

RESEARCH

Acceptability and Usability of a Wearable Activity Tracker and Application Among Inactive Adolescent Girls

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Objective: To evaluate the acceptability and usability of the Fitbit Flex 2™ activity tracker and application (app) among inactive adolescent girls.

Design, Sample, and Setting: This mixed-methods study included girls in the 8th and 9th grades ($N = 33$) recruited from a high school in the Midwest. Participants were given the Fitbit Flex 2™ to wear for one week with access to the app.

Measures: Daily steps, miles, and active minutes were measured. Girls participated in a focus group and completed a survey regarding acceptability and usability of the tracker and app.

Results: Girls (14.62 ± 0.60 years) completed a daily average of 7,758.87 ($SD = 1763.69$) steps, 3.66 ($SD = 1.98$) miles, and 21.69 ($SD = 13.71$) minutes of moderate to vigorous physical activity (MVPA). Survey responses (scale of 0–3) indicated girls liked using the Fitbit ($Mean = 2.94$, $SD = .25$) and reported it was easy to use ($Mean = 2.56$, $SD = .50$). For girls who chose to use the app ($n = 28$), all but one reported that they liked it. Girls reported the tracker increased their awareness of activity, helped them set goals, and motivated them to do more steps. Some girls reported issues with usability including difficulty getting the tracker on and off the wrist and confusion regarding the green light system.

Conclusion: The Fitbit and app were well received by the inactive adolescent girls. A more advanced tracker with a screen display and improved reliability for capturing MVPA is suggested for future research.

Keywords: activity tracker; adolescent; females; physical activity

Introduction

Physical inactivity is a global public health threat (Ainsworth & Macera, 2018), contributing to the development of non-communicable diseases and mortality (World Health Organization, 2018). Despite the health benefits of physical activity (PA), including a decreased risk for cardiac disease and diabetes (Janssen & LeBlanc, 2010), most adolescents do not meet guidelines recommending ≥ 60 minutes of moderate to vigorous physical activity (MVPA) each day (Fakhouri et al., 2014; World Health Organization, 2018). Furthermore, MVPA declines from childhood to adolescence (Cooper et al., 2015) with an additional 17% decline from adolescence to early adulthood (Corder et al., 2019).

Adolescent girls engage in less MVPA than boys (Hallal et al., 2012), a difference that increases with age (Dumith et al., 2011). By the 9th grade, only 22% of girls report achieving ≥ 60 minutes of MPVA seven days a week (Kann et al., 2018). Moreover, when PA is measured objectively, only 2% of girls meet PA recommendations (Cooper et al., 2015). Intervention efforts are warranted to reverse these trends that are linked to an increasing chronic disease burden (Durstine et al., 2013). Unfortunately, the efficacy of PA interventions for adolescent girls, based on objectively measured PA, is limited (Voskuil, Frambes, & Robbins, 2016). More research is needed to to inform future intervention work to increase efficacy.

The availability of wearable activity trackers has enabled users to monitor their activity levels (Evenson, Goto, & Furberg, 2015) with the possibility of improving physical fitness and increasing PA (Piwek et al.,

2016). Research incorporating these devices into interventions has increased significantly in recent years (Shin et al., 2019). However, most studies using wearable activity trackers have included adult participants with some evidence linking device use to increases in MVPA (Shin et al., 2019).

Systematic reviews of studies incorporating wearable activity trackers have reported a lack of research involving youth (Coughlin & Stewart, 2016; Ridgers, McNarry & Mackintosh, 2016; Shin et al., 2019). Intervention studies utilizing wearable activity trackers among adolescents (Gaudet, Gallant, & Bélanger, 2017; Kerner, Burrows, & McGrane, 2019; Remmert et al., 2019; Pittman, 2020; Sloomaker et al., 2010) have resulted in limited intervention success for increasing PA, mostly due to small sample sizes and single group intervention designs (Shin et al., 2019).

Research findings have indicated that wearable activity trackers may be more effective at increasing PA among adolescent girls compared to boys (Ridgers et al., 2016). Sloomaker and colleagues (2010) found girls who wore an accelerometer as part of an intervention had significantly higher levels of moderate PA after three months than girls in the control group. However, among boys, there were no differences in PA between the intervention and control groups post-intervention. Kerner and Goodyear (2017) reported that adolescent girls demonstrated higher autonomous motivation for PA than adolescent boys after wearing a Fitbit Charge™ for eight weeks. In a study examining use of wearable activity trackers among Finnish adolescents, researchers noted that girls were more likely than boys to use tracker applications on a mobile device (Ng, Tynjälä, & Kokko, 2017).

Examining adolescent girls' perspectives may help to understand how these devices can be used in future intervention studies to assist girls in meeting recommendations for PA. However, studies assessing the acceptability and usability of these devices among adolescents is limited (Ridgers et al., 2018). To our knowledge, only one study has specifically evaluated adolescent girls' perceptions regarding a wearable activity tracker (Metos et al., 2018). Additional research is needed to understand how adolescent girls view and use wearable activity trackers and their accompanying applications. Therefore, the purpose of this study was to evaluate the acceptability and usability of the Fitbit Flex 2™ activity tracker and application (app) among inactive adolescent girls.

Methods

Design, sample, and setting

This mixed-methods exploratory study evaluated the acceptability and usability of a wearable activity tracker among inactive adolescent girls. Participants wore a Fitbit Flex 2™ for one week to collect objective PA data and to assess overall wear time. After one week, girls participated in a focus group and completed a Fitbit survey. Ethical approval for the study was granted by the Hope College Human Subjects Review Board (Ref: 58d86a85ab9f7).

Girls in the 8th and 9th grades were recruited from a high school in West Michigan after approval from the principal and physical education teacher. The school serves a diverse student body with approximately 60% non-white enrollment, 46% of whom are Hispanic. Over half of the student body is considered economically disadvantaged based on eligibility for free or reduced-price lunch. The research team provided a brief study overview and gave out information packets that included an eligibility screening form as well as consent and assent forms to girls who were interested in participating. Girls were asked to complete the forms with their parent(s) or guardian and return them within two days. Our goal was to recruit subjects who were inactive (i.e. not meeting the recommended guidelines for PA). Girls were excluded from the study if they were: 1) involved in school or community sports; 2) involved in any other organized PA \geq 3 days per week; 3) had a health condition that prevented PA; or 4) could not read or write English.

Data collection took place in May of 2017 ($n = 11$) and May of 2018 ($n = 22$) from eligible participants at their school. Girls received and were fitted with a Fitbit Flex 2™. Research team members provided written instructions for use and all participants were invited to install and use the Fitbit app on their mobile phone or school computer. Because the Fitbit Flex 2™ only displays green lights showing progress towards a daily goal of 10,000 steps, the app is helpful as it provides a dashboard to visualize PA data. Participants were given an email account so researchers could track PA data from the Fitbit. After one week, the research team returned to the school to collect the Fitbits, administer a Fitbit survey, and conduct focus groups. A total of four focus groups, two in May of 2017 and two in May of 2018, were conducted at the school using a semi-structured interview process and were tape recorded. Girls received an incentive for returning the Fitbit and participating in a focus group.

Measures

A Fitbit survey was used to examine acceptability and usability quantitatively. The survey contained seven questions, five of which assessed participants' perceptions regarding the Fitbit on a 4-point Likert scale: 0) *not at all true* to 3) *very true*. Participants were also asked if they had used the Fitbit app and if they liked using it. Usability was also assessed by calculating mean days of wear time. Semi-structured interview questions from the focus groups were used to measure acceptability and usability qualitatively. Sample questions included: 1) Tell us what you liked about the Fitbit and app; 2) Tell us what you disliked about the Fitbit and app; and 3) What are your thoughts about using a Fitbit to assist girls to increase their PA?

The Fitbit Flex 2™ (Fitbit, Inc., San Francisco, CA, USA) consists of a triaxial accelerometer that fits into a flexible wrist-worn band which measures steps taken, calories burned, distance traveled, and active minutes. Activity progress is displayed by five indicator lights with each light illuminating when 20% of a daily activity goal is obtained. When a goal is reached, the device vibrates and the lights flash. The default goal of 10,000 steps was used in this study. Battery life is approximately five days and the device comes with a charger. The device can be worn in the shower and is swim-proof up to 50 meters. The Fitbit has demonstrated acceptable reliability and validity when compared to the Actigraph GT3x accelerometer (Jones et al. 2018) but may underestimate daily step counts (Evenson et al., 2015). Although PA measurement was not the primary aim of the study, average daily steps, miles, and minutes of MVPA were reported to describe the sample. Mean minutes per day of MVPA were calculated by combining fairly active and very active minutes (Mooses et al., 2018). On days where no steps were recorded, we assumed the participant did not wear the tracker.

Data analysis

Quantitative analysis was conducted using the Statistical Package for the Social Sciences (SPSS) Version 23 (IBM Corp., 2015) including means, standard deviations, frequencies, and percentages. For the qualitative analysis, interview data from the focus groups were transcribed and imported into ATLAS.ti Version 8 software (ATLAS.ti Scientific Software Development GmbH, 2019) by the second author. The first author also listened to the focus group recordings and reviewed the data for accuracy. Both the first and second authors coded the focus group responses. Data were examined to identify themes related to participant perceptions regarding the acceptability and usability of the Fitbit and app.

Results

Sample characteristics

A total of 33 girls in 8th ($n = 22$) and 9th grades ($n = 11$) participated in the study. Average age was 14.62 years ($SD = 0.60$). Approximately one third of the girls ($n = 10$) indicated they were of black race. Of the girls who did not specify race ($n = 9$), all were of Hispanic ethnicity. The majority of girls ($n = 19$; 58%) received free or reduced-priced lunch at their school. Girls averaged 7758.87 ($SD = 1763.69$) steps and 3.66 ($SD = 1.98$) miles per day. None of the participants met the recommended guidelines of ≥ 60 minutes of MVPA per day ($M = 21.69$ minutes/day; $SD = 13.71$). See **Table 1** for additional sample characteristics.

Quantitative results

Results of the Fitbit survey are provided in **Table 2** with questions categorized by acceptability and usability. Overall, girls' responses demonstrated a high degree of acceptability for the Fitbit: 1) I liked using the Fitbit ($M = 2.94$; $SD = .25$); 2) The Fitbit helped me think about PA ($M = 2.56$; $SD = .50$); and 3) I would recommend a Fitbit to other girls my age ($M = 2.75$; $SD = .44$). The Fitbit app also proved to be acceptable with almost all of the girls ($n = 27$; 96.4%) liking it.

Girls' perceptions of usability for the Fitbit were also favorable: 1) The Fitbit was easy to use ($M = 2.81$; $SD = .40$); and 2) If I had a Fitbit I would use it on most days ($M = 2.94$; $SD = .25$). Most of the girls used the Fitbit app ($n = 28$; 87.5%). Due to the limitations of the device, we were not able to calculate hours per day of wear time so we tracked whether or not the Fitbit was worn each day as another measure of usability. On average, girls wore the Fitbit tracker 6.79 ($SD = .48$) days with 27 girls (81.82%) wearing the Fitbit on all seven days. All girls wore the activity tracker at least five of the seven days.

Qualitative results

Results from the qualitative analysis for acceptability are displayed in **Table 3**. Themes for acceptability included awareness, goal setting, and motivation. Girls referred to being aware of their PA several times ($n = 8$). Girls mentioned the Fitbit gave them reminders which increased their awareness of their PA.

Table 1: Sample Characteristics.

Characteristic	Mean	(SD)	Min	Max
Age (years)	14.62	(0.60)	13.58	16.03
MVPA (average minutes/day) ^a	21.69	(13.71)	2.43	50.86
Steps per day	7758.87	(1763.69)	5194	11899
Miles per day	3.66	(1.98)	1.89	11.84
Grade	<i>n</i>	(%)		
Eighth	22	(66.67)		
Ninth	11	(33.33)		
Hispanic ethnicity				
Yes	15	(45.45)		
No	18	(54.55)		
Race				
Asian	1	(3.03)		
Black	8	(24.24)		
Indian	2	(6.06)		
White	10	(30.30)		
Mixed	2	(6.06)		
Other	1	(3.03)		
Not reported	9	(27.27)		
Free or reduced-price lunch ^b				
Yes	19	(57.58)		
No	10	(30.30)		
Not reported	4	(12.12)		

Note: *N* = 33. MVPA = moderate-to-vigorous physical activity; *Min* = minimum; *Max* = maximum; *SD* = standard deviation. Percentages may not add to 100 due to rounding error.

^a MVPA (*n* = 24) not reported for 9 participants due to missing data for active minutes.

^b Free/reduced-price lunch program used as an indicator of socioeconomic status.

Table 2: Acceptability and Usability Results from the Fitbit Survey.

Evaluation Component	Fitbit Activity Tracker Questions	Mean	SD
Acceptability	I liked using the Fitbit.	2.94	.25
Acceptability	The Fitbit helped me think about my physical activity.	2.56	.50
Acceptability	I would recommend a Fitbit to other girls my age.	2.75	.44
Usability	The Fitbit was easy to use.	2.81	.40
Usability	If I had a Fitbit I would use it on most days.	2.94	.25
	Fitbit App Questions	Yes (%)	No (%)
Usability	Did you use the Fitbit App?	28 (87.5)	4 (12.5)
Acceptability	If you used the Fitbit App, did you like it?	27 (96.4)	1 (3.6)

Note: *SD* = standard deviation; responses based on *n* = 32. Likert scale of 0) *not at all true* to 3) *very true* used for Fitbit Activity Tracker Questions.

Interestingly, girls became aware that their PA levels were lower on weekdays versus weekend days. However, this was not true for all participants as some girls found they exercised less on the weekend.

Girls also discussed how the Fitbit helped them set goals (*n* = 11). Girls felt the Fitbit facilitated a stepwise approach to higher goals. For example, one girl said: “*Maybe if you’re more physically active, make your steps*

Table 3: Qualitative Analysis to Support Acceptability of the Fitbit Activity Tracker and Fitbit App.

Category and Themes	Sample Excerpts from the Focus Groups
Acceptability Themes	
Awareness (n = 8)	<p>"I liked the app because it would tell you like exactly how many steps you had"</p> <p>"I like that you could always see like how many steps you got because it made me more aware and encouraged me to be more active"</p> <p>"So what I've noticed when I've had the Fitbit was that during the week I wasn't as active cuz I was always indoors but then on the weekends I would like reach my goal more or go over the goal"</p> <p>"I liked that it gave off reminders uh for you to get up and moving because I realized after like the sixth or seventh buzz I had to get up from laying down"</p>
Goal-setting (n = 11)	<p>"During the whole week it kind of made me want to reach that goal. I made the 10,000 step goal twice I think"</p> <p>"Be more active so you can reach that goal"</p> <p>"I wanted to get to the green light so I would walk a lot"</p> <p>"I liked how it danced when you got your goal because I saw like a lot of people were excited when they got their goal...so yeah it helps"</p> <p>"It's also just kind of fun to just tap on it and see how many you know dots there are and how close you are to your goal"</p>
Motivation (n = 14)	<p>"So I think that's kind of motivation I guess to like be more active"</p> <p>"There are alarms and that helped a lot for me. It will alarm me if I reached halfway to my score and maybe boost me to do more and stuff like that"</p> <p>"So I would say technology is like...we're all so motivated so like we're surrounded by technology like every day our phones included"</p> <p>"I would say it was kind of like a motivator to me... if I was like laying on the couch like I'd be like man I have to get some steps in. And my sister she likes to do Just Dance on the TV so I'd just go in and hop in with her and do a couple steps"</p> <p>"I feel like a lot of us were really inspired to do more steps but as it went on I feel like they'd just go in there and do what they normally would do"</p>

Note: n = number of focus group excerpts from subjects for each theme.

higher so that you have a tougher goal to reach." However, there was some indication this trend in goal setting may decrease over time. For example, one girl said: "I feel like at first everyone was like I gotta get the steps in. And then after a little bit they're like, eh".

The third theme related to acceptability was motivation. Girls used the word motivation repeatedly (n = 14). Some girls referred to the potential for motivating girls in the future: "I would say keep doing the Fitbit thing with girls of different grades...that could like motivate them more to get out". Girls also described the Fitbit as providing encouragement to do PA which was categorized under motivation.

Results from the qualitative analysis for usability are presented in **Table 4**. Themes for usability included functionality, visibility, and wearability. Participants referred to functionality of the Fitbit and app positively (n = 3) and negatively (n = 2). Positive aspects included notifications on the wrist, tracking of steps, and connecting with friends. Negative aspects included being confused by the vibration notifications and accuracy of step counts.

As for visibility, participants also had both positive (n = 5) and negative responses (n = 3). Positive responses reflected seeing daily progression of steps, blinking of lights once 10,000 steps were achieved, and being able to view daily steps on the app. Visibility also facilitated getting to a PA goal. Suggestions for improvement included decreasing confusion over the green light system and having a time display on the tracker.

The theme of wearability included positive responses (n = 2) but had the most negative responses (n = 6). Wearability was important in terms of tracking steps per day. While some participants found the wrist band to be comfortable, not all participants agreed. In fact, several girls mentioned issues regarding wearability, specifically related to comfort.

Table 4: Qualitative Analysis to Support Usability of the Fitbit Activity Tracker and Fitbit App.

Category and Themes	Sample Excerpts from the Focus Groups
Usability Themes	
Functionality (n = 5)	<p>“I like the uh...when you got a call and how it would vibrate on your wrist because I was at one of my friend’s birthday parties and my dad called me and all of a sudden my wrist started like vibrating intensely and I started freaking out”</p> <p>“I’d just randomly get like the message notifications where it was the two dots and the purple and I was like, “I don’t have a message. Why are you vibrating?” I was getting confused by that”</p> <p>“I really liked the fact how on the app you can find and cheer your friends if you aren’t friends with them on that”</p> <p>“I just like how it tracks...how many steps you’re taking per hour. So that’s pretty helpful”</p>
Visibility (n = 8)	<p>“I like how it showed me like my progression...throughout the day”</p> <p>“So the four dots, they were confusing because I thought you said 25 so I thought 2,500 but then it would get there at like 1,000 so I was starting to get confused. So the dots for me didn’t make sense”</p> <p>“I like when it blinks all different types of colors once you reach 10,000 steps”</p> <p>“I liked how after doing a sport it’ll (App) show you that you did a sport instead of just not”</p>
Wearability (n = 8)	<p>“When putting it on and taking it off, it’s like extremely difficult. But I also see why it’s difficult, so you keep it on”</p> <p>“I really liked how comfortable the band was”</p> <p>“One thing I didn’t like about the Fitbit was when I sleeping like it kind of bothered me, but that was only like only a couple times but it wasn’t no biggie because I knew I could take it off”</p> <p>“I don’t like things on my wrist. I’ve never liked things on my wrist, so having that on all day like I’d go home and have the urge to take it off, but I have to keep it on”</p>

Note: n = number of focus group excerpts from subjects for each theme.

Discussion

This study evaluated the acceptability and usability of the Fitbit Flex 2™ and app among inactive adolescent girls. Findings indicated good acceptability with high ratings on the Fitbit survey and participants noting that awareness, goal-setting, and motivation were facilitated by the tracker and app. Usability ratings were also high and most girls wore their device and used the app for one week; however, results from the qualitative analysis indicated areas for improvement with respect to usability.

Girls responded favorably to the acceptability of the Fitbit with 100% choosing the options of somewhat true or very true. Although most of the literature on acceptability of wearable activity trackers has been assessed qualitatively, some research has assessed acceptability quantitatively. Brannon and colleagues (2016), using a wrist-worn Actigraph for 20 days with adolescents, administered an acceptability questionnaire with a 7-point Likert scale ranging from *not at all true* to *very true*. While the questions were not specific to the activity tracker, participants responded positively regarding enjoyment of the study ($M = 4.59$; $SD = 1.87$).

Almost all of the girls who used the Fitbit app ($n = 28$) liked using it ($n = 27$; 96.4%). Similarly, in a study involving young adults, with most being female (78%), over 91% of the sample reported enjoying the ability to review their PA with the Fitbit app (Mollee et al., 2017). These findings are consistent with national survey data indicating girls utilize health-related mobile apps more frequently than boys (Wartella et al., 2016). Researchers designing PA interventions for girls using activity trackers should consider incorporating mobile apps to enhance intervention effectiveness.

Acceptability themes included awareness, goal setting, and motivation. The theme of awareness is consistent with the current literature. In a systematic review of wearable activity tracker research, increased self-awareness of PA was reported as a positive behavior change element in several studies (Shin et al., 2019). Urban middle school youth who wore a Fitbit One™ for five weeks became more observant of their PA which allowed them to either realize they had a good amount of PA or were not very active at all (Schaefer et al.,

2016). Likewise, Australian adolescents who used a Fitbit Flex™ for six weeks reported better awareness of their PA levels (Ridgers et al., 2018). Similar to our study, researchers found that adolescent girls were more aware of their PA after using a Fitbit tracker and app for one month (Metos et al., 2018).

Goal setting as a theme related to acceptability was not surprising as it is the most common behavior change technique associated with wearable activity trackers (Lyons et al., 2014). In a school-based study of low-active adolescents, intervention participants reported the Fitbit to be helpful for remembering PA goals (Remmert et al., 2019). Likewise, adolescents in the United Kingdom reported the Fitbit assisted them to create their own goals beyond 10,000 steps (Goodyear, Kerner, & Quennerstedt, 2019). Ridgers and colleagues (2018) found that adolescent participants who wore a Fitbit Flex™ thought more about their PA goals and were more likely to make new goals to achieve even higher levels of PA.

Several girls in the current study described the Fitbit as a motivator to increase their PA. Schaefer and colleagues (2016) also reported this in their research with middle school youth as did Goodyear et al. (2019) with adolescents. Kim (2014) found motivation to be a key personal factor from a focus group of female college students who wore a Fitbit for three months. Australian adolescents noted that just the presence of the wrist-worn device acted as a motivator (Ridgers et al., 2018).

Girls found the Fitbit easy to use, said they would use it on most days, and >80% of participants used it on all seven days. However, other studies have reported lower percentages of use over longer time frames (Gaudet et al., 2017; Kerner & Goodyear, 2017). Similar findings have been reported regarding use of the Fitbit app. Among a group of young adults, use of the app was highest in the first two weeks (>80%) but only 46.7% of participants were using the app at the end of a 12 week intervention (Mollee et al., 2017). While we may not have captured long-term use patterns for the Fitbit and app given that our study lasted for one week, we were able to demonstrate that inactive adolescent girls were willing to use the activity tracker and app for the duration of the study.

Researchers have reported a novelty effect in other studies with wearable activity trackers. Ridgers et al. (2018) noted that around two weeks into a six week intervention, participants wearing a Fitbit Flex™ demonstrated an overall decline in device use. Kerner and colleagues (2019) also reported declining participation after three weeks for adolescents wearing a Fitbit Charge™. In contrast, among adolescents with attention deficit hyperactivity disorder (ADHD) assigned to wear a Fitbit Flex™ for four weeks, 85% wore the device through the entire study and had significant increases in daily steps (Schoenfelder et al., 2017). Additional intervention components included a Facebook group and daily text messages. Periodic cash incentives for completing surveys may have also contributed to increased compliance. Wearable activity trackers may work best when they are incorporated into multi-component interventions.

Girls demonstrated mixed responses for the functionality of the Fitbit. The main function of tracking steps appeared to be the most useful. They found the vibration feature to be both helpful and confusing. Some girls reported using the Fitbit app to make social connections with friends. Regarding accuracy of step counts, one participant mentioned she knew some girls found they could just move their wrist and that would count for steps. While not specifically mentioned by participants in our study, some Australian adolescents found that the Fitbit Flex™ was limiting as the device was not waterproof and did not track activity for certain sports such as biking (Ridgers et al., 2018). The activity tracker used in our study was the Fitbit Flex 2™, which is swim proof and has a SmartTrack™ feature for tracking cycling.

Girls found it useful to see their progress toward a goal on the tracker and app. They also noted the app showed them which sport they had participated in. Visibility was also a theme among a sample of female college students wearing a Fitbit for three months (Kim, 2014). Similar to participants in our study, Ridgers and colleagues (2018) reported that adolescents found not being able to see their steps displayed on the device to be a limitation. A few girls in our study found the green light system confusing, potentially indicating the need for better explanation at the start of the study.

Wearability responses centered on comfort of the wrist band as well as the ability to get the device on and off. In a pilot trial of adolescents, most of the intervention participants (67%) using a Fitbit Flex 2™ reported that the wrist-worn device was comfortable (Remmert et al., 2019). While we did not specifically ask this question, participants in the focus groups stated the wrist band was comfortable. A few participants in our study reported difficulties getting the tracker on and off the wrist. Wearability was associated with the most negative responses. Issues included wearing the band while it was wet or during sleep, a skin reaction, and sizing issues. Based on the visibility and wearability issues mentioned, use of an activity tracker that displays the number of steps on the device, includes the date and time, and has a watch band strap may be a better fit for this population.

Limitations

Some important limitations should be noted for our study. First, participants wore the Fitbit and used the app for one week, which is a short time frame. Because the study was completed at the end of the school year, we were constrained to a one week period. Second, while the sample size was sufficient for the qualitative analysis, additional data from more participants would have been beneficial for the quantitative analysis. Third, social desirability bias may have impacted the high acceptability and usability ratings on the Fitbit survey. Lastly, missing data related to active minutes for a few participants indicated that some of the Fitbits may not have functioned appropriately.

Implications for future research

Results from a recent survey on health and technology use among adolescents indicated over 90% of teens had never used a wearable activity tracker (Wartella et al., 2016). Furthermore, adolescents who do use heart rate monitors or smart watches are twice as likely as those who do not use them to meet PA guidelines (Ng et al., 2017). Developing interventions focused on increasing the use of wearable activity trackers seems like a promising venture for adolescents. However, more studies are needed in order to determine additional information regarding the adolescents' experience with wearable activity trackers (Hermsen et al., 2017). Because technology is constantly evolving, newer versions of wearable activity trackers that have the capability to monitor heart rate and location with a global positioning system (GPS) are recommended (Evenson et al., 2015) for future research.

Conclusion

This study provided evidence for the acceptability and usability of a wearable activity tracker and app among inactive adolescent girls. While we found acceptability of the Fitbit Flex 2™ and application to be adequate, a more advanced tracker with a screen display and better reliability for capturing PA data is recommended to improve usability in future research.

Funding Information

This study was supported by a Hope College Jacob E. Nyenhuis Faculty Development Grant, a Hope College Department of Nursing Jean M. Debbink Faculty Research Development Grant, and a Hope College Department of Nursing Holleman Student Research Award.

Competing Interests

The authors have no competing interests to declare.

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How to cite this article: Voskuil, V. R., Stroup, S., & Leyden, M. (2020). Acceptability and Usability of a Wearable Activity Tracker and Application Among Inactive Adolescent Girls. *Physical Activity and Health*, *4*(1), pp. 52–61. DOI: <https://doi.org/10.5334/paah.51>

Submitted: 20 March 2020 **Accepted:** 12 April 2020 **Published:** 03 June 2020

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