

Gamified Text Messaging Contingent on Device-Measured Steps: A Randomized Feasibility Study of a Physical Activity Intervention for Cancer Survivors

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Introduction

- Most cancer survivors do not meet the recommended physical activity levels.
- Combining game design elements, wearable technologies, and behavior change theory may be a useful and scalable approach to promoting cancer survivors' physical activity.
- Self-Determination Theory (SDT) provides a framework for understanding how one's motivation affects adherence to health-related lifestyle behaviors.
 - Autonomous regulation, which includes enjoyment, is a strong predictor of physical activity.

Aim

We created *Steps2Health*, an mHealth intervention that uses game design elements to increase autonomous regulation associated with physical activity in insufficiently active cancer survivors. The aim of this study was to evaluate the feasibility, acceptability and potential efficacy of *Steps2Health*.

Methods

- We randomized participants to an experimental or comparison group. All participants received a Fitbit Alta.
- Experimental group participants also received MMS messages that were triggered by step counts in real time.
- These messages presented photographs and vivid descriptions of actual, geographically accurate destinations along a tour of Japan's Inland Sea.
- Progress on the 166,000 step (approximately 83 mile) journey was determined by cumulative step count.
- Messages also presented content related to SDT constructs of *autonomy* (providing choice in optional mini-journeys), *relatedness* (role model narratives), and *competence* (self-efficacy-enhancing techniques).
- We administered pre- and post-intervention surveys and conducted 15 individual interviews to evaluate the intervention. We performed mixed effects linear modeling and directed content analysis of these data, respectively, to pursue the study research questions

Figure 1. Example *Steps2Health* messages

Example Messages	Image
<p>Welcome to <i>Steps2Health</i>! Please save this number in your phone as <i>Steps2Health</i>, and be sure that your Fitbit is up set to sync automatically.</p> <p>Bridges serve as major checkpoints for this 83 mile island-hopping trek through beautiful Japanese islands. Keep your step count high to maximize your progress!</p>	
<p>You have made it to the beautiful Kosanji temple. It was built in 1936 by a wealthy industrialist in honor of his mother!</p> <p>It is written in a famous haiku: The mothers of the world are as the Goddess of Mercy.</p>	
<p>RUBY: Hello! My name is Ruby. I am an ovarian cancer survivor and have already completed this journey.</p> <p>I wanted to get strong to keep up with my grandson. Is there a goal you'd like to work toward?</p> <p>Would you share it with me in a text? If not, just text 0.</p>	

Results

- We randomized 78 participants, 3 (4%) were lost to follow-up
- The sample was mostly female and relatively well-educated. The mean age was 55.1 years (SD=13.5 years). Most participants were breast cancer survivors (58%) and the overall mean time since cancer diagnosis was 9.4 years (SD=7.3 years). Most participants were either overweight (46%) or obese (24%)
- The median number of days to complete the journey for experimental group participants was 30 days; this ranged from 15 to 128 days (IQR = 23-51).
- We identified 3 overarching themes in individual interviews (Figure 2)

Figure 2. Themes and subthemes identified in individual interviews with illustrative quotations



Results (continued)

- There was minimal loss to follow up (4%), the device wear rate was high (83.5% of days), and technical problems were limited.
- Participants successfully navigated the technological aspects and game design elements of the intervention.
- Participants found messages targeting *autonomous motivation* and *competence/self-efficacy* to be enjoyable and compelling, but one feasibility criterion for participant engagement (response rate to text messages) was not met.
- Messages targeting *relatedness* were less highly rated than the messages targeting *autonomous motivation* and *competence/self-efficacy*.
- Multilevel modeling indicated:
 - Both groups tended to increase *autonomous motivation* ($B = 0.16$; 95% confidence interval [CI] 0.01 to 0.30; $P = 0.040$; $d = 0.49$)

Figure 3. Assignment to the experimental group was associated with increased self-reported physical activity pre- to post-intervention ($B = 10.78$, 95% CI 3.54 to 18.02; $P = 0.005$; $d = 0.64$)

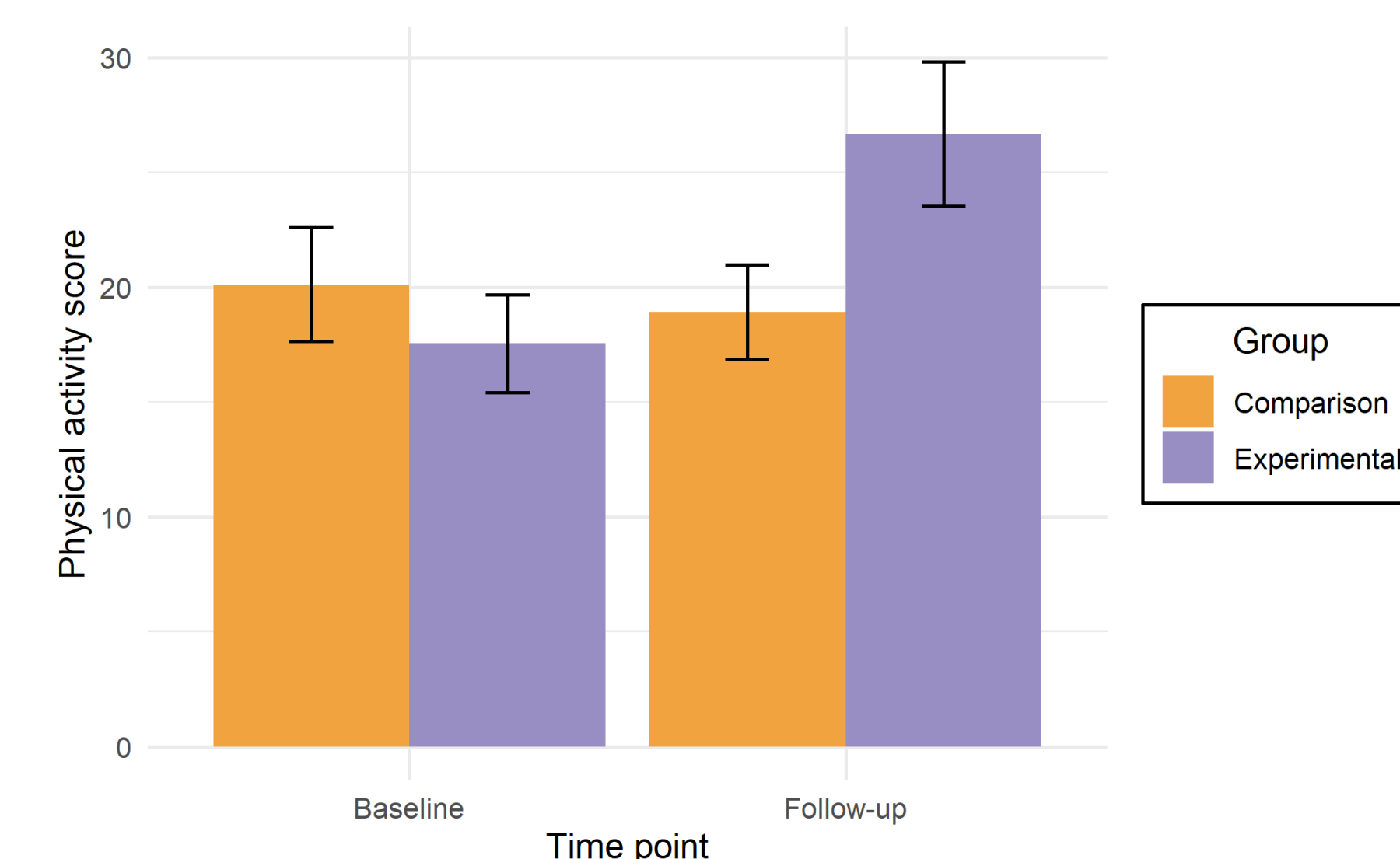
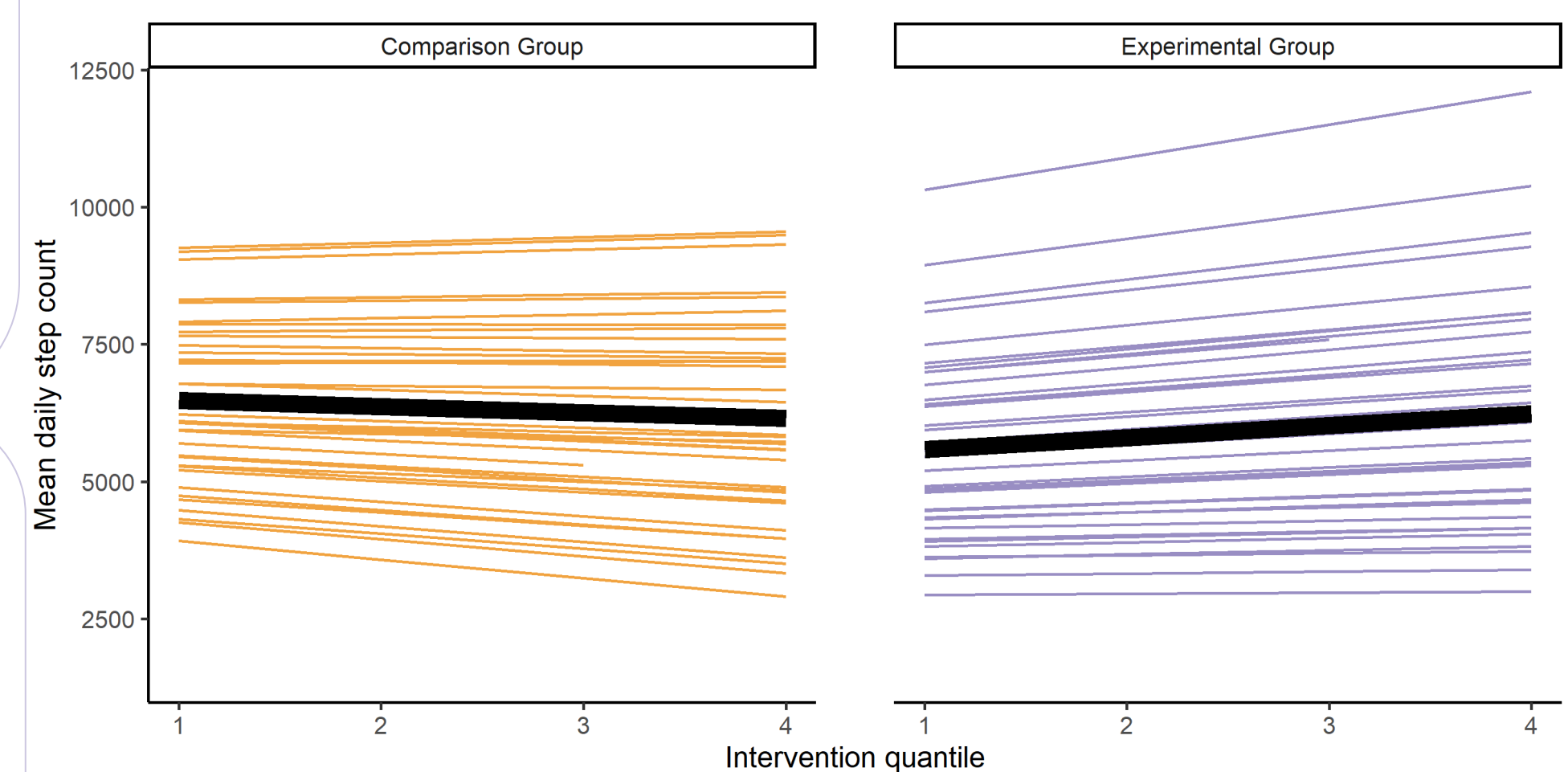


Figure 4. Assignment to the experimental group was associated with increased device-measured step count over the course of the intervention ($B = 322.08$; 95% CI 54.01 to 590.15; $P = 0.019$; $d = 0.28$)



Conclusions

- This study supports the feasibility of using real-time game design elements to target SDT constructs.
- Findings generally support the acceptability of the *Steps2Health* intervention, but fostering active participant engagement and targeting relatedness may present additional challenges.
- Steps2Health* may help cancer survivors increase their physical activity levels.

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