TECH SAVVY: Mobile Technologies for Promoting Health and Physical Activity


Author Information

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SUMMARY

Markets for mobile apps in health and fitness are growing exponentially, particularly with the expansion of the mobile health (mHealth) market. These applications are being developed in the hope of helping people with their health and fitness habits. The use of mobile technologies has the potential to transform the health and fitness market in the United States by providing user-centered, mobile health technologies. These apps range from irresponsible health and fitness apps to those that are well-designed.
Abstract

LEARNING OBJECTIVES:

* To define mobile technologies.
* To address advantages and barriers to the use of mobile devices in health and fitness-related practices.
* To provide current evidence, considerations, and guidelines for selecting exercise and fitness smartphone apps on the market.

With new mobile technology being developed at such a fast pace, trying to keep up with the ever-changing technological terminology — with words and acronyms such as 3G, 4G, SMS, RSS feeds, and Web 2.0 (see Sidebar 1) — can be overwhelming. The technological boom also has produced a sizeable influx of health-related applications (apps) available on mobile devices, with more than 13,600 mobile phone health apps currently existing on the market according to MobiHealthNews. The increasing popularity of health apps demonstrates that people are looking for ways to promote physical activity and monitor dietary intake using smartphones, iPhones, and other mobile devices. As mobile technology becomes more ingrained in our lives, some may make the argument that this technology may take away from a healthy lifestyle by decreasing physical activity and increasing sedentary behavior (e.g., prolonged sitting) (13). However, as described herein, this same technology can be used to enhance healthy lifestyles. In this article, we review some of the ways in which mobile technologies have been used in health and fitness-related practices and provide examples of exercise and fitness smartphone apps for promoting physical activity in all age groups.

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WHAT ARE MOBILE TECHNOLOGIES?

Mobile technologies include any device that uses wireless technology to send and receive information to or from other devices. Examples are mobile phones, laptops, notebook computers, tablets, and global positioning system (GPS) devices. Mobile phones are the most common mobile devices and are used for interpersonal communication via voice data, Short Message Service (SMS or text messaging), where up to 160 characters can be sent from one mobile phone to another, and Multimedia Messaging Service (MMS), which can include longer text, graphics, photos, audio clips, video clips, or any combination of these, within certain size limits. MMS is used frequently to send photos and videos from camera phones to other MMS-capable phones or email accounts. Most mobile phones with cameras are capable of using MMS, as are many noncamera phones. Smartphones are Web-enabled mobile phones with features comparable to those found on a computer. Smartphones and other mobile devices, such as tablet computers, can provide real-time Internet connectivity that allows users to browse Web sites to search for information, access social networking sites such as Facebook and Twitter, and receive updates from Web sites and blogs through Rich Site Summary (RSS) feeds, providing a format for delivering regularly changing Web content. These Web-enabled mobile devices also provide access to location-based apps and services, such as GPS navigation systems. This is possible through a built-in GPS receiver, which is often enhanced by secondary location information known as assisted GPS (aGPS) (see Sidebar 1).

Following the growing popularity and marketing of smartphones and new smartphone technology such as 4G (the fourth-generation cellular wireless standards), mobile-friendly Web sites likely will gain corresponding popularity in the coming years. As a matter of fact, mobile technology already has been adopted widely for use in disease prevention and management. Mobile health (mHealth, also written as m-health) is the use of mobile technology to aid in the delivery of health care, using SMS, MMS, RSS, and mobile-friendly Web sites for an array of issues including improving communication between the patient and health care provider and monitoring conditions of patients (10). In addition, mobile devices can be used as wearable monitors. There are GPS-enabled watches, for example, Forerunner (Garmin Ltd., Olathe, KS), mobile wrist and armbands such as the Nike+ FuelBand (Nike, Inc., Beaverton, OR) and Fitbit Flex™ (Fitbit Inc., San Francisco, CA), that track participant activities remotely, such as monitoring an individual’s level of physical activity, estimating total energy expenditure, and detecting falls for older adults (7).

Pedometers are attractive commonly used tools for motivating individuals to be physically active. They are inexpensive and are easily used. In addition, severalFitbit Flex™ (Fitbit Inc., San Francisco, CA), that track participant activities remotely, such as monitoring an individual’s level of physical activity, estimating total energy expenditure, and detecting falls for older adults (7).
Pedometers are attractive commonly used tools for motivating individuals to be physically active. Pedometers provide step counts that are easy to understand by both health professional and participants (19). However, recent research on a free pedometer iPhone application showed that the app is not a valid instrument for monitoring activities. Further research with the other free and paid pedometer apps is needed to assess their accuracy at different speeds and placements (3).

ADVANTAGES TO THE USE OF MOBILE TECHNOLOGY

Health and Physical Activity Promotion and Services

Low-cost or freely downloadable mobile phone apps are now available, with more being developed – many of which feature products and services designed to facilitate behavior change. Typical mobile phones contain complex suites of technologies including cameras, microphones, GPS receivers, and accelerometers. Mobile device apps that aim at promoting regular physical activity and related health behaviors support: 1) self-monitoring by allowing users to log in and track their progress across time using their mobile devices; 2) active problem solving by receiving personalized targeted feedback, which is formulated by using actual data logged in by users; 3) social support networks by creating a virtual community of social support; and 4) instant feedback through a remote interface that collects health and physical activity data from the user, such as heart rate or walking steps. The users’ data are transmitted to a remote program provider for tracking, personal goal setting, advice/messages, and scheduling. This entire process includes seamless data upload with accurate time stamps and locations wherever Internet access is available.

Research suggests that mobile technology-based applications, in addition to traditional face-to-face delivery approaches, are effective for changing health behavior (9,12). For example, an interdisciplinary team of behavioral and exercise scientists, physicians, computer scientists, and engineers collaborated in designing three activity smartphone apps to promote daily physical activity and reduce sedentary behavior in adults (11). Sixty-eight adults, aged 45 years and older and physically inactive, participated in 8 weeks of feasibility testing of the 3 apps. Their results showed that not only were the mobile phone apps effective in improving physical activity (average increase in brisk walking, 100.8 ± 167.0 minutes per week) and decreasing sitting time (average decrease in TV viewing, 29.1 ± 84.5 minutes per day) but also all 3 apps were accepted by the majority of the participants (87%) who had no prior experience with smartphones. The study concluded that no particular app could be considered more influential than the others, but by integrating behavior change and evidence with an interactive user-oriented design process, as well as commercially available programs, behavior changes may be enhanced in sedentary adults who are not familiar with smartphones (11).

Social Media/Multiplayer Effects

Social support is a well-established important correlate of physical activity. Most individuals who engage in regular physical activity or start a fitness program report having strong support from their friends and families (17). Internet-based health interventions typically use social support strategies such as group bulletin boards, scoreboards, chats, and email communication to increase physical activity (6,8). The term “social media” refers to the Internet-based applications built on Web 2.0, which include blogs, content communities, virtual social worlds, virtual game worlds, and social networking sites (2). Social networking sites, such as Facebook™, allow users to create profiles, formulate connections with others, visualize their social networks, and offer additional functions, including public and private messaging and the sharing of photos, videos, and other content that could enhance social support intervention (5). Review of social networking sites for health research that targeted adolescents and young adults revealed that the use of social networking sites could reach diverse and hard-to-reach groups of people while delivering health interventions in a cost-effective manner (15).

Gamification Effects

There is increasing interest in gamification, which is the use of game mechanics to problem solve, in health and fitness fields (18). Video games typically have not been associated with social activity nor have they usually required physical exertion to play. But with technological advancement, such as those mobile apps with aGPS
(assisted GPS) functions and game mechanics, the capability of video games to do both has become much more prominent in recent years. A multiplayer game requires user engagement and participation, and social bonding becomes one of the most important motivating factors for playing the game. Location-based mobile exergames (video games that require physical activity to play) feature both a social and multiplayer component (4). Themes of location-based exergames include virtual treasure hunting, ranking in multiplayer games, and visiting and discovering unique and interesting locations (GPS-based geocaching, geodashing, and waymarking games). A preliminary study involving 14 healthy adults with a mean age of $21 \pm 3$ years found that playing the games for 10 minutes in a multiplayer mode increased energy expenditure (mean difference, 0.5 METS) and heart rate (mean difference, 7.9 BPM) more than playing in a single-player mode (14).

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Barriers to the Use of Mobile Technology

Despite the promise that mobile devices show for offering health/fitness professionals great opportunities to develop and expand their relationships with larger segments of the population, there are multiple potential barriers to using mobile technologies.

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Internet Safety: Security and Privacy

The highly dynamic nature of information contribution, sharing and use within social networking sites presents a new and challenging environment, particularly for health care organizations. Some key features that would help ensure security and privacy for users are: encryption (a way to enhance the security and privacy of a message or files by scrambling the contents) and Hyper Text Transfer Protocol Secure (HTTPS). HTTPS allows the Web site to encrypt the data, so that it can be read only by the intended recipient. HTTPS should be used by any Web site that is collecting sensitive user data, such as their full name, addresses, and banking information (16). Users can tell when a Web site is using HTTPS in two ways: 1) there will be a padlock icon in Web browsers such as Internet Explorer and Firefox, and 2) the URL displays https:// in the address bar.

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User Experience: Ease of Use and Faster Access, Cost

Mobile devices and programs should be easy to use. For example, once a participant’s location-based app is turned on, the GPS signal on the mobile device ideally would be automatically detected and engaged, but this may require a secondary step outside the app. Although the digital divide has in some ways been bridged by mobile technology, there remain some barriers to access, such as device, app, and data service costs.

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Evaluation Outcomes

Most mobile technology-based health interventions for promoting physical activity have no follow-up measurements or impact outcomes, such as dose delivered and received, knowledge and behavior change, or usability and appeal of the site or application (15). Further research is needed to document the best practices in this area and to quantify the health and fitness benefits of mobile technology-based apps and intervention programs (4,15).

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EXERCISE AND FITNESS APPS ON THE MARKET

The mobile exercise and fitness application market is booming and very likely will continue to grow across time. After reviewing currently available exercise and fitness apps on the market, we classified these apps into five types that may be used as tools for behavior changes. We also listed some examples of popular apps for each category. Here are the five categories: 1) training program apps, 2) pedometer apps, 3) data-monitoring and feedback message apps, 4) game apps, and 5) interactive multimedia game apps (1).
Training Program Apps

Training program apps bear similarity to exercise DVDs or training programs offered via a Web site. Examples of popular apps in this category include: *Couch-to-5K*, a program that consists of spending 20 to 30 minutes, 3 times a week, for 9 weeks, preparing users for a 5K race ($1.99, Active.Trainer.com); *FitnessClass* is an app that offers 475+ fitness class videos (free-$9.99, App Store).

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Pedometer Apps

*Pedometer Free* is equipped with a built-in accelerometer, which can be used by pedometer applications and count steps as the user walks, runs, or jogs outdoors or on a treadmill (Free, requires iOS 7.0 or later). It also can log the user’s height and weight, calculate body mass index (BMI), and track the distance, workout time, calories burned, and changes in BMI. It displays walking routes with markers using GPS. These apps may have limited accuracy in counting steps (3).

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Data-Monitoring and Feedback Message Apps

Users input their progress in these apps during the course of several days, and a system then processes the submitted data and gives feedback to the users. The feedback can consist of tailored messages based on the input, patterns of exercise, and other options provided by the apps. These apps include social interactions via emails, blogs, and text messages among users. *Endomondo Sports Tracker* tracks any physical activity by monitoring duration, distance, and speed by GPS, and it also estimates calories spent during the activity. This tracker app can provide audio feedback that helps users reach their time goals. Users may receive pep talks from their friends — they can write a short text on the Endomondo Web site, which is then read out loud to the users later. It also can provide all the user’s friends’ activities and statistics (Free-$4.99). *Nike Training Club* is another popular workout app that includes 130 drills that build on the fundamentals of strength, cardio, interval, and core training. The app offers a rewards system. Every workout completed is rewarded with a time stamp that users can share with friends on Facebook. Users also can earn badges for the number of minutes they clocked while working out with the training app. Each time a badge is unlocked, the user receives an email with a professional trainer’s tips and suggested alternative workouts (Free, App Store).

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Game Apps

*Zombies, Run!* is a game app that facilitates physical activity by playing games. When a player goes for a run, they also take part in a mission in a post-zombie apocalypse world. The players collect much-needed supplies for Earth’s survivors while listening to the game’s plot unfold on their headphones. There are more than 30 missions to choose from ($3.99). *GameFit Racing* is another exercise-powered app that encourages players to engage in fitness activities. It is a three-dimensional racetrack fitness game that can be calibrated with almost any exercise machine at a gym or at home, making calorie-burning workouts more appealing and fun for users ($1.99).

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Interactive Multimedia Game Apps

*Virtual Active* is an interactive, cinema-quality, video-based cardio workout app. All the users need to do is place an iPad, iPhone, or iPod on a cardio machine, bike, or elliptical and start exercising. This app uses unique technology to respond to how fast users are working out (free sample video-$7.95). *Teemo* is a game app designed to incorporate socialization with friends, small exercises, and exotic adventures, such as climbing Mount Everest and hiking the Inca Trail, to make fitness more enjoyable and encouraging (Free-$2.00).

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SUMMARY

Mobile technologies can offer opportunities to promote health and physical activity as an integral part of conventional face-to-face instructional formats that are delivered in clinics, gyms, or other community settings. Mobile phones can be used as
Mobile phones can be used as more than two-way communication tools by allowing users to have instant access to health information and be rewarded for their healthy behavior choices at any time of the day or night; this serves as a virtual-community, with real-time social support and encouragement for physical activity. This instant positive reinforcement creates social support among peers, helping to motivate long-lasting behavior changes, which is a difficult thing to achieve. Mobile phone apps also provide personalized programs and are tailored to fit the needs and schedules of their users, who will be more likely to be open to communications and behavior changes. Further research is needed to document the efficacy for behavior change and whether any health outcomes are accrued and have long-term effects.

**SIDEBAR 1. TERMINOLOGY IN MOBILE TECHNOLOGY**

**3G:** Third-generation mobile telecommunications, defined by the International Telecommunication Union. Most mobile phones today run on some type of 3G network (depending on the carrier) for voice and data access. This access makes possible advanced phone functionality, such as the smartphone features of email, viewing videos on YouTube, upload and download capacity for surfing the Internet, and sending enhanced text messages that include images.

**4G:** Fourth-generation wireless service is a step up from 3G and currently is the most widespread high-speed wireless service. This allows simultaneous use of voice, internet access, gaming, and streamlined multimedia services such as TV and video-streaming services. 4G wireless is designed to deliver greater speed.

**aGPS:** aGPS, or assisted GPS, helps speed up the time it takes to pinpoint the location of the mobile device initially (known as “time to first fix”) by combining GPS satellite information with the support of spatially explicit information, such as the fixed location of nearby cellular towers.

**App:** A software application program for a specific purpose, now commonly available on mobile devices.

**Cloud App:** Short for cloud application. Cloud app is the phrase used to describe a software application that primarily resides and functions on a server and is accessed by a mobile device via the Internet.

**GPS:** The Global Positioning System (GPS) is a satellite-based navigation system. The embedded GPS receiver in a smartphone can be accessed by mapping and other location-based services for real-time position tracking, text- and voice-guided directions, and proximity of points of interest.

**Location-based services:** Location-based services are software functions that support machine-to-machine (e.g., mobile device to/from a server) interaction using information on the geographical and temporal position of the mobile device and supporting location information (e.g., other devices and/or nearby mapped points of interest).

**MMS:** Multimedia Messaging Service (MMS), which can include longer text messages, graphics, photos, audio clips, video clips, or any combination of these within certain size limits. MMS frequently is used to send photos and videos from camera phones to other MMS phones or email accounts. MMS capabilities are frequent among mobile phones with or without camera capabilities.

**mHealth:** mHealth (also written as m-health or mobile health) is a term used for the practice of medical and public health supported by mobile devices. The term is used most commonly in reference to using mobile communication devices, such as mobile phones and personal digital assistants (PDAs), for health services and information.
Real-time Data Capture: Real-time data capture is the creation and expansion of access to high-quality, real-time, multimodal data that are captured from connected mobile devices.

RSS: RSS (Rich Site Summary) feeds, a format for delivering regularly changing Web content.

Smartphone: A smartphone is a mobile phone that offers more advanced features and allows the user to install and run more advanced applications, for example, the ability to send and receive email and edit documents; capabilities similar to that of a PDA or a computer.

SMS: Short Message Service (SMS) allows users to send up to 160 characters of text from one mobile phone to another.

Tagging: Site authors and content contributors attach key word descriptions (called tags) to identify images or text within the site as categories or topics. Tagging is used commonly in blogs. Web pages and blogs with identical tags can then be linked together, allowing users to search for similar or related content. If the tags are made public, online pages that act as a Web-based bookmark service can index the tags.

Web 2.0: The term Web 2.0 was coined in 1999 to describe Web sites that use technology that facilitates collaboration, sharing, and interaction beyond the static pages of earlier Web sites (Web 1.0).

Wifi: The name of a popular wireless networking technology that uses radio waves to provide wireless high-speed Internet and network connections.

QUICK FACTS (SIDEBAR 2)
1. Not all apps are free; the price for paid mobile apps ranges from $0.99 to $9.99.
2. Some mobile apps shorten a battery life significantly and use memory in the mobile device.
3. Pedometer apps may not be accurate when counting steps.
4. Mobile apps may be effective in encouraging participation in exercise programs but may not be as effective in sustaining that participation.
5. Some mobile apps may not be user-friendly. There can be a tradeoff in the provision of multiple and sometimes sophisticated functions ideal for athletes who train every day and the ease of use particularly necessary for beginners.
6. Certain apps may require creating an account before purchase and logging in to keep track of workouts.
7. Some mobile apps are just for fun and may not include fitness information.
8. New technologies and capabilities may not be supported on older mobile devices and/or operating systems.

EXAMPLES OF EXERCISE AND HEALTH APPS WEBSITES (SIDEBAR 3)

Couch-to-5K
http://www.active.com/mobile/c25k

FitnessClass https://itunes.apple.com/us/app/fitnessclass/id348715624?mt=8


Endomondo Sports Tracker

Nike Training Club https://itunes.apple.com/us/app/nike-training-
BRIDGING THE GAP

The use of mobile technology in the fields of health and fitness is expanding rapidly from basic voicemail, instant text messaging, mobile blogging, and social networking. Today, there are five main types of mobile health and fitness apps available on the market: training programs, pedometers, data monitoring and feedback messages, games, and interactive multimedia game apps. Exercise leaders and health/fitness instructors and directors have the opportunity to incorporate these technologies into programs and also to design and evaluate the program outcomes to understand which approaches will educate people and promote health and physical activity most effectively.

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