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ORIGINAL INVESTIGATIONS

International Mobile-Health Intervention on Physical Activity, Sitting, and Weight

The Stepathlon Cardiovascular Health Study

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ABSTRACT

BACKGROUND Although proof-of-concept for mobile health (mHealth) life-style programs targeting physical inactivity and overweight/obesity has been established in randomized trials, the feasibility and effect of a globally distributed, large-scale, mass-participation mHealth implementation has not been investigated.

OBJECTIVES The purpose of this study was to determine the effect of Stepathlon, an international, low-cost, mass-participation mHealth intervention, on physical activity, sitting, and weight.

METHODS We prospectively collected cohort data from participants completing Stepathlon, an annual 100-day global event in 2012, 2013, and 2014. Participants were organized in worksite-based teams, issued pedometers, and encouraged to increase daily steps and physical activity as part of the team-based race. The program was conducted via an interactive multiplatform application available on mobile devices and the Internet. Analysis was performed according to a pre-specified plan.

RESULTS A total of 69,219 subjects participated (481 employers, 1,481 cities, 64 countries, all populated continents, age 36 ± 9 years, 23.9% female, 8.0% high-income countries, and 92.0% lower-middle income countries). After Stepathlon completion, participants recorded improved step count (+3,519 steps/day; 95% confidence interval [CI]: 3,484 to 3,553 steps/day; $p < 0.0001$), exercise days (+0.89 days; 95% CI: 0.87 to 0.92 days; $p < 0.0001$), sitting duration (−0.74 h; 95% CI: −0.78 to −0.71 h; $p < 0.0001$) and weight (−1.45 kg; 95% CI: −1.53 to −1.38 kg; $p < 0.0001$). Improvements occurred in women and men, in all geographic regions, and in both high and lower-middle income countries, and the results were reproduced in 2012, 2013, and 2014 cohorts. Predictors of weight loss included step increase, sitting duration decrease, and increase in exercise days (all $p < 0.0001$).

CONCLUSIONS Distributed mHealth implementation of a low-cost life-style intervention is associated with short-term, reproducible, large-scale improvements in physical activity, sitting, and weight. (Effect of the Stepathlon Pedometer Program on Physical Activity, Weight and Well-Being; ACTRN12615001310550) (J Am Coll Cardiol 2016;67:2453–63)

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ABBREVIATIONS AND ACRONYMS

HIC = high-income countries

LMIC = low- and middle-income countries

mHealth = mobile health

Physical inactivity, sedentary behavior, and obesity are increasingly recognized as growing contributors to the global burden of cardiovascular disease and type 2 diabetes mellitus, in addition to their association with excess mortality (1,2). The increasing global presence of internet technology, with more than 3.2 billion users (3), and in particular the dynamic growth of mobile broadband, which now has 47% penetration (3), provides a powerful new potential pathway to enable low-cost distributed implementation of life-style interventions in diverse geographic and sociocultural settings (4,5).

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A growing body of evidence in randomized settings arising from proof-of-concept-type studies has demonstrated that mobile health (mHealth)-based life-style programs and workplace-pedometer programs may be a useful strategy to achieve modest but statistically significant improvements in physical activity, sitting, and weight (6–11). To date, such studies of mHealth and workplace life-style interventions have predominantly been conducted at a limited scale in relatively targeted populations (4,6,7), with nearly all analyses focused toward single high-income countries (4,6,12).

At the current time, however, it remains unclear whether improvements in physical activity and weight with mHealth interventions seen in randomized trials will be translated when conducted as large-scale, mass-participation programs, using "real-world" participants. The potential power of mHealth technology, however, lies in its capacity for inexpensive geographically distributed implementation. It is unclear whether mHealth technology utilization for life-style change will be feasible or efficacious when conducted internationally, including large numbers of participants from both high-income countries (HIC) and low- and middle-income countries (LMIC) (5). mHealth-based distribution of preventive health life-style strategies may be especially advantageous in LMIC settings, in the context of the rising burden of cardiovascular disease morbidity in these nations (13).

To address the global population-level burden of physical inactivity, there is a clear need to develop mass-participation interventional programs with the capacity for geographically distributed implementation. To achieve such large-scale international mass participation, it may be important that such programs utilize appropriate and accessible technologies, are attractive to consumers, and are of sufficiently low cost to enable self-financed growth.

In the current study, we sought to investigate the feasibility and efficacy of Stepathlon, a low-cost, pedometer-based, workplace physical activity and wellness program, which utilized an mHealth technology-based approach to facilitate large-scale implementation and program delivery. The program was conducted annually as a 100-day event in the years 2012 to 2014. Light-weight, low-cost, noninteractive pedometers were used as a self-monitoring and motivational tool (14), with the aim of encouraging participants to increase step counts and physical activity. Our study's objective was to determine the effect of Stepathlon participation on step counts, sitting duration, and weight.

METHODS

The study was conducted as an academic-private partnership between researchers at both Flinders University and University of Adelaide and Stepathlon Private Limited, a start-up company located in Mumbai, India. The Human Research Ethics Committee of the University of Adelaide reviewed and approved the research protocol with a low-risk waiver. Data were provided on an unrestricted basis by Stepathlon for the purposes of scientific research and were analyzed according to a pre-specified statistical analysis plan. The project was registered in the Australian and New Zealand Clinical Trials Registry (ACTRN12615001310550).

STEPATHLON PROGRAM. The Stepathlon is a 100-day international event where employees participate in a workplace-based pedometer program. The Stepathlon was conducted annually, with employee participants organized into teams of 5 individuals to provide a supportive social environment to facilitate activity. Participants were issued low-cost, light-weight pedometers to monitor daily step counts. Pedometers used in Stepathlon used 3-dimensional piezoelectric accelerometer technology to increase accuracy of step

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