MOTIVATIONAL DYNAMICS OF WEARABLE ACTIVITY MONITORS

by Elizabeth J. Lyons, Ph.D., M.P.H. and Maria C. Swartz, Ph.D., M.P.H., RD.

INTRODUCTION

Wearable activity monitors (also known as fitness trackers and electronic activity monitors) are popular among both consumers and researchers. These monitors range from basic pedometers to multisensor wearables that connect to complex mobile apps. Popular models of these monitors include those made by Fitbit, Misfit, and Garmin, as well as multipurpose smartwatches with monitoring functionality. Typically, monitors track and provide feedback on activity-related metrics such as steps, minutes of moderate-vigorous intensity physical activity, distance walked, and discrete bouts of specific activities. Some specialized devices and apps target athletic enthusiasts with additional functionality, such as detecting strength training exercises automatically and guiding heart rate training.

Determining which type of monitor to choose is difficult, whether it is for personal use or to recommend to patients or clients. This decision must take into account empirical evidence, theory, and personal preferences. For this article, we will not provide advice regarding specific wearable activity tracking monitors because of the rapid changes occurring in the wearable industry. Instead, we will discuss the rationale for using specific types of wearables and recommendations for their implementation, which can be used by health and fitness professionals to evaluate various wearable devices (and/or apps).

RATIONALE FOR THE USE OF WEARABLES

Wearables and their related apps are attractive to researchers and practitioners for several reasons, including their potential effects on self-regulation, motivation, and surveillance/communication between practitioners and clients.

Apps that use monitors to automate self-monitoring can improve upon traditional methods of delivering behavior change techniques related to self-regulation. Apps that use information from wearables (both directly, such as with Fitbit’s app, and indirectly, such as with apps like MyFitnessPal that pull information from multiple different wearable types) include many behavior change techniques that often are used successfully in clinical...
physical activity interventions (8). For example, theorists suggest that self-monitoring should occur close in time to the activity performed and that feedback should include the context of a comparison with previous performance, behavior of similar others, and precise personal goals (1). Although apps and systems can easily gather, calculate, and immediately communicate back the information to the client, it is harder for counselors to do so on a moment-by-moment basis. Therefore, using wearable monitors and apps that use interactive tools that allow for self-monitoring and feedback can help health and fitness professionals adhere to these recommendations. For example, Withings offers an interactive tool that allows users of its monitoring app to action plan for specific situations, such as an after-dinner walk, and receive push notifications as reminders at prearranged days and times.

In addition, these apps may be able to improve autonomous forms of motivation for engaging in physical activity. Autonomous motivations are related to intrinsic enjoyment of physical activity and/or personal identity and values related to physical activity. An autonomously motivated person might engage in activity because he/she enjoys a specific sport or because he/she values feeling like an active person. These forms of motivation, in contrast to more external and controlling forms, have been associated with greater habitual physical activity over time (11). Self-determination theory suggests that fulfillment of basic psychological needs for autonomy, competence, and relatedness can increase autonomous forms of motivation (3). For example, interactive tools in activity apps can support autonomy by allowing users to choose and change their goals, journal about their reasons for being active, and read information providing a rationale for changing their behavior. Positive feedback, guided practice, and demonstrations of technique can improve perceptions of competence, and social networking can improve perceptions of relatedness to others. For more information about self-determination theory, see the feature article, “Chang ing Motivation Over Time in Health and Fitness Settings: The Role of Need-Support,” by Wasserkampf et al. in this issue of the Journal.

Wearable monitors also offer opportunities for long-distance surveillance and intervention. Most activity monitors offer functionality for “friending” other accounts in the feedback application. By making an account and friending clients, patients, and/or research participants, it is possible to obtain continuous information on their activities. Many systems also offer data downloads of long-term data in one spreadsheet file. Practitioners and researchers can then use the gathered information to customize care or intervention and build a partnership with their clients or participants.

RECOMMENDATIONS FOR IMPLEMENTATION

Use Behavior Change Techniques as a Guide
Behavior change techniques are the fundamental building blocks of interventions, and as such, are a useful tool for comparing different monitoring systems. In Table 1, we list some techniques taken from two major taxonomies (5,9) that are pertinent to activity-related apps and discuss aspects of their implementation that may be helpful for comparison across systems. In addition to investigating available behavior change techniques, practitioners and researchers would be well served by investigating several other aspects of how the techniques are delivered. For example,

- Are the techniques available in the basic version of the app, or do users need to pay additional money to use them?
- Are the interactive tools that deliver the techniques easy to use and understand for all experience levels of users?
- Can the app be connected to other apps to provide even more techniques (e.g., Lose It!, My Fitness Pal)?
- Will supplemental intervention, such as by phone, email, or in person, deliver any desired techniques that are missing from the system?

Supplement With Other Intervention Components if Necessary
As mentioned previously, it may be necessary to use other forms of media in addition to a wearable monitor and its app. For example, in our studies, we have included in-person goal-setting activities that contextualize “little why” step goals within larger “big why” goals related to personal values (e.g., “I want to be able to keep up with my kids on our special yearly hike” or “I want to be able to walk to the mailbox without being out of breath” as goals related to family and function) (7). We also have used weekly phone calls to supplement the content of the app we were using at the time. The calls could include techniques not available in the app and improve upon techniques that were implemented shallowly. For example, a phone call or in-person counseling can allow practitioners and interventionists to promote more in-depth action planning and go through problemsolving procedures to address any barriers to engaging in those plans. Several meta-analyses have provided recommendations
on which behavior change techniques are most likely to be important for promoting physical activity (see citation (8) for a review in the context of activity monitors).

### Take Individual Lifestyles and Preferences Into Account

A wearable monitor is only as good as how often it is worn, and an app is only as good as how often it is used. Wearable monitors are accessories that often are highly visible and are intended to be worn as often as possible. Designs that appear particularly sporty may be inappropriate for formal occasions or worksites. In addition, many women may have difficulty with some formats of wearables because of the rarity of pockets in many pieces of women’s clothing. Large wristbands can interfere with typing and other aspects of everyday living. However, jewelry-like formats also can cause difficulties. Necklaces may bounce painfully during vigorous activity, and water/sweat can stain or ruin many monitors that are not water-resistant. Often, those who wish to monitor their lifestyle activity on an everyday basis as well as track their athletic activities must use two different monitors, because monitors often are tailored specifically to one or the other of these purposes. For example, swimmers need special monitors that are not only waterproof but that also include algorithms to track strokes accurately.

### TABLE 1: Behavior Change Techniques That May Appear in Activity Monitoring Systems

<table>
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<tr>
<th>Behavior Change Technique</th>
<th>General Description</th>
<th>Things to Look for in the App</th>
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<tbody>
<tr>
<td>Self-regulation</td>
<td>Negotiate a specific goal related to the target behavior</td>
<td>Can the user change the goal? Is a rationale provided for suggested goals? Can short- and long-term goals exist at the same time?</td>
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<td>Feedback</td>
<td>Deliver informative and/or evaluative feedback based on performance</td>
<td>Can users see cumulative feedback over time? Is progress compared with their past performance, similar others, and their specific goals? Are abstract/reflective graphics available to help users picture their progress?</td>
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<tr>
<td>Action planning</td>
<td>Provide opportunities to make very specific plans for physical activity</td>
<td>Is the user prompted to think about who, what, where, and how he/she plans to be active? Is the user prompted to make plans using an “if…then” format? (e.g., “if it’s raining, then I will walk in place while watching TV”)</td>
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<td>Persuasion</td>
<td>Encourage positive self-talk related to the behavior (can be internal, written, verbalized, etc.)</td>
<td>Can users comment on their own progress as well as others’? Is some form of journaling possible?</td>
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<tr>
<td>Behavioral journalism</td>
<td>Provide stories from real-life role models</td>
<td>Are the role models similar to the user?</td>
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<td>Changes to the environment</td>
<td>Create a stimulus that prompts or cues performance of the behavior</td>
<td>Can the nature of the prompts be individualized so as not to disrupt the user’s other activities?</td>
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<tr>
<td>Prompts/cues</td>
<td>Change defaults and/or choices to make performance of the behavior seem to be easy, automatic, or the default</td>
<td>Does the app ask users to create goals for strength training or other behaviors as well as walking? Are the default goals reasonable?</td>
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<tr>
<td>Social support</td>
<td>Facilitate social support from others, e.g., by promoting new social linkages or enhancing existing social networks</td>
<td>Are options for socializing available beyond simple step competition? Can users socialize with existing friends/family as well as find new ones? Are there ways to maintain privacy and/or anonymity?</td>
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There are several questions practitioners/researchers can ask to help match a monitoring system to an individual’s lifestyle and preferences. For example,

- What does the individual want the monitor to track (steps, minutes of moderate-vigorous intensity activity, heart rate during runs, etc.)?
- When and how will the monitor be worn?
- Would the individual rather have more sophisticated functions, like global positioning system distance tracking, or longer battery life?
- Is a standard, inexpensive monitor sufficient for their purposes, or are special features needed?
- Is there a way to connect the individual to their friends and family using the device (either within the device’s app, by sharing to social networks, or by sharing to other related apps such as MyFitnessPal)?

Incorporate Social Interactions

Social networking features in a wearable monitor’s associated app can serve as a source of social support, social influence, and social comparison, all of which can impact physical activity. Scholars who study the interaction between humans and computers recently have described several recommendations for transforming the “quantified self” into the “quantified us;” that is, using information provided by activity monitors and other wearables socially rather than individually (12). They recommend that apps facilitate connection with truly similar others in metrics that are important to the user. These metrics may include personal characteristics such as age and culture as well as metrics related to health behavior, such as running speed or desired amount of weight loss. In addition, apps are recommended to provide tools for emotional self-expression related to the information over and above numbers and simple “like” functionality. Opportunities for posting photographs and journaling, for example, may promote greater connection between users. Finally, they recommend use of “slow technology” that emphasizes reflection and learning rather than efficient information provision. Mueller, in Khot and colleagues (4), for example, used heart rate monitor outputs to create 3D printed objects such as line graph necklaces, differently sized frogs, and even chocolate emojis based on performance. Others have used virtual objects to provide feedback information, such as growing flower gardens and virtual pets (2). Growth and thriving of flowers/pets can be shown with bright colors, lively music, and the like and compared with colorless, smaller, wilting versions when activity does not meet goals. These novel, abstract forms of feedback may be a way of providing activity information to others in a way that is viewed as interesting (e.g., “I grew a beautiful flower by meeting my goals all month!”) rather than bragging (“I beat all of my friends this month!”).

“Gamify” Very Carefully

Activity monitor systems typically are intended to increase motivation — specifically, to increase autonomous forms of motivation. App developers often include game elements to attempt to increase perceptions of fun and enjoyment during use of the app, but this gamification process should be performed very carefully. There is evidence that some game elements may actually backfire in some circumstances, making users feel controlled and condescending to rather than autonomous and interested (6,10). Context is very important; for example, a weight loss competition in a workplace with monetary or health insurance punishment can feel quite different from a casual weight loss competition with friends or family with virtual sticker rewards.

The “RECIPE” system is a useful metric for determining whether gamification is likely to increase autonomous forms of motivation (10). Table 2 hereinafter shows the components of this system — reflection, exposition, choice, information, play, and engagement — with questions that may help the reader determine whether the app is likely to feel meaningful,

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<th>Component</th>
<th>Reflection Questions</th>
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<tr>
<td>Reflection</td>
<td>Are there opportunities or prompts to connect things that happen in the app to the user’s life? Are there ways to share these reflections with others and discuss them?</td>
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<tr>
<td>Exposition</td>
<td>Is there a story, analogy, or metaphor contained in the app? Can users read their own stories, analogies, or metaphors into it?</td>
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<td>Choice</td>
<td>Do choices meaningfully alter the experience of using the app? Can users choose their own goals or types of goals?</td>
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<tr>
<td>Information</td>
<td>Does the app provide a rationale for its use? Does the app connect its use to real-world positive outcomes? Is the information provided relevant to the user?</td>
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<tr>
<td>Play</td>
<td>Does use of this app feel emotionally safe? Would someone decide to stop using it if he/she gained weight or stopped exercising? Does using this app feel like a fun choice or a mandatory chore? Does the app feel like exploring, discovering, or learning something interesting?</td>
</tr>
<tr>
<td>Engagement</td>
<td>Are there opportunities for meaningful social engagement with other people, either already existing friends or new social ties?</td>
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interesting, and fun. Many game elements that are used commonly in wearable monitoring systems’ apps do not offer these experiences. For example, leaderboards typically do not provide opportunities for meaningful social engagement with others. Competition of this type also can feel emotionally unsafe, like personal accomplishments are less meaningful if the individual is at the bottom of his/her team’s list. Badges or trophies that emphasize information and silly accomplishments or that tell a story may be more meaningful than badges that simply state, for example, “5,000 steps” (6).

Apps that provide superficial gamification only, such as standard leaderboards and badges, run the risk of turning physical activity into a pursuit of steps and likes rather than a pursuit of enjoyment. This outcome has been reflected in some of our research participants stating that they were not motivated to walk when they forgot to wear their monitors because that day’s steps “wouldn’t count.” If they didn’t get credit for those steps, what was the point of taking them? Similarly, tangible rewards in the form of coupons, discounts, and donations to charity also may backfire by promoting external motivators rather than internal ones. Ultimately, promoting an intrinsic enjoyment of physical activity and an integration of activity into one’s personal identity and value system is likely to produce better long-term results than providing external incentives or rewards, as discussed previously (10,11). Gamification should ideally promote feelings of enjoyment and pleasure related to activity rather than treat activity as a chore to be completed in exchange for some reward.

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A number of apps have experimented with building upon standard gamification strategies by offering interesting or silly badges, animal walking companions that can be earned with steps, or virtual tours that offer opportunities to learn interesting things. For example, a tour of California vineyards by Virtual Active offers beautiful views as well as information on different types of wine and how the grapes are grown. Furthermore, augmented and alternate reality games that offer opportunities to battle friends to virtually capture real-life locations (turf.ly, Ingress) or collect virtual items via physical activity (Zombies, Run!, Pokemon Go!) offer models for the application of meaningful gamification principles.

CONCLUSIONS

A wearable monitor is a promising tool that can be used to increase motivation and promote self-monitoring for physical activity among clients and research participants. However, to leverage the usefulness of the wearable monitors and their associated apps, we recommend that practitioners and researchers first think about the behavioral change techniques they would like to incorporate to help individuals change their behavior. Next, it is important to consider client personal preferences. In 2013, our laboratory studied the behavior change techniques that existed across every wearable activity monitoring system we could find in the United States at the time (8). Three researchers wore each of 18 monitors for at least 2 weeks per monitor. At the end of the study, all three researchers chose different monitors for different reasons — and all of us have changed our preferred monitor several times since then! Clearly, determining the best match for an individual can be difficult, and preferences would likely change as monitor features and function change over time. Third, it is important not to overlook social network features that may offer additional social support. Lastly, evaluate how the associated app uses game elements to address user motivation. Dressing up virtual pets, eating chocolate emojis, and learning about how wine grapes are grown can target personal interests, values, and identity while also providing information on performance; in contrast, step counts simply communicate numbers. Ultimately, a good fit between individual client preferences, tools to promote behavior change, and the fitness professional who provides those tools will likely produce better outcomes. Wearable activity monitors and their companion apps are capable of providing more than just numbers and can be a useful tool to enhance fitness professionals’ practice.

Dressing up virtual pets, eating chocolate emojis, and learning about how wine grapes are grown can target personal interests, values, and identity while also providing information on performance; in contrast, step counts simply communicate numbers.

MOTIVATION AND WEARABLE ACTIVITY MONITORS


Recommended Reading:


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Elizabeth J. Lyons, Ph.D., M.P.H., is an assistant professor in the Department of Nutrition and Metabolism at the University of Texas Medical Branch (UTMB). Her research focuses on using behavior change techniques and game elements to increase motivation for long-term physical activity behavior change. She is particularly interested in intervening with cancer survivors and older adults to improve quality of life.

Maria C. Swartz, Ph.D., M.P.H., RD, is a postdoctoral fellow in the Division of Rehabilitation Sciences at the University of Texas Medical Branch (UTMB). Her primary research interest is in developing and evaluating technology-based health promotion interventions that can be incorporated into rehabilitation services. Her research topics of interest include cancer survivorship, aging, eating behavior, physical activity, sedentary behavior, and ecological momentary assessment.

BRIDGING THE GAP

Choosing the right wearable activity monitor and evaluating the apps that go with it can be challenging. We recommend that practitioners use behavior change techniques and characteristics of gamification to determine appropriate monitor systems and how to implement them. We also recommend that practitioners pay careful attention to the match between personal preferences and characteristics of the monitor as well as the app portions of the system.

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