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JACC REVIEW TOPIC OF THE WEEK

Mobile Health Advances in Physical Activity, Fitness, and Atrial Fibrillation

Moving Hearts

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ABSTRACT

The growing recognition that "health" takes place outside of the hospital and clinic, plus recent advances in mobile and wearable devices, have propelled the field of mobile health (mHealth). Cardiovascular disease and prevention are major opportunities for mHealth, as mobile devices can monitor key physiological signals (e.g., physical activity, heart rate and rhythm) for promoting healthy behaviors, detecting disease, and aid in ongoing care. In this review, the authors provide an update on cardiovascular mHealth by highlighting recent progress and challenges with mobile and wearable devices for assessing and promoting physical activity and fitness, and for monitoring heart rate and rhythm for the detection and management of atrial fibrillation. (J Am Coll Cardiol 2018;71:2691–701)

Despite the great strides our health care system has made in cardiovascular (CV) diagnosis and treatment, the global burden of CV disease continues to rise, particularly in low- and moderate-income countries, with a plateau in the decline of CV mortality in high-income regions (1,2). Contributing to this is the low percentage of adults and children who meet the American Heart Association's 2020 goals for the key preventative health factors and behaviors (3,4). Only recently has the medical community started to embrace the reality that most "health" takes place outside the hospital and clinic (i.e., the daily activities and clinical events that occur "the other 362 days" per year when people are not seen by a clinician) (5). CV disease management and prevention, in particular, involve daily decisions about physical activity, dietary intake, medication adherence, and self-monitoring (e.g., blood pressure, weight), which currently go largely unmeasured. The emergence and rapid growth of mobile devices and wearable sensors has made real-world, continuous monitoring of health possible. Enabling patients and clinicians to leverage these technologies for proactive health care can transform CV prevention and disease management (**Central Illustration**). How to incorporate technology effectively into the health care system remains a challenge, yet has the potential to yield enormous individual and societal benefits.

Listen to this manuscript's audio summary by *JACC* Editor-in-Chief Dr. Valentin Fuster.

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ABBREVIATIONS AND ACRONYMS

ACC = American College of Cardiology

AF = atrial fibrillation

AHA = American Heart Association

AMA = American Medical Association

CV = cardiovascular

ECG = electrocardiogram

EHR = electronic health record

mHealth = mobile health

PPG = photoplethysmographic

RCT = randomized controlled trial

The broad area of "digital health" applied to CV disease, as we and others have reviewed, includes everything from electronic medical records, connected blood pressure cuffs and scales, and artificial intelligence applied to large datasets (6–9). Mobile health (mHealth) is the subset of digital health that focuses on the use of mobile and wearable devices and software applications (apps) (10,11). mHealth aims to leverage the worldwide growth of both mobile devices (mobile subscription plans now exceed the world population of 7 billion) (12) and mobile and wearable sensor technology to enable regular monitoring of physiology, behavior, and disease. Smartphones are now the dominant "mobile" device, and the frequent interactions people have with them—exceeding 3 h/day—offer the ability for technology to connect at a personal level throughout our daily lives (13). The opportunity to leverage this connectivity for health promotion and management, as well as research, is unprecedented.

CV disease and prevention are particularly relevant for mHealth, given the multitude of relevant signals that can be measured through apps and devices—from heart rate to electrocardiograms (ECGs) to physical activity and fitness. We previously outlined a "roadmap" for CV mHealth, reflecting on the challenges and opportunities emerging from the inaugural American Heart Association's (AHA) Health Technology Forum (11). In particular, we emphasized that this burgeoning field needs broad collaboration to address meaningful problems and demonstrate clinical effectiveness. The American College of Cardiology (ACC) has also been active in this field. Digital health was the topic of the inaugural Technology Corner in the *Journal* (6) and the ACC Innovation Strategy was recently published (14).

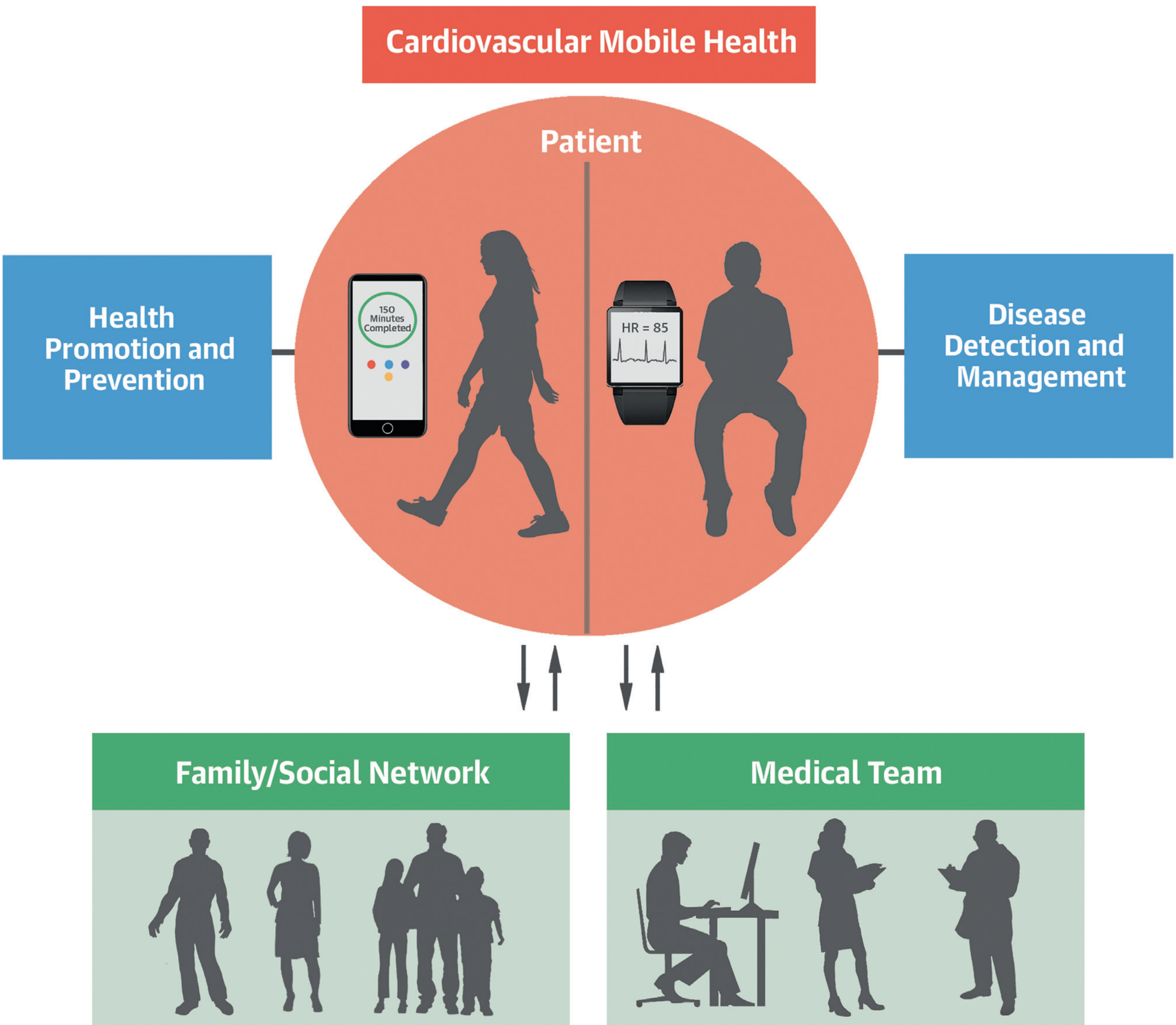
In this review, we provide an update on cardiovascular mHealth, with a focus on recent advances in the areas of physical activity and fitness, as well as monitoring heart rate and rhythm, especially for atrial fibrillation (AF).

CV mHealth FOR PREVENTION AND PHYSICAL ACTIVITY, FITNESS. A key area of promise in CV mHealth is to help people better follow published guidelines around healthy preventive behaviors, including physical activity, as embodied in AHA's Life's Simple 7 and 2020 Goals (3,15). The scientific evidence for mHealth for each of Life's Simple 7 preventive behaviors and risk factors was reviewed in detail in a 2015 AHA Scientific Statement (15), with subsequent systematic reviews for mHealth prevention that include physical activity (16). Physical activity can now be readily measured by an ever-expanding number of mobile and wearable devices (17) and regular physical activity is widely recognized as contributing to vascular health, improving CV risk factors, reducing CV events, and increasing longevity (18). Plus, the need for improvement is substantial (e.g., <30% of children and adults >50 years in the United States meet recommended guidelines) (4), and physical inactivity is estimated to be responsible for 13.4 million disability-adjusted life years worldwide and >$100 billion in health care expenditures in the United States alone (19). It is estimated that every minute of moderate-to-vigorous physical activity is associated with 5+ min of increased longevity (20). Understanding more fully the molecular transducers of the benefits of physical activity is the focus of a recent large, multicenter National Institutes of Health research program (21). The broad benefits of physical activity have led to initiatives such as Exercise Is Medicine by the American College of Sports Medicine and the American Medical Association, to "prescribe" regular physical activity as part of routine clinical care (22,23).

There are now hundreds of activity-tracking phones and wearables with apps to aggregate and display physical activity measures. Step counting has been a common metric as it is easier to measure and the goal of 10,000 steps/day was initially popularized by pedometers from the 1960s. Recent studies have validated step count accuracy (24), but steps are not well aligned with the physical activity guidelines promoted by the ACC/AHA and World Health Organization, which emphasize intensity not just quantity (18,25). Specifically, the recommended 150 min/week of moderate-intensity physical activity (or 75 min/week vigorous) requires at least brisk walking, but also gives "double credit" for more vigorous activities (e.g., jogging, lap swimming). Disappointingly, a review of consumer physical activity apps found only 1 of 379 even incorporated the established 150 min/week aerobic physical activity guideline (26). Assessing the intensity of physical activity is more challenging than step counting (27). Many trackers or smartwatches now incorporate heart rate sensors to provide an additional indicator of intensity (28,29). However, there is continued need for improvement, as even recent wearable devices continue to show suboptimal estimation of physical activity intensity and energy expenditure (29,30).

Importantly, the data that underlie the physical activity guidelines have been based primarily on self-report rather than direct measurement, with evidence that people overestimate their physical activity.

CENTRAL ILLUSTRATION Mobile Health for Physical Activity and Atrial Fibrillation



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Cardiovascular mobile health starts with the patient in the center. The two main areas reviewed in the paper are physical activity monitoring for health promotion and prevention plus heart rhythm monitoring for atrial fibrillation detection and management. The **left** silhouette presents a woman walking with her phone, with the phone screen congratulating her for achieving her weekly American College of Cardiology/American Heart Association/World Health Organization physical activity guidance of 150 min. The **right** silhouette presents a patient sitting and taking an electrocardiogram with a smartwatch, with the watch screen showing heart rate (HR) and electrocardiogram waveforms of atrial fibrillation. The health care team and family and social network are shown in 2-way communication with the patient and his or her mobile health data.

Notably, when accelerometer-based assessment was added to the 2003 to 2004 National Health and Nutritional Examination Survey, <5% of adults were determined to meet the guidelines at the time (30 min/day of moderate physical activity most days of the week), compared with ~50% of participants meeting guidelines by self-report (31). Mobile devices can now readily allow more quantitative assessment and analysis of real-world patterns of physical activity in individuals and across geographies (**Figure 1**). In the MyHeart Counts mobile CV health study, we applied machine learning to smartphone-based physical

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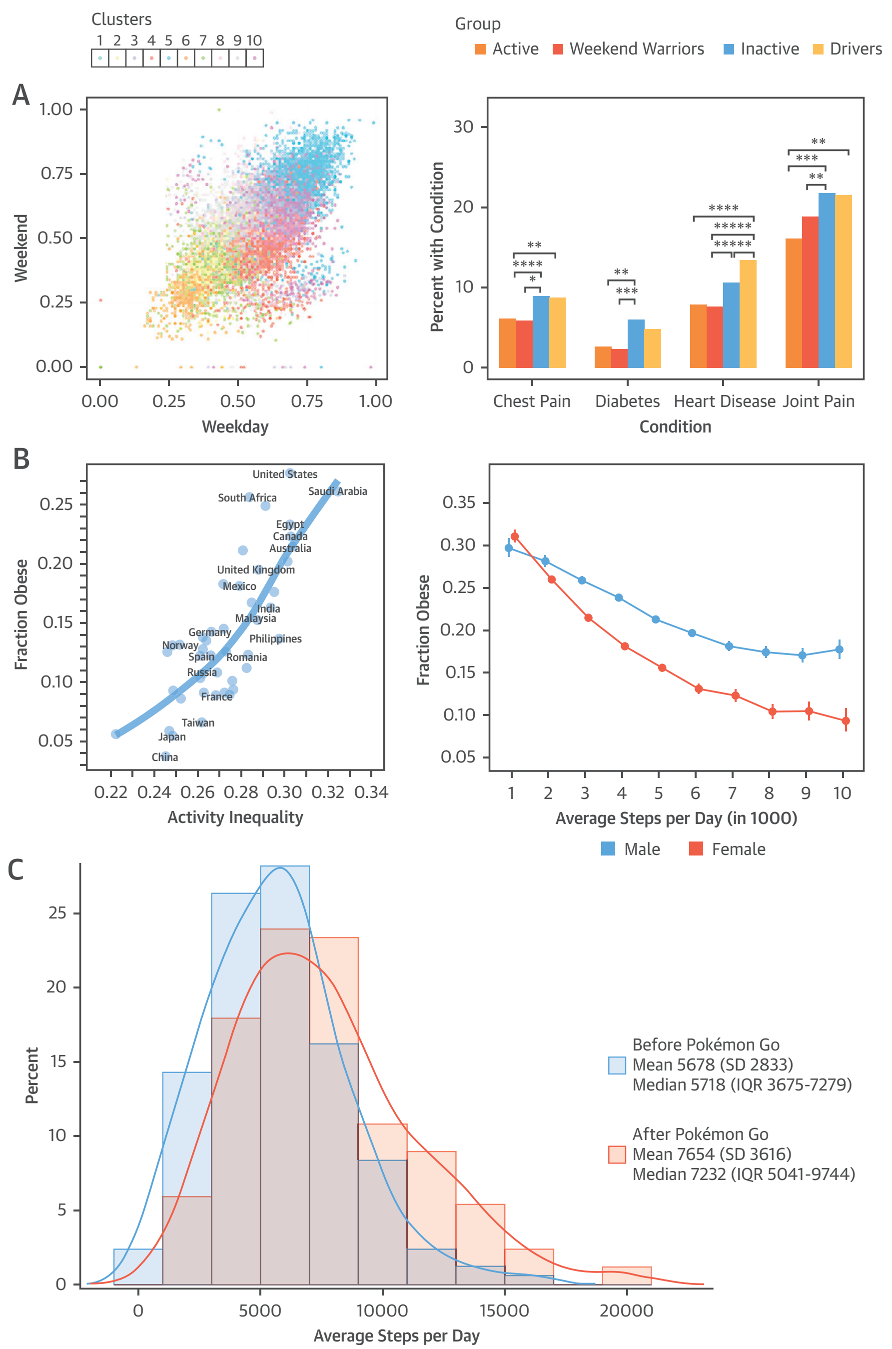
FIGURE 1 Mobile Health Studies of Physical Activity Patterns and Promotion



(A) Machine learning of physical activity patterns from >20,000 participants in the MyHeart Counts study found distinct activity clusters. The scatterplot on the left shows the proportion of time participants' smartphones indicated they were stationary during weekdays and weekend days. The bar graph on the right compares the 4 main activity clusters, showing the 2 more active groups had lower prevalence of medical conditions (e.g., chest pain, self-reported heart disease). Adapted with permission from McConnell et al. (32). **(B)** Smartphone physical activity data from >700,000 individuals across the world show that the degree of activity inequality within a country is associated with higher obesity levels ($R^2 = 0.64$). The graph on the right shows how the obesity-activity relationship differs between men **(blue)** and women **(red)**, with the prevalence of obesity decreasing more rapidly for women as activity level (steps) increases. Adapted with permission from Althoff et al. (33). **(C)** Analysis of smartphone steps per day in 167 individuals before and after playing Pokémon GO showed a 35% increase in daily physical activity ($p < 0.001$). Adapted with permission from Xian et al. (50). IQR = interquartile range.

activity measures in >20,000 participants and found 4 distinct activity clusters (from sedentary to "weekend warriors"), which correlated to current disease status and well-being (32). Further analysis showed benefit to more frequent breaks from sedentary behavior and confirmed the poor correlation between measured and self-reported physical activity. However, while enrolling a large cohort was facilitated through smartphone-based research, the participant demographics were skewed toward a younger (mean 36 years of age) and male (82%) cohort. Plus, a low percentage of participants completed all study tasks. A broader study, analyzing 68 million days of smartphone-based physical activity data from >700,000 people in 111 countries, showed marked global variation between countries and within countries (33). The latter variation, termed "activity inequality," was a better predictor of obesity prevalence in the population than average activity volume. The main contributor to this inequity was reduced activity in women, which was associated with community-level built environment characteristics linked with walkability. More walkable cities had increased physical activity, especially in women. Assessing the built environment to identify areas for improvement is an additional opportunity for mobile devices (34).

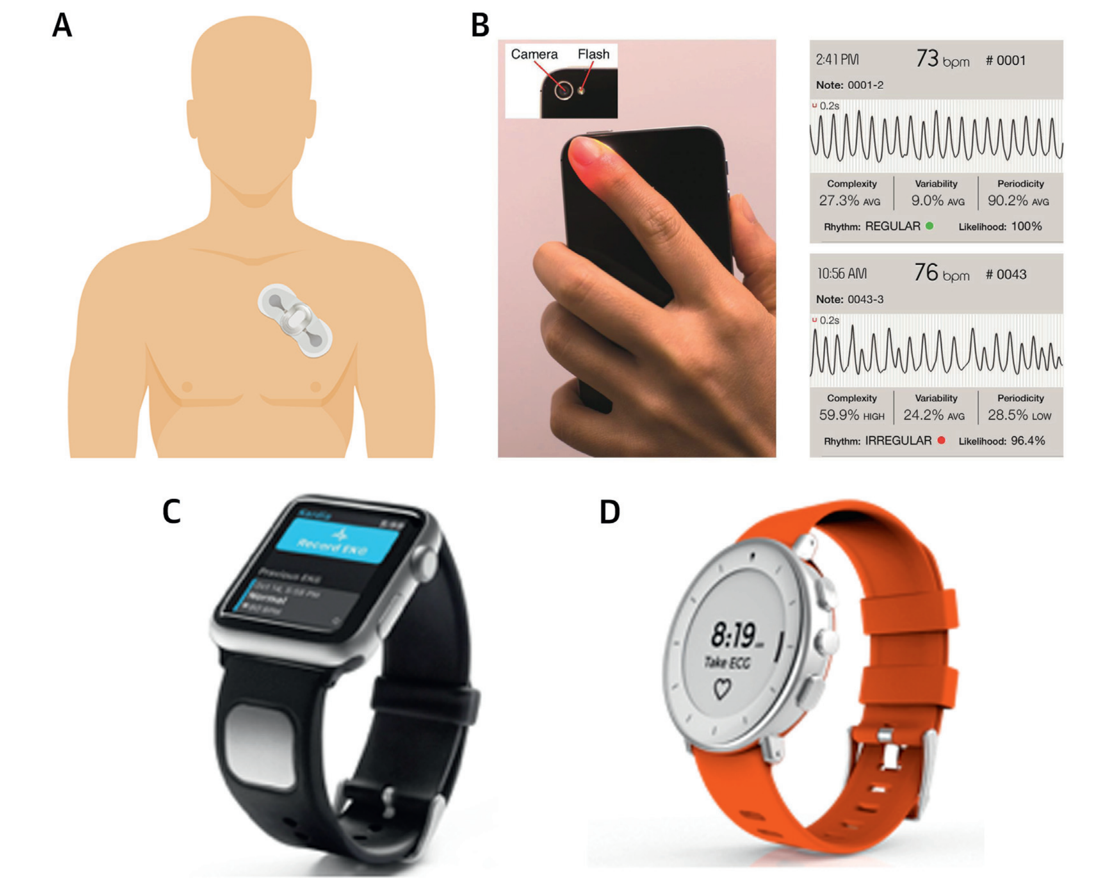
Physical fitness, not just the amount of regular physical activity, has also been shown to be an independent risk factor for CV disease and longevity (35-37). This has led to a recent call for assessing cardiorespiratory fitness as a vital sign in clinical practice (38). Mobile devices can be used to assess fitness (32,39), with the most straightforward being a self-administered 6-min walk test. This was validated as part of the Health eHeart study, where the smartphone-measured distance was accurate to within 15% for >90% of participants (40).

EFFECTIVENESS OF mHEALTH PROMOTION FOR PHYSICAL ACTIVITY, FITNESS

The new U.S. 2018 Physical Activity Guidelines Advisory Committee Scientific Report reviewed the literature through 2016 and found "moderate" to "strong" evidence that mobile phones and wearable devices increase physical activity (18). A 2016 systematic evaluation identified 35 studies of mobile and wearable interventions to improve physical activity, the majority randomized controlled trials (RCTs), with 77% found to be effective (16). However, studies were mostly short term, with limited data on long-term adherence and effectiveness. A 2017 meta-analysis that pooled results of 21 RCTs of mHealth interventions to improve physical activity and sedentary behavior showed only small effects, with a median study duration of only 9 weeks (41). Unfortunately, studies of mHealth interventions to improve cardiorespiratory fitness are very limited (42), a clear unmet need. The IDEA (Innovative Approaches to Diet, Exercise and Activity) trial, by contrast, was a long-term study of weight loss, with physical activity and fitness as components (43). Young adults (n = 470) were prescribed a low-calorie diet, increased physical activity, and group counseling for 6 months before being randomized to "enhanced" intervention with a wearable device to track calories and physical activity. Paradoxically, at the end of the 24 months, the enhanced group lost less weight. Notably, the majority of weight loss and improved physical fitness (with mixed results on physical activity measures) occurred at the pre-randomization 6-month timepoint. Clearly, the wearable in this study did not show the hoped- for benefit in maintaining weight loss, but its contribution to behavior change is difficult to determine, as the armband form factor has not been commercially successful and the wear time was limited—median of 31% days worn, with almost 20% of participants not wearing the device for a single day. It is also possible that introducing the wearable device earlier in the behavioral weight loss program, as opposed to after 6 months, might have allowed for better integration of the device as part of the behavior change intervention and promoted greater device wear time and impact during the maintenance phase.

A critical issue, highlighted in this and other studies, is the recognition that changing a behavior such as physical activity is more challenging and complex than purchasing a mobile device or app. mHealth interventions that incorporate behavioral science theory and evidence-based approaches have been found to be more effective, but are still in the minority (16,44,45). The mActive study found that using a wrist wearable to provide feedback on daily activity helped increase step counts, but only when combined with personalized, positively reinforcing text messages (46). Workplace, team-based interventions have shown promise, in particular the international Stepathlon study, which included almost 70,000 employee participants organized into teams of 5, with 100-day challenges using pedometers supplemented with e-mails providing educational content and highlighting individual and team milestones (47). Financial incentives and gamification have also been viewed as promising approaches (48). The Pokémon GO mobile game was developed in part to promote physical activity, with initial data showing not only a 25% to 35% increase in daily steps among players, but

FIGURE 2 Mobile Heart Rhythm Monitors



(A) Leadless patch electrocardiogram (ECG) monitor (Zio, iRhythm Technologies, San Francisco, California), which is placed over the patient's left pectoral region and can provide continuous ECG monitoring for several weeks. (Image courtesy of iRhythm Technologies.) **(B)** An investigational smartphone app (Cardiio Rhythm, Cardiio, Cambridge, Massachusetts) uses the camera for photoplethysmography (PPG) measurements from the finger. Examples of PPG recordings from a patient in sinus rhythm **(top)** and a patient in atrial fibrillation **(bottom)**. Adapted with permission from Chan et al. (82). **(C)** A Food and Drug Administration–approved wristband (Kardia Band, AliveCor, Mountain View, California) that attaches to a smartwatch (Apple Watch, Apple, Cupertino, California) contains electrodes to acquire a single-lead ECG for arrhythmia detection (image courtesy of AliveCor). **(D)** An investigational smartwatch (Verily Study Watch, Verily Life Sciences, San Francisco, California) that combines continuous PPG with electrodes for on-demand single-lead ECG acquisition (image courtesy of Verily Life Sciences).

also a larger increase in those individuals with low baseline activity (**Figure 1**) (49,50). However, a recent analysis of a large insurer-sponsored program to enhance physical activity, using both gamification and financial incentives, showed very low rates of device or app activation (especially among older and lower-income members), though those that passed the activation step achieved high and sustained levels of physical activity (51). In contrast, another major insurer has a reward program for employees to earn >\$1,000/year by wearing an activity tracker and meeting regular physical activity goals, and reports 68% of those eligible enroll and then 65% of participants sustain engagement at 18 months (52).

Translating the assessment and promotion of physical activity into health care settings was the focus of a recent AHA Scientific Statement (53). This included evaluating available wearable devices for compliance with physical activity guidelines, validation data, behavior change strategies, data security, and access to data for electronic health record (EHR) integration. Notably, 4 of the 5 top-scoring wearables (of a final pool of 23), were consumer-friendly Fitbit devices (Fitbit, San Francisco, California). However, multiple challenges in clinical translation remain, including the high degree of heterogeneity in the physical activity metrics and validation studies, which is being addressed in part by the formulation of accuracy standards and validation protocols by the

Consumer Technology Association (54,55). Even more challenging is the limited integration of physical activity assessment into the clinical workflow. Consumer devices provide near-continuous daily measures of physical activity, which would be overwhelming for a provider to review. Thus, software solutions are needed to summarize clinically relevant physical activity measures and integrate into the EHR to allow review with similar ease as viewing a vital sign or lab result (56). Several health care systems have integrated mHealth device data on physical activity into the EHR, but broader adoption by patients and clinicians and integration into the clinical workflow is lacking. While the Ochsner Clinic has reported integration of physical activity data into their successful digital hypertension management program (57), inviting patients outside of a defined care program to sync personal activity tracker data into the EHR had limited success (58).

CARDIOVASCULAR mHEALTH FOR AF DETECTION AND MANAGEMENT. A major opportunity for mHealth beyond prevention is enabling earlier disease detection and helping both patients and providers better manage CV disease—working together for proactive rather than reactive health care (**Central Illustration**). There is a wide range of mHealth programs and apps that have been developed to help patients manage CV diseases—from hypertension to heart failure to coronary artery disease (57,59–62). The 2018 inaugural issue of *Digital Medicine* recently reviewed 27 RCTs of remote patient monitoring, with close to half in cardiovascular disease, finding mixed results for clinical outcomes (63). A clearly disruptive area for mHealth in CV disease relates to the ability of mobile and wearable devices to assess heart rate and rhythm. In particular, the detection and management of the most common arrhythmia—AF—represents a major CV mHealth opportunity to prevent strokes, manage symptoms, and reduce hospitalizations (64).

AF has been challenging to detect and manage, as episodes can be paroxysmal or asymptomatic. Office visits or short-term monitoring devices provide only limited "snapshots" as to disease presence and burden. This can result in complications of stroke, tachycardia-related left ventricular dysfunction, and heart failure, as well as ever-increasing AF-related hospitalizations and health care costs (65,66). The prevalence of undiagnosed AF in the United States alone is estimated to be almost 600,000 patients, with an economic burden >$3 billion (67). The recognition that there is a significant rate of occult AF—a risk for primary or secondary stroke—has spurred efforts to implement AF-screening strategies in at-risk populations (68,69). Indeed, the recent REVEAL AF (Reveal Atrial Fibrillation) study of high-risk patients with an implantable loop recorder showed a detection rate of 29% for new AF at 18 months, and 40% at 30 months, with a median of 4 months until AF detection. This has motivated the development of smartphone and wearable devices for AF detection to empower broader patient and consumer access (**Figure 2**). For patients with established AF, these mHealth devices could enable ongoing rate and rhythm monitoring to aid in AF management without the need for implanted devices. There have been consensus reports highlighting the potential for integrating these new devices in AF management (70), and the European Society of Cardiology has released both patient- and provider-facing AF management apps (71), but there are few trials as yet on clinical effectiveness (72,73).

One could argue that Holter monitors, although bulky, were one of the first "mHealth" devices. Their redesign led to the emergence of small patch ECG monitors (**Figure 2A**), which allow longer monitoring and increased diagnostic yield (74). This has been followed by the development of multiple consumer-friendly, smartphone-connected handheld or wearable ECG monitors for mobile use (75–78). Smartphones and wearable devices have also leveraged optical detection of photoplethysmographic (PPG) signals to track heart rate and rhythm from the finger, face, and wrist (30,79,80). Recent studies have shown good heart rate accuracy during rest and exercise for most, but not all, of these wrist devices (30,81). Heart rate monitoring would be valuable in AF patients to ensure they are adequately rate controlled to mitigate symptoms and decompensation. Unfortunately, there are limited data on the accuracy of PPG-based heart rate monitoring during AF, which has the added technical challenge of AF causing variation in PPG signal amplitude (similar to the challenge of using the radial pulse in assessing AF heart rate).

Recent studies of both mobile ECG- and PPG-based AF detection show high rates of accuracy. Automated analysis of handheld single-lead ECGs in a diverse population of 381 participants yielded a 94% sensitivity and 99% specificity (75). A screening study performed using both ECG and PPG methods in >1,000 at-risk primary-care clinic patients found ~3% incidence of AF (82). Using the PPG signal from placing the finger over the phone's camera (**Figure 2B**) had 93% sensitivity and 98% specificity for AF detection, compared with 71% and 99% for the automated handheld ECG-based app. Despite these promising early results, a major concern for broader use of AF detection algorithms is loss of specificity, as other rhythms that create irregularity (e.g., premature atrial

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or ventricular contractions, supraventricular tachycardia, atrioventricular block) could potentially be misclassified as AF, leading to improper diagnosis and treatment.

Artificial intelligence and machine learning (topics of a recent review in the *Journal*) (8) have been applied to arrhythmia detection from mHealth devices. One study, published but yet to undergo peer review, used machine learning on >64,000 single-lead patch ECGs in almost 30,000 patients, claiming greater diagnostic accuracy than the average cardiologist for 12 common arrhythmias (83). Machine learning of smartwatch PPG-based heart rate measurements plus step counts was used to train an AF-detection algorithm in >9,000 Health eHeart participants, with high accuracy (98% sensitivity, 90% specificity) when tested in patients before and after cardioversion, but limited accuracy (68% sensitivity and specificity, 8% positive predictive value) when tested in a broader ambulatory cohort that self-reported AF status (84). The Apple Heart Study was recently launched to prospectively detect irregular rhythms via smartwatch PPG, with ECG patch follow-up (85). New wrist-worn devices with both PPG and ECG sensors may combine the benefits of both technologies (**Figure 2C and 2D**) (86,87). A smartwatch app combined with ECG watchband recently received Food and Drug Administration clearance (88). This is timely, with an international AF screening collaboration reporting on the evidence supporting AF screening and advocating country-specific screening programs and large randomized trials (69).

EFFECTIVENESS OF mHEALTH ON CLINICAL OUTCOMES IN AF

For AF detection, community screening using a smartphone-based mobile ECG device has been shown to be feasible and effective (89), including in rural India, where a higher than previously reported AF prevalence of 5.1% was found among 354 participants 50 years of age and older (90). The recent REHEARSE-AF (REmote HEArt Rhythm Sampling using the AliveCor heart monitor to scrEen for Atrial Fibrillation) RCT showed promise of using a twice-weekly mobile ECG in 1,001 at-risk patients, with a 4-fold increase in AF detection over 12 months in those randomized to screening versus routine care, although the lower stroke rate in the screening group was not statistically significant (91). The large mSToPS trial is comparing wearable ECG- and PPG-based devices with routine care for detecting undiagnosed AF (92), with the ECG patch monitoring results presented recently (93). At 1 year of follow-up, patients enrolled in ECG monitoring (n = 1,732), compared with observational control participants (n = 3,464), had significant increases in both AF detection (6.2% vs. 2.3%) and anticoagulation initiation (5.4% vs. 3.4%), but no change in stroke incidence to date.

For AF management effectiveness, there are more limited published data. A recent RCT (n = 209) used a smartphone app to provide self-management tools and education to patients (including tracking heart rate and blood pressure), plus clinical decision support to providers (72). They found significant improvements in medication adherence, AF knowledge, and quality of life, but the study size and 3-month duration were too limited to assess differences in stroke, bleeding, or death. The iCARE-AF (Intermittent vs. Continuous Anticoagulation theRapy in patiEnts with Atrial Fibrillation) study used daily smartphone-based ECG monitoring to guide AF anticoagulation therapy, randomizing paroxysmal AF patients (n = 58) over 20 months to monitored care (intermittent anticoagulation only when AF detected) versus routine care (continuous anticoagulation without daily monitoring) (94). No significant differences were seen in strokes or major bleeding, but there was a significant reduction in gastrointestinal bleeding in the monitored, intermittent anticoagulation group.

An important topic that links physical activity and fitness and AF is the growing recognition that healthy behaviors can help prevent AF. Recent reviews have highlighted lifestyle and risk-factor modification as the “fourth pillar” of AF management (95,96). Not only are physical activity and fitness linked with primary prevention of AF, but lifestyle interventions incorporating physical activity show reduced AF burden and recurrence.

LOOKING FORWARD

Mobile devices to measure and promote physical activity are widespread and now accessible to a large proportion of the world’s population, which is a major opportunity to support a key health behavior with such positive and broad health benefits. While the scientific evidence supports mHealth interventions to promote increased physical activity (18), efforts to incorporate more behavioral science and promote broader and longer-term engagement are needed. Research on real-world, quantitative assessment of physical activity is beginning to reveal patterns of physical activity across individuals, populations, and geographies, which may guide better ways to promote individual activity and reduce activity inequality within populations. The Project Baseline study, launched in 2017, and the just-begun

All of Us study, have incorporated mobile devices to track physical activity and heart rate to phenotype health status (87,97,98). Thus, while consumers and researchers are increasingly engaging with mHealth devices for physical activity and fitness, integrating their assessment and promotion into the health care system is lacking and warrants further focus (53).

Mobile health for AF has shown very promising data for AF detection in undiagnosed populations, providing the opportunity to reduce its substantial clinical consequences (e.g., stroke). However, our current AF treatment guidelines are based on a clinical AF presentation, so there is much work to do to understand the right population to screen and the burden of detected AF that warrants intervention to improve clinical outcomes (99). Empowering patients and health care providers with ongoing heart rate and rhythm data may also help improve AF management, but broader efforts are needed in both technology development and clinical research in this challenging area.

Consumers, researchers, and providers would all value greater transparency about mHealth device accuracy, data privacy, and health benefits. In addition to the mHealth efforts of the ACC and AHA mentioned previously, Xcertia is a collaboration of health organizations to improve the quality, safety, privacy, and effectiveness of mHealth apps (100). The Food and Drug Administration has recently published an action plan for digital health regulation (101) and is working with digital health companies on a certification process based on 5 "Excellence Principles," including product quality, cybersecurity, and clinical responsibility (102).

CONCLUSIONS

Mobile technology has thrust itself into health care, with broad opportunities and challenges for impact across CV disease and prevention. The recent progress highlighted in this review—assessment and promotion of physical activity and fitness as well as detection and management of AF—has already shown impact, yet represents only a subset of the opportunities for CV mHealth. Many challenges remain, a primary one being the need to show that mHealth provides sustained benefit with improved health outcomes. Further work is also needed in providing equitable access, stronger links to scientific guidelines, and integration into clinical care. The growing involvement of CV societies, government funding agencies, technology companies, and regulatory bodies, will accelerate the translation of mHealth to improve CV disease and prevention, with a shared mission to promote equitable health and well-being, and a world free of CV disease.

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