A Group-Based Walking Study to Enhance Physical Activity Among Older Adults: The Role of Social Engagement

Study Protocol and Statistical Analysis Plan

NCT03803085

Document Date: 7/22/2019

WeChat Study Protocol

Scientific background

There is compelling evidence that an active lifestyle has broad benefits for cognitive, physical, and psychological health among older adults (Cockerham, Wolfe, & Bauldry, 2020; Matz-Costa et al., 2016). Physical activity can delay or prevent many chronic diseases, including heart disease, type 2 diabetes, dementia, and some cancers (Booth et al., 2012). Active older adults have a reduced risk of moderate or severe physical limitations, are less likely to suffer from falls and fracturing bones, and are more likely to remain mobile and independent (Kohl et al., 2012; McPhee et al., 2016). Being physically and socially active can also improve mental health and delay dementia and cognitive decline (Holt-Lunstad et al., 2015; Liu & Lachman, 2019). According to the 2016 report from Centers for Disease Control and Prevention (CDC), non-institutionalized adults ages 50 years and older account for $860 billion in health care costs each year, despite the fact that 4 in 5 of the most costly chronic conditions for this age group can be prevented or managed with physical activity (National Center for Health Statistics, 2017).

CDC researchers examined patterns of inactivity using data from the 2014 Behavioral Risk Factor Surveillance System for all 50 states and the District of Columbia (D.C.) and found 31 million Americans (28 percent) age 50 years and older were inactive, defined as no physical activity outside of work during the past month (Watsonet al., 2016). Trends in physical activity consistently show that activity levels progressively decrease with age with the prevalence of inactivity being highest among adults aged 65 or greater. Current estimates indicate that 66% of adults over 75 do not engage in any regular physical activity. Moreover, evidence suggests that 50% of sedentary adults have no plan of starting an exercise program (Watson et al., 2016).

In recent years, a number of researchers have conducted studies to evaluate the potential of using pedometers as health interventions (see Foster et al., 2010; Sullivan & Lachman, 2017). Foster and colleagues (2010) used pedometers and a specifically made app, StepMatron, on Facebook to compare the effects of social and non-social motivation on physical activity within a friend group in the same work place. The ten participants in the social group could see their step counts compared to their friends in a competitive format. The social group could also communicate with each other through the page. The nonsocial group could only see their own step counts and had no communication through the app with other participants. There was a significantly higher number of steps in the social group compared to the non-social group. The conversations of the participants in the social group indicated that the competitive social aspect among the friends influenced the number of steps. In a review of the evidence for increasing physical activity among sedentary adults using fitness technology, Sullivan and Lachman (2017) indicated that fitness technology, including trackers and smartphone applications, have become increasingly popular for measuring and encouraging physical activity. Overall, fitness technology has the potential to significantly impact public health, research, and policies. Behavior change techniques such as goal setting, feedback, rewards, and social factors are often included in fitness technology; however, it is not clear which components are most effective. Sullivan and Lachman (2017) discussed additional cognitive behavioral strategies not typically included in fitness technology devices or apps, such as action planning, restructuring negative attitudes, enhancing environmental conditions, and identifying other barriers to regular physical activity, that were promising for engaging inactive populations. Our study adds to the discussion and considers social engagement as a possible mechanism for increasing physical activity among older adults using fitness technology.

The use of fitness technology services could have beneficial effects on chronic disease management in late life, including positive changes in health perception, social functioning, and mental health (Lindeman et al., 2020). Fitness technology is regarded as a vital means for maintaining and enhancing older people's quality of life (Khosravi et al., 2016; Mitzner et al., 2018). In addition, previous research also indicated that information communication technologies could provide a link between older adults and their informal and formal networks. Technologies allow older adults to transcend spatial barriers and provide them a greater sense of connection to other people (Clarke et al., 2009; Schlomann et al., 2020). Exploring the role of social factors in increasing physical activity using technology is a promising direction (Zhang et al., 2016).

Objectives

This paper reports on the use of WeChat to improve physical and social activity among community dwelling older adults. WeChat is a free mobile text and voice messaging communication service. This pilot study explored the efficacy of one function of the app WeChat: a group-based pedometer function WeRun. There are previous empirical studies conducted on WeRun with younger adults; for example, Gui and colleagues (2017) conducted a qualitative study of 32 users of WeRun. Their findings indicated that sharing fitness data with pre-existing social networks motivated users to continue self-tracking their steps and enhanced their existing social relationships.

However, we are not aware of any empirical studies conducted using WeRun with older adults.

The objectives of this study are to explore: a) whether the participants in the treatment group would show greater increases and higher maintenance of daily steps as well as greater increases in level of social engagement and exercise self-efficacy in comparison to the participants in the control group who were not given the treatment; and b) whether social engagement would be a significant mediator, that is a mechanism of behavior change.

Design

The study was approved by the University's Institutional Review Board. The clinical trial was registered at the US National Institutes of Health (ClinicalTrials.gov). After the participants were deemed eligible to participate in the study, participants were randomly assigned to one of two conditions: treatment or control. During the 4-week study, participants were blinded to condition. Data collection was also blinded to the experimenters, as the survey and physical activity data were collected through online platforms (Qualtrics and WeRun, respectively).

All participants completed a survey with demographic questions and the self-report outcome measures at pretest. They were asked to use WeRun to track their own daily steps for one week, prior to being assigned to groups. This provided pretest physical activity data and helped participants become familiar with WeChat and syncing the data with their phone. After 4 weeks of using the application, all participants completed the same self-report measures to assess changes in the outcomes of interest. They also completed a follow-up assessment 1 month after the post-test for the same measures.

During the intervention, participants' daily walking steps were recorded by WeRun, and the data were logged by the research assistant every day. The research assistant also recorded each participants' daily ranking and number of social interactions in the treatment condition. Messages were sent by email and WeChat messages to the participants to remind them to carry their phone with them as often as possible during the day and use the application every day. The trained research assistant explained how to use WeChat, WeRun to all participants. Participants in both conditions were asked to use the application every day. A message was sent to remind them to use the application if they had not done so for three consecutive days.

Treatment condition: Participants used WeChat for 4 weeks, during which time the steps data were recorded by the WeRun function and downloaded by the research assistants. The participants in the treatment condition could interact with the other group members by sending text messages which were documented by the research assistants. The researchers sent out instructions to check step counts on Monday mornings during the 4-week intervention, for example "Dear all, this is Week 1! please remember to take your phone with you as often as possible during the day and check your step count in WeRun by the end of the day. Please also share your number of steps with your group members. Thank you!" The daily walking steps of the participants in this group were displayed to the group and the participant with the highest daily steps in the group was indicated as the champion each day.

Control condition: Participants only saw their own daily walking steps using WeChat. They did not see other group members' daily steps and did not interact or compare walking steps with other group members. The participants received messages on

Monday mornings during the 4-week intervention to remind them to take their phones as often as possible during the day.

Methods

Participants

Eligibility. Inclusion criteria specified that participants must be 60 or older and fit enough to walk for at least 20 minutes at a time. They also needed to have a smartphone, with either an Android or iPhone system with Internet access. A power analysis (using G*Power 3.1) for the study and analysis design indicated that a total of 56 participants (randomly assigned across two groups) would provide adequate power (> 80%) to detect medium-sized effects ($\rho = 0.3$) at $p < .05$. We recruited 60 participants in the northeast U.S. by posting recruiting posters in community public posting boards, including public libraries, grocery stores and shopping malls. Participants were given two 25-dollar gift cards (one at the pretest and one after the 4-week intervention) as compensation for their participation.

Sample. As shown in the consort diagram in Figure S1, of the 241 adults who filled out our eligibility questionnaire online, 38 were not eligible, 15 gave up as they had trouble downloading the app, 4 did not meet the age requirement, 4 indicating participating in a walking intervention would be a potential health risk, and 3 could not participate due to travel. One hundred and forty-three potential participants who were eligible did not respond when we notified them that they were eligible. Recruitment took place from October 2018 to March 2019, with primary data collection completed in February 2019, and follow-up data collection completed in March 2019. Those who were physically active (i.e., who had 7,000 - 10,000 daily steps or above everyday) were not included after the one-week baseline. A total of 60 adults were recruited and randomly assigned to either the control condition (n = 30) or the treatment condition (n = 30). They completed the study in one of three subgroups, with 20 participants randomly assigned into two groups (10 in treatment group, and 10 in control group) for each subgroup.

Measures

Covariates. Age, gender, education, race, and self-reported health were used as covariates in the analyses because of their expected relationship with the outcome measures. For physical health, the participants were asked "in general would you say your health is?" The response options ranged from 1 (poor) to 5 (excellent) with a higher score indicating better physical health.

The outcome measures were administered at the pretest, posttest and follow up using self-report questionnaires given before and at the completion of week 4 of the pilot study and at the 1 month follow up through an online platforms-Qualtrics.

Daily step counts. Participants' daily steps were recorded by using the WeRun function in WeChat by the end of each day during the 4-week intervention period and at the 1 month follow up. Mean daily steps for pretest week, post-test week and one month follow up week were calculated as the mean number of steps across the 7 days in that week of the study.

Percentage change in mean weekly steps at posttest was calculated as the difference between the mean weekly steps at posttest and pretest divided by the mean weekly steps at pretest. The percentage change in mean weekly steps at the one month follow up was calculated as the difference between the mean weekly steps at one month follow up and pretest divided by the mean weekly steps at pretest.

Social engagement. We had two measures of social engagement. The 18-item version of the Lubben Social Network Scale (LSNS), was used to examine social contact and support as indicators of social engagement at the pretest and posttests (Lubben & Gironda, 2004). For the treatment group only, the number of participants' daily text messages exchanged in the group discussion was used to measure social interaction. This version utilizes two subscales for friends and family and has the highest level of internal consistency (α= .82) of the three available versions of the LSNS (Lubben & Gironda, 2004). The scale weighs size, closeness and frequency of social contacts. The sum of the 12 equally weighed items is computed with scores ranging from 0 to 60. Lower scores indicate smaller networks, or lower levels of perceived social support. Items include 'How many relatives (friends) do you see or hear from at least once a month?', 'How many relatives (friends) do you feel you can talk to about private matters?', and 'How many relatives (friends) do you feel close to such that you could call on them for help?'

Exercise self-efficacy. Based on Bandura's model (Bandura, 1990; Lachman et al., 2011; Resnick & Jenkins, 2000), exercise self-efficacy was measured using the Self-Efficacy for Exercise (SEE) Scale, which was a 9-item instrument that focuses on self-efficacy expectations related to the ability to continue exercising in the face of barriers to exercise. There was sufficient evidence of internal consistency (α = 0.92), and a squared multiple correlation coefficient using structural equation modeling provided further evidence of reliability (R2 ranged from 0.38 to 0.76). The sum of the nine items is computed with scores ranging from 0 to 90. Lower scores indicate lower levels of exercise self-efficacy. Items include ‘the weather was bothering you’, “you were bored by the program or activity” and “you have to exercise alone”.

Data Analysis Plan

Statistical analyses of survey measures were done using SPSS. Descriptive information and correlations were computed for all study variables. Changes in daily steps, social engagement and exercise self-efficacy from the pretest to 4 weeks were examined. Repeated measures ANCOVA was used to test for effects of the treatment on mean daily step counts over the intervention period, exercise self-efficacy, and social engagement and to compare treatment and control groups at pretest, posttest, and follow-up using a two condition by three occasions design. All post hoc analyses were performed using Bonferroni corrections controlling the covariates. We conducted a sensitivity analysis without the covariates and the results were the same.

Conditional process modeling was applied using PROCESS in SPSS to test the predicted mediation model. Mediation analyses was based on 1000 bootstrapped samples using Hayes’ PROCESS Macro v3.3 (Hayes & Preacher, 2014), allowing for formal tests of the total, direct, and indirect effects of intervention on percentage of change of mean weekly steps from pre-test to post test. The predictor variable was condition, the mediator variable was change in social engagement, and the outcome was percent change in mean weekly steps from pre-test to post test.