; 95% CI, 636 to 1690), respectively, taking more steps per day than adolescents. Individuals with a nonphysical disability took more steps per day than those with a physical disability overall (mean difference = −1120; 95% CI, −1474 to −765).

Differences in step counts on weekdays and weekend days are presented in Supplementary Table S1a and S1b (available online), respectively. A significant interaction between gender and day type was shown (P < .05), indicating that boys took more steps on weekdays than girls (mean difference = −1230; 95% CI, −1728 to −732). However, there were no significant gender differences in steps on weekend days. More steps per day were taken on weekdays than on weekend days for children (P < .001), preadolescents (P < .001), and adolescents (P < .05). A significant age group by day type interaction was shown (P < .05) with both children (mean difference = 1346; 95% CI, 790 to 1902) and...
preadolescents (mean difference = 1393; 95% CI, 776 to 2010), respectively, taking more steps per day than adolescents on weekdays. Children also took more steps than adolescents on weekend days (mean difference = 930; 95% CI, 53 to 1808). Individuals with a nonphysical disability took more steps per day than those with a physical disability on weekdays (mean difference = −1255; 95% CI, −1668 to −841) and weekend days (mean difference = −769; 95% CI, −1428 to −110).

**Secondary Utility Indicator—Intraday Step Counts**

Visual examination of Figure 3 highlights peaks in physical activity on weekdays at times that correspond approximately to before school (8 AM), recess (10 AM), lunchtime (12 PM), and after school (2–4 PM). These trends are particularly prominent for boys (Supplementary Figure S1a [available online]), children (Supplementary Figure S2a [available online]), preadolescents (Supplementary Figure S2b [available online]), and those with a nonphysical disability (Supplementary Figure S3a [available online]).

**Discussion**

This study provides evidence to support the feasibility and utility of Fitbit Charge HR for measuring physical activity among ambulatory children and youth with disabilities. Our results demonstrate high adherence to the 28-day wear protocol, with participants wearing the device for an average of 21 out of the 28 days (75% of days) and 83% of the sample meeting our feasibility criterion success of 14 or more days of valid wear time. This high degree of adherence suggests that many children and youth with disabilities find the Fitbit to be an acceptable device to wear for tracking daily activity patterns. While there were differences in wear time between genders, with girls wearing the device for approximately 20 minutes more per day than boys, this difference was relatively minimal and is consistent with gender differences in wear time found in accelerometer research (37). We also found that adolescents and preadolescents wore the device for approximately 20 and 30 minutes, respectively, longer each day than children. Reasons for these differences were beyond the scope of this study although we can speculate that children may have had a slightly lower tolerance for the device due to greater sensory needs, that they were more likely to take it off for bedtime (and spend less time awake) or that older children and youth were simply more motivated to wear the device. However, it is important to acknowledge that children still wore the device for about 15.5 hours each day. Finally, no differences were present in wear time between disability groups and age-based differences in wear time were consistent across weekdays and weekend days. Taken together, and alongside our work on validation (5), our findings suggest that the Fitbit is a feasible option for both short- and long-term tracking of physical activity behavior among children and youth across gender, age, and a range of disabilities.

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<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>By gender&lt;sup&gt;a&lt;/sup&gt;</th>
<th>By disability group</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>n</strong></td>
<td>157 (100%)</td>
<td>44 (28%)</td>
<td>112 (71%)</td>
<td>112 (71%)</td>
<td>45 (29%)</td>
</tr>
<tr>
<td><strong>Age, y</strong></td>
<td>10 (8–13)</td>
<td>12 (9–14)</td>
<td>9 (7–11)</td>
<td>10 (7–12)</td>
<td>10 (8–14)</td>
</tr>
<tr>
<td><strong>Anthropometry</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Height, cm</strong></td>
<td>140 (124–152)</td>
<td>145 (127–157)</td>
<td>137 (124–150)</td>
<td>140 (124–152)</td>
<td>139 (127–152)</td>
</tr>
<tr>
<td>**Weight,&lt;sup&gt;a&lt;/sup&gt; kg</td>
<td>32.4 (24.0–43.4)</td>
<td>39.4 (27.1–47.0)</td>
<td>31.8 (23.6–40.8)</td>
<td>33.1 (24.8–43.7)</td>
<td>29.5 (25.4–42.7)</td>
</tr>
<tr>
<td>**BMI,&lt;sup&gt;a&lt;/sup&gt; kg/m²</td>
<td>17.0 (15.2–19.7)</td>
<td>17.9 (15.8–20.2)</td>
<td>16.8 (14.9–19.5)</td>
<td>17.1 (15.3–19.7)</td>
<td>16.6 (14.7–19.9)</td>
</tr>
<tr>
<td><strong>BMI percentile,&lt;sup&gt;a,b&lt;/sup&gt;</strong></td>
<td>52.6 (22.3–88.6)</td>
<td>48.2 (22.9–81.8)</td>
<td>52.8 (22.4–90.4)</td>
<td>53.4 (23.9–90.1)</td>
<td>42.9 (10.2–79.9)</td>
</tr>
<tr>
<td><strong>BMI weight category,&lt;sup&gt;a,b&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thin</td>
<td>14 (9%)</td>
<td>4 (9%)</td>
<td>10 (9%)</td>
<td>5 (5%)</td>
<td>9 (21%)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>100 (64%)</td>
<td>29 (66%)</td>
<td>70 (63%)</td>
<td>76 (68%)</td>
<td>24 (55%)</td>
</tr>
<tr>
<td>Overweight</td>
<td>20 (13%)</td>
<td>8 (18%)</td>
<td>12 (11%)</td>
<td>17 (15%)</td>
<td>3 (7%)</td>
</tr>
<tr>
<td>Obese</td>
<td>22 (14%)</td>
<td>3 (7%)</td>
<td>19 (17%)</td>
<td>14 (13%)</td>
<td>8 (18%)</td>
</tr>
<tr>
<td><strong>Disability group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Developmental</td>
<td>79 (50%)</td>
<td>19 (43%)</td>
<td>59 (53%)</td>
<td>79 (71%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Physical</td>
<td>21 (13%)</td>
<td>10 (23%)</td>
<td>11 (10%)</td>
<td>N/A</td>
<td>21 (47%)</td>
</tr>
<tr>
<td>Sensory</td>
<td>4 (3%)</td>
<td>3 (7%)</td>
<td>1 (0.9%)</td>
<td>4 (4%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Other</td>
<td>1 (0.6%)</td>
<td>1 (2%)</td>
<td>N/A</td>
<td>1 (0.09%)</td>
<td>N/A</td>
</tr>
<tr>
<td>Developmental and physical</td>
<td>10 (6%)</td>
<td>3 (7%)</td>
<td>7 (6%)</td>
<td>N/A</td>
<td>10 (22%)</td>
</tr>
<tr>
<td>Developmental and sensory</td>
<td>28 (18%)</td>
<td>6 (14%)</td>
<td>22 (20%)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Physical and sensory</td>
<td>3 (2%)</td>
<td>N/A</td>
<td>3 (3%)</td>
<td>N/A</td>
<td>3 (7%)</td>
</tr>
<tr>
<td>Developmental, physical, and sensory</td>
<td>11 (7%)</td>
<td>2 (5%)</td>
<td>9 (8%)</td>
<td>N/A</td>
<td>11 (24%)</td>
</tr>
<tr>
<td><strong>Mobility aid use&lt;sup&gt;a&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>19 (12%)</td>
<td>5 (11%)</td>
<td>14 (13%)</td>
<td>1 (0.09%)</td>
<td>18 (40%)</td>
</tr>
<tr>
<td>No</td>
<td>137 (88%)</td>
<td>39 (89%)</td>
<td>97 (87%)</td>
<td>110 (99%)</td>
<td>27 (60%)</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index; IQR, interquartile range (25th–75th percentile); MVPA, moderate to vigorous physical activity; N/A, not applicable; WHO, World Health Organization. Note: Data are median (IQR) or n (%).<sup>a</sup>Data available for n = 156 participants.<sup>b</sup>BMI percentiles calculated based on age- and sex-specific WHO 2007 growth charts; weight categorized according to BMI WHO z scores.
Previous research on the feasibility of wearable activity monitors is limited and has not included children and youth with disabilities. In line with the findings of the current study, the feasibility studies that do exist among children and youth without disabilities suggest that wrist-worn wearable activity monitors may be the most feasible option (28,29). For example, Schaefer et al (29) compared the feasibility of 4 different wearable activity monitors, each worn for 1 week. While none of the 4 devices were a Fitbit, the authors found that the wrist-worn Polar Active (Polar Electro) was the most popular option due to its comfort, ability to provide feedback, and clock features. Further, participants wore the device for 98% of the week (29). In contrast, hip-worn wearable activity monitors, such as the now discontinued Fitbit One, and devices that do not provide live feedback have presented barriers to use and lower feasibility among children and youth (20,28).

Our findings also demonstrate the utility of the Fitbit to differentiate group effects we would expect to see in physical activity data and to explore intraday variability. We found a significant gender effect, with boys taking more steps per day than girls, and a significant age effect with children and preadolescents taking more steps per day than adolescents. We also found that individuals with a nonphysical disability took more steps per day than those with a physical disability. These gender (10,11,21), age (11,13,36), and disability group (8,19,34) effects are all consistent with known trends in physical activity, thus pointing to the utility of the Fitbit to differentiate these group effects. This study also highlights the potential utility of the Fitbit for researchers to use in intervention planning and physical activity surveillance. The minute-by-minute Fitbit data provide opportunities to explore in depth the daily and weekly activity levels through, for example, heat maps of the data. Further, this information can be used by practitioners who download the minute-by-minute data or use the readily available data within the Fitbit dashboard to view steps in 15-minute increments. This detailed information can be used to tailor interventions to times of the day when children and youth with disabilities are more (or less) active than usual. For example, weekday lunchtime may be an optimal target for intervention since children are already being active. Practitioners could consider introducing further skill-building activities or targeting this time for more equitable participation across subgroups. Visual representation of the Fitbit data can also provide practitioners and family members with a simple method to monitor physical activity levels.

Figure 2 — Number of valid days of data per participant.
over time, along with within- and between-day variabilities in physical activity. For children and youth with disabilities, this can provide an opportunity to use the Fitbit as a monitoring tool, which may provide a greater sense of agency in their physical activity behavior that they are not often afforded (30). Future research may wish to explore the effectiveness of the Fitbit as a tool for self-monitoring and behavior change among children and youth with disabilities.

These study findings are not without their limitations. First, our sample does not include equal representation across genders, age, or disability groups with fewer of the children being girls or children with physical disabilities. The overrepresentation of boys with nonphysical (ie, neurodevelopmental) disabilities is likely due to the National Physical Activity Measurement study’s recruitment efforts thus far through community-adapted physical activity and recreation programs, and differences in prevalence levels between these disability groups in childhood (17). However, our relatively large sample and representation of multiple disability groups within a single study are strengths of this work. Second, we take note that several individuals were unresponsive or experienced some technical issues with the Fitbit leading to a loss of data; however, a large proportion (83%) of participants had valid data on 14 measurement days.

Table 2  Device Wear Time and Step Counts by Gender, Age, and Disability Group

<table>
<thead>
<tr>
<th>By gendera</th>
<th>Girls</th>
<th>Boys</th>
<th>Mean difference between groups (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>44</td>
<td>112</td>
<td></td>
</tr>
<tr>
<td>Valid person-days, n</td>
<td>968</td>
<td>2339</td>
<td></td>
</tr>
<tr>
<td>Valid days per person, count</td>
<td>22 (7)</td>
<td>21 (7)</td>
<td>1.1 (–1.8 to 4.0)</td>
</tr>
<tr>
<td>Wear time, min/d</td>
<td>960 (114)</td>
<td>942 (129)</td>
<td>18.0 (6.8 to 29.1)</td>
</tr>
<tr>
<td>Steps, count/d</td>
<td>8829 (4341)</td>
<td>9869 (4907)</td>
<td>–1040 (–1465 to –615)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>By age groupb</th>
<th>Child</th>
<th>Preadolescent</th>
<th>Adolescent</th>
<th>Child–adolescent</th>
<th>Preadolescent–adolescent</th>
<th>Preadolescent–child</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>74</td>
<td>43</td>
<td>40</td>
<td>–0.6 (–9.8 to 2.6)</td>
<td>0.4 (–3.2 to 4.0)</td>
<td>1.0 (–2.1 to 4.1)</td>
</tr>
<tr>
<td>Valid person-days, n</td>
<td>1533</td>
<td>933</td>
<td>852</td>
<td>21.2 (–33.6 to –8.7)</td>
<td>6.4 (–7.4 to 20.2)</td>
<td>27.6 (15.5 to 39.7)</td>
</tr>
<tr>
<td>Valid days per person, count</td>
<td>21 (8)</td>
<td>21 (6)</td>
<td>21 (7)</td>
<td>934 (133)</td>
<td>961 (117)</td>
<td>955 (115)</td>
</tr>
<tr>
<td>Wear time, min/d</td>
<td>9896 (4640)</td>
<td>9814 (4886)</td>
<td>8650 (4772)</td>
<td>1245 (770 to 1721)</td>
<td>1163 (636 to 1690)</td>
<td>–82.1 (–544.0 to 379.9)</td>
</tr>
<tr>
<td>Steps, count/d</td>
<td>112</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviation: CI, confidence interval. Note: Data are n, mean (SD), or mean difference (95% CI); differences in bold denote statistical significance (P < .05). Valid day defined as ≥600 minutes per day wear time between 5 AM and 11 PM; wear time relative to a maximum of 1080 minutes (5 AM–11 PM).

aData available for n = 156 participants. bChild (≤9 y); preadolescent (10–12 y); adolescent (≥13 y). cNonphysical disability includes any developmental or any sensory disabilities, or combination thereof; physical disability includes any physical disability with or without additional nonphysical disability; data based on parent report.

Figure 3 — Heat map of hourly step counts per day for the full sample.
days and 67% had valid data on 21 measurement days, which suggests high acceptability and thus feasibility of the Fitbit device for use in children and youth with disabilities. Furthermore, the use of heart rate as a physiological marker for wear time is a distinct strength of this study. Third, our sample only included ambulatory children and youth with disabilities. Future research should explore the feasibility and utility of wearable activity monitors among nonambulatory populations.

**Conclusions**

This study provides evidence that a commercially available wearable activity monitor is feasible for shorter- and longer-term tracking of physical activity behavior among ambulatory children and youth with disabilities. Furthermore, the step count data that is available for extraction from these devices presents as a useful measure for inclusion in future surveillance and intervention research. Future research can build on these findings by examining the utility of the Fitbit as a behavioral intervention for this population and its use over even longer durations (eg, 6+ mo of wear).

**Acknowledgments**

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