

Worn on the Older Body: Physical Activity Technologies and the Commitment to Health

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Physical activity (PA) is a proven strategy for reducing risk of chronic disease. Many older adults do not reach recommended levels of activity to achieve health benefits. There is growing interest among scholars and practitioners about the potential of technology to increase PA and improve health. This study investigated knowledge of, attitudes toward, and experiences with PA technology among a sample of older adults to determine potential for use in interventions. Overall, participants indicated that they learned about their levels of PA, held positive attitudes toward, and reported good experiences with PA technology, including desired behavior change. Negative outcomes included concerns about risk from using PA technology. Outcomes from this study suggest the need for updated views of older adults and technology and potential health benefits from using PA technology.

Keywords: barriers, motivators, psychosocial perspectives, technology

Many older adults do not meet government guidelines for physical activity (PA) to receive health benefits and reduce risk for chronic and cardiovascular disease (Centers for Disease Control and Prevention, 2019; Troiano et al., 2008), creating a critical need for effective and practical interventions. Barriers that limit PA among older adults include caregiving duties, health problems, and environmental factors, such as neighborhood conditions (King et al., 2000; Miller & Brown, 2017).

Technologies that allow users to measure and monitor PA are becoming increasingly popular. Physical activity technologies (PAT) include smartphone apps and wearable devices (e.g., Fitbit [Fitbit, Inc., San Francisco, CA], Apple Watch [Apple, Cupertino, CA], and pedometers) that are commercially available for self-monitoring by individual consumers. These PAT are the focus of this study. They are different from devices such as accelerometers (e.g., ActiGraph[®]; Actigraph, Pensacola, FL) that are used primarily for research purposes.

Attitudes among older adults about technology are complex and varied and more positive than stereotypes suggest (Mitzner et al., 2010). Demiris et al. (2004) found that older adults are generally aware of benefits from technology and are open to trying new technologies. Lee and Coughlin (2015) point to 10 factors that influence older adults' adoption of technology including perceived value, usability, and prior experience. A recent investigation by Takemoto et al. (2018) found that older individuals have more positive experiences with technology for PA when given adequate support and guidance. However, individual differences such as age, economic status, educational level, and ethnicity may also impact the decision to adopt technology (Porter & Donthu, 2006) and influence benefits from technology use (Rich & Miah, 2017).

Technologies in general, including computers, video games, and tablets, have been implicated in the reduction of PA and the increase in sedentary time across the population (Conroy et al., 2017). However, there is growing evidence that digital tools, such

as smartphone applications and wearable devices, may help self-regulate health promotion practices, and provide support to users through goal setting and motivation, thereby improving adherence to PA (Chaddha, Jackson, Richardson, & Franklin, 2017). Among adults, pedometer use is associated with increased PA and decreased body mass index (Bravata et al., 2007). More research is needed to understand how commercially, readily available PAT is perceived of by older adults (Takemoto et al., 2018) before recommendations for implementation can be made.

Broad consumption of technology is largely based on a general agreement about how health behavior, including PA, is measured (Thacker et al., 2006). For example, some types of PAT (e.g., pedometers and smartphone apps) measure steps, and many users aim for the popular target of 10,000 steps. Although the 10,000 step goal has been widely adopted by the general public as beneficial to health, there is limited science supporting the claim of its efficacy in reducing risk of disease or as a baseline for cardiovascular health (Tudor-Locke et al., 2011; Wilde, Sidman, & Corbin, 2001). Among older, and limited mobility adults, normative data suggest that the step recommendation should be substantially lower (Tudor-Locke et al., 2011; Tudor-Locke et al., 2013). Some researchers suggest that a recommendation of 5,000–8,000 steps per day for older individuals and those with disabilities or limiting health conditions would match to the 150 min/week of moderate PA currently recommended by the Centers for Disease Control and Prevention (Wilde et al., 2001). In spite of these discrepancies, many users of PAT aim for the recommended 10,000 steps with limited consideration of its scientific validity. Agreement on guidelines for PA among older individuals could potentially support recommendations for PAT.

Purpose

To better understand the feasibility of technology use among older adults to increase PA, the goal of this project is to understand knowledge about, attitudes toward, and experiences with PAT among a population of older adults. The major questions informing this study of PAT among older adults include: (a) What do participants know about PAT? (b) What

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are users' attitudes toward PAT? and (c) What are users' experiences with PAT?

Methods

The institutional review board of San Francisco State University approved the protocol for this study. Participants were recruited through the Buchanan YMCA (San Francisco, CA) and the Stanford Prevention Research Center, Stanford University School of Medicine, Stanford University (Stanford, CA). Inclusion criteria included age (50 years and older) and being a member of an ethnic minority who use/have used or do not/have not used PAT. An ethnic minority sample was selected for this project based on national data showing lower PA levels among this population (Saffer, Dave, Grossman, & Leung, 2013).

Procedures

We interviewed each participant using a semistructured interview guide with 12 questions (11 open-ended questions) and an additional six demographic questions. This study presents data from the group of questions pertaining to experience with, perceptions of, and knowledge about PAT. Participants were recruited by e-mail, invited to participate in the study and scheduled for the interview at a convenient time and place. Interviews ranged from 28 to 42 min were audio-recorded and transcribed by two research assistants at San Francisco State University. All interviews were conducted by the first author. Data were analyzed by both authors using paper format transcriptions.

Interview Guide

The semistructured interview guide was developed for the purpose of this project from a literature review of participant experiences with PAT (see Corbie-Smith, Thomas, Williams, & Moody-Ayers, 1999; Dugas et al., 2017; Kelli, Witbrodt, & Shah, 2017). The interview began with a warm-up question about participants' past experiences using PAT. In addition to ensuring that participants answered the same questions, the semistructured format allowed the interviewer to explore specific ideas and responses and address participant differences in knowledge about, attitudes toward, and experiences with PAT (Barriball & While, 1994).

Data Analysis

The five steps to thematic data analysis described by Braun and Clarke (2006), and implemented by McGannon, Busanich, Witcher, and Schinke (2014), formed the framework for data analysis and development of themes. First, the data were transcribed verbatim and the coauthors read each transcription multiple times to increase familiarity with content and initiate interpretive thinking. Second, initial, broad codes were systematically generated across the dataset based on features that corresponded to the research questions of user experiences with and attitudes toward PAT. Third, codes and interpretations were reviewed by the researchers and grouped into themes. Data could be coded for more than one theme. Fourth, the themes and subthemes were aligned with the data and a thematic map was generated. Fifth, the themes were refined and clear definitions and names were derived.

The data were treated as a whole set that was subjected to thematic analysis to identify salient themes, overarching perspectives and patterns, and generate meanings. The analysis was framed

around the view that individual participants make meaning of their experiences, yet this meaning is situated in the broader social context (Braun & Clarke, 2006). The two authors conducted a recursive reading of interviews based on the assumption that participant responses to the interview probes were iterative, rather than linear.

The results are presented by themes relating to (a) knowledge about PAT (five subthemes: purpose of PAT, quantification of health, know PA levels, know importance of 10,000 steps, and age and technology), (b) attitudes toward using PAT (two subthemes: motivation and improvement and risk concerns), and (c) experiences with PAT (two subthemes: technology for self-monitoring and goal setting behavior).

Results

Participant Demographics

The study included a sample of 10 participants ranging in age from 50 to 76 years with a mean age of 62.8 years. Although there is no agreement on age group categories among scholars and health professionals, and such labels differ according to political, social, and cultural assessments (World Health Organization, 2015), for the purposes of this study individuals aged 50 years and older are defined as older adults. Seventy percentage of the sample were female and 100% ethnic minority (60% Latino/a, 30% Asian/Pacific Islander, and 10% African American). Seventy percent had an income of \$73,300/year or higher. Income levels in the San Francisco Bay Area Region are higher than the national average, as was the average income of this sample of older adults. However, this does not necessarily indicate higher spending power (Brinklow, 2019; U.S. Department of Labor, Bureau of Labor Statistics, 2019), and the average income of the sample is now viewed as low income for this geographical region (Sperling, 2018).

Knowledge About PAT

The theme of knowledge referred to participants' understanding of the overall purposes of PAT, their awareness of the specific role of the 10,000 step goal, and their familiarity with the skills necessary to use PAT. For some participants, knowledge appeared as a practical understanding of PAT rather than a theoretical understanding of the benefits of being physically active.

Purpose of PAT. All participants, regardless of their active use of PAT, were able to describe the general purposes of PAT. Several specified the PAT goal of self-tracking and gathering individual health behavior.

I think to make people aware of their exercise, activities for the day . . . Helps you become aware of calories you consume and figure out what you're burning, so you're not burning less than what you're eating, I guess. (RC, male, age 62, non-PAT user)

I think sometimes we don't realize how little we walk or how much we walk so something that keeps track of it gives you an idea. (YB, age 63, user)

The apps, I know they are prompts; my sister has one. If she doesn't get her steps, it will prompt her to start moving so she can hit her goal and it really influences her. It's amazing. (AK, female, age 59, non-PAT user)

Quantification of health. The idea of quantifying health behavior appeared in participants' comments about the need for

accuracy in determining personal levels of PA as well as their knowledge of the value of knowing how engaged they are in health behavior.

Even though I think I'm exercising, the technology would tell me that I'm not exercising that much. Like counting steps, I know that we always tell our members here at the Y, that you have to walk 10,000 steps, that's the general rule of thumb. And you start using technology and you find out that, oh, I'm only using 2,000. So, I think it keeps us in check with reality. (RC, male, age 62, non-PAT user)

I may think I really don't walk very much and I am getting in and out of my truck constantly. I am not walking long distances, but I am walking from here to here and to the truck. I am putting in steps that I don't realize I am even doing. So, I think it's a really great way to track. (YB, female, age 63, PAT user)

Know PA levels. Being able to monitor their level of PA gives the participants access to knowledge about their health, and with it comes a sense of accomplishment when they reach their goals. Although most participants perceived PAT to be accurate, one participant commented on its limits as a valid piece of equipment.

I wasn't very active at all, and so it sounded great, so I started going there and they gave me a pedometer and wanted to know how many steps a day I would take. And that got me interested in how active I am during the day. As soon as I started that, it was amazing because I didn't just want to sit down all the time. I cut down on my television time that I had spent sitting down, and so I would just walk around the house, and do this and do that, and it was amazing. I really loved it because it was like a wake-up call as to what I do every day. (SAP, female, age 70, PAT user)

I think it's ok to (um), to use it as a reference every so often, I know from personal experience when you think you've walked enough using a pedometer, you look and it's "is this all I did?" Sometimes I think it's ok as a gauge, but not to take it like it's the bible, so to speak. So, I think it's just as a useful tool, but not to be in place of, or in lieu of, more accurate and official equipment that we have out there now. (DJ, female, age 57, PAT user)

Short answer is to remind people to be active and I think the bigger piece is to give the user a sense of how inactive or active they are and maybe bring them into reality. (AK, age 59, nonuser)

Know importance of 10,000 steps. Participants readily adopted the goal of 10,000 steps based on its role in maintaining healthy levels of PA without questioning its appropriateness for their physical status. Achieving or failing to achieve the "required" steps became a knowable outcome each day. Even when participants did not know the guidelines for PA or the scientific basis for the 10,000 steps, they still held a practical understanding of PAT goals.

The pedometer worked great; I would see I didn't have that much steps and it would force me to go out there and walk a little more which I normally don't, but since someone was keeping track, I made sure I'm trying. I don't know if I ever made the 10,000 steps; very often I had goals and I met them. (YB, female, age 63, PAT user)

... my sister has one. If she doesn't get her steps, it will prompt her to start moving so she can hit her goal. (AK, age 59, nonuser)

Age and technology. The participants challenge the stereotype of older adults being unable to understand or know how to use technology. For most users, once they felt capable of using the device, it took on an important, motivating role in their desire to achieve their goals. In general, the participants did not question the necessity of PAT, though not all were users. No participants who used PAT decided against using PAT, and the two participants who did not use PAT, did not report that they were going to start.

It (the pedometer) was easy. Yeah, some of them (apps) are a little bit complicated and older age as I am now, it's kind of harder for me to understand it. But, for example, with my iPhone my husband has gotten that tells me how active I am, and if I'm just sitting down it will let me know it will alert me. It's fantastic, I think; it's really amazing, something that we didn't have before. I have a very positive (attitude) right now, because like I said, when we get older we tend to stay away from things that are difficult to understand, so we just give up. But if we get involved, I've learned that they're not that difficult, if I have an open mind to learn something than they are very helpful in your life. (SAP, female, age 70, PAT user)

I guess my generation is not very tech savvy. So, I don't really use technology a lot. I guess my view is a lot of things that are in technology now, people know or should know how to do these things without using technology and technology has become, like I said, fashionable, as opposed to being very useful. But I'm learning I have to get into technology, especially in my line of work now. So, I'm a little better with apps now on my phone. I finally got a smartphone maybe 6 months ago because it was work related. I was missing a lot of information when I'm not here on my own computer. (RC, male, age 62, non-PAT user)

Attitudes Toward PAT

The theme of attitudes referred to participants' positive and negative feelings about PAT, including feelings related to record-keeping as well as potential risks from PAT use.

Motivation and improvement. Participants reported negative feelings when a day of record-keeping was missed and reported the positive feelings from making changes in behavior that became possible because of technology.

But, it's an awareness, and that is what I found interesting, that if you don't walk you feel guilt, and when you do walk you feel so good, not just because physically you feel good, but because you have accomplished something that you want to do every day. (MH, female, age 63, PAT user)

It's so funny how it's motivating, and I know that's a computer, but it was good. And I thought it was really good, in fact, I liked it so much that I mentioned it to my son, and they gave me this Fitbit for Mother's Day. And they said, "Here. We want you to stay healthy and keep tracking your steps." (MH, female, age 63, PAT user)

This was at the beginning, at the end of the day, the first thing that I would do is try to find out all the time how many steps

and that changed my mind and then it changes completely my attitude towards it. (SAP, age 70, user)

Risk concerns. One participant expressed concern about potential health risks of using PAT and debated whether the benefits outweigh the possible negative effects.

My concerns were what they do to the skin. I've heard that they would burn the skin. So, I'm concerned about that. I'm not too crazy about having something strapped onto me, 24/7 . . . I don't mind an occasional, a pedometer would be ok, I would be ok with a pedometer. But everything else, that's really on your skin, because a pedometer's not really on your skin, it's on your clothing . . . If they could monitor me remotely, that's fine. Even then, I don't know what kind of radioactive stuff is going on there, so I'm not too sure how I feel about having a monitor on me. (DJ, female, age 57, PAT user)

Experiences With PAT

The theme of experience corresponds to participants' active use of PAT. Experience also implies the ability of the participants to gain knowledge from PAT that enhances changes to health behavior.

Technology for self-monitoring. The idea of self-monitoring was described positively by most participants, as they became aware of the possibility of making a sought-after change (e.g., increase healthful activity). Several participants noted the way that self-monitoring became embedded in their everyday lives.

I discovered that I loved walking. I started very slow, but with time, I increased walking. Now I walk about 4 miles in San Bruno. It (pedometer) felt good because when I saw the numbers, I thought "oh good." I did 7000 and I increased to 8 and then to 10. I did even more the days that I went to Zumba; I kept it on and I did more than 10,000, and that made me feel good. (ES, female, age 76, PAT user)

Goal setting behavior. Goal setting was a necessary complement to participants' acceptance of the use of PAT for the quantification of health information. Implicit in the goals set by participants was acceptance of the 10,000 step goal, even though some participants also considered it out of reach.

I think it encourages you, me at least, you know it was a goal I set, because it would say, how many steps do you want to do? And I would start at 6 to make sure I could do it, and so I set that goal, and it's for me and I am not trying to impress anyone by doing it. But it was to get those 6000 steps in; it was an incentive. (YB, female, age 63, PAT user)

The technology can help set goals so you keep them. (RT, male, age 49, non-PAT user)

So, it's like you want to beat your own record, so yesterday I did 5000 steps, I wonder if I can walk 5500 steps. I wonder if I could do this, and with the Fitbit, I like it, because it's the same sort of thing. You look at what you've done all day. Like last night it said I had 5560 steps, and I started walking around the house, and Harold says, what are you doing? And I said, I at least want to get to 6000; like give me a break. Are 40 steps really going to make a difference? No but it's the whole idea that, okay, I want to hit that goal at least. (MH, female, age 63, PAT user)

I think it's a stretch because, more often than not, I don't hit it. If I'm honest, I have to say that, however, it's okay to have a goal that's a little out of reach. I really think that makes you reach and when you hit, then it's like you are doing cartwheels, if you can do a cartwheel after 10000 steps. And, the other day, I went out and I got 13000 steps. I was like you would have thought it was my birthday, I was so happy. What does that mean? I do not know but it means that it was a good day I'll take it. (MH, female, age 63, PAT user)

Discussion

This project sought to answer the following questions among a population of older adults who both use and do not use PAT: (a) What do participants know about PAT? (b) What are users' attitudes toward PAT? and (c) What are users' experience with PAT?

Our thematic analysis demonstrated that most participants learned about their level of PA by using PAT. Most accepted the value of 10,000 steps and did not comment on the need to adapt that goal for health or other reasons. Users and nonusers were aware of potential benefits from using PAT, including its role in increasing awareness about actual, as opposed to assumed, daily PA levels. One nonuser questioned the "need" for PAT, indicating that people should learn how to be physically active without it.

Most users expressed positive attitudes toward technology and reported increased motivation and enthusiasm for being active, and increasing their activity levels, from viewing their own PA data. Participants generally viewed PAT positively, though this did not influence nonusers to adopt PAT. Negative views that were expressed mainly focused on concerns about potential risks from using PAT and occasional difficulty with usability, rather than disbelief for possible outcomes from its use.

The participants also indicated overall satisfaction with their experiences using PAT and a general sense of well-being that accompanied positive changes to activity levels. PAT users' adopted self-monitoring behavior and found that it became part of their daily routine. In part, the capacity to set personal goals using PAT, contributed to participants' embracing of the self-monitoring process. More importantly, the users embrace of goal setting suggests that PAT supports health behavior change.

Overall, these outcomes suggest the need for further examination of stereotypes of fear of technology among older individuals who might benefit from PAT use. Our study demonstrates that, overall, older individuals are adopting PAT and recognize its value in promoting good health behavior. As the current middle-aged generation moves into older adulthood, their historical experiences with technology are likely to support even greater adoption and acceptance of PAT. Given that most American adults do not meet the government recommendations for activity (Troiano et al., 2008), PAT offers a potentially effective strategy for increasing and maintaining adequate PA levels.

In addition, we have determined at least four major bases on which to recommend PAT for promoting health and reducing risks of chronic disease among older adults. First, as Lee and Coughlin (2015) suggest that training and education to increase understanding of PAT improve user's experience as well as benefits from technology, especially during the introductory phase. This may potentially reduce any concerns or negative perceptions about PAT. Most participants indicated that they became more aware of the actual amount of PA they were doing as well as learning about strategies for increasing PA.

Second, even for those older adults with positive attitudes toward PA, many prefer individual exercise over group or structured classes (King et al., 2000; King, 2001). The Centers for Disease Control and Prevention online intervention review website, The Community Guide, recommends individual-based strategies as effective for increasing PA among older adults (Centers for Disease Control and Prevention, n.d.). Again, this suggests that tools such as PAT may be effective in supporting healthful PA behavior among (older) individuals.

Third, the availability of relatively inexpensive PAT (e.g., pedometers are available for less than \$20.00) and widely accessible mobile technologies (Manganello, Gerstner, Pergolino, Graham, & Strogatz, 2016) suggest their value for increasing PA among older adults, particularly those who are low income.

Finally, PAT offers an important strategy for focusing on ways for older adults to recover their sense of personal competence while allowing for different levels of mobility (Tulle, 2008). For example, older adults can self-evaluate and determine goals for their own PAT outcomes (e.g., steps). This study raised questions about knowledge of, experiences with, and perceptions of PAT and concludes by reporting overall positive views of PAT and challenging stereotypes of fear and rejection of PAT among a population of older adults.

Limitations

The study sample included older adults, aged 50–76 years, who were in generally good health and without mobility issues. Their interest in becoming or remaining physically active will thereby be different from older adults experiencing health conditions or mobility limitations. The population also resides in a temperate climate and does not have to address limitations to PA associated with weather. The use of one-on-one in-depth interviews allowed for deeper understanding of the issues associated with technology use among an older population, but the small sample size precludes generalizations across populations of older adults.

Conclusions

Technology increasingly appears to be an effective strategy for motivating users to become active or increase levels of PA. Based on the outcomes of this study, PAT offers an important strategy for increasing health benefiting activity among adults with minor or no mobility issues. PAT provides motivation, feedback, and a way to quantify and observe changes to PA levels. In addition, older individuals, who are less likely to engage in communal settings such as school and work, may also benefit from this individually based activity promotion strategy, particularly if the adoption of technology is coupled with adequate training and support (Takemoto et al., 2018).

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