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What motivates participants: a qualitative analysis of gamification and financial incentives to increase physical activity



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Abstract

Background Physical activity reduces the risk of major cardiovascular events, but many people who are most at-risk do not get enough exercise. In the BE ACTIVE randomized controlled trial, - a study in which text messages were used to communicate with participants- game playing (gamification), financial incentives, and the combination of gamification plus financial incentives increased physical activity from baseline more than control over a 12-month intervention period. Participants randomized to gamification plus financial incentives maintained a significantly greater increase than control over the 6-month post-intervention follow-up. To understand the impact of the interventions on motivation and performance we conducted semi-structured interviews with a subset of participants.

Methods Using extreme case sampling, interviewees were selected from participants who were randomized to an intervention arm and were identified as either high or low performers based on their change from baseline to the end of the trial in mean daily step count. During semi-structured telephone interviews, participants were asked their thoughts and feelings about the trial, motivations for participation, and about specific aspects of the intervention. Interviews were conducted within 6 months after the participant completed participation in the trial. Thematic analysis was conducted inductively and deductively, and identified themes were mapped onto the COM-B Framework to understand the interaction between different themes.

Results We achieved saturation after conducting interviews with 55 participants (30 high performers and 25 low performers); 19 in the gamification arm, 19 in the financial incentives arm, and 17 in the gamification plus financial incentives arm. Based on qualitative interviews, the importance of individual accountability via goal setting and feedback appears to be a primary factor in behavior change in this trial; however, the combination of accountability with the opportunity of access to the intervention had additional impact on the results.

Conclusion Gamification and financial incentives both increased physical activity in the BE ACTIVE study, but results may be improved by tailoring interventions based on participants' personal traits and level of social support to optimize motivation. (328 words)

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Keywords Gamification, Behavioral economics, ASCVD, Financial incentives

Introduction

Atherosclerotic cardiovascular disease (ASCVD) is the leading cause of mortality worldwide, accounting for more than a quarter of all deaths [1]. Physical activity - including walking - is associated with a lower risk of cardiovascular events in middle-aged and older adults, and consensus guidelines recommend that individuals obtain 150 min of moderate or 75 min of vigorous physical activity per week. However, most U.S. adults fall well short of these goals, especially older adults at higher risk for cardiovascular events [2].

Though many individuals express a desire to increase their levels of physical activity, achieving lasting behavior change is challenging. In the BE ACTIVE randomized controlled trial, we tested the efficacy of strategies informed by behavioral economics-a field of study that seeks to understand and influence how individuals make decisions-to increase physical activity over 12-month intervention and 6-month post-intervention follow-up periods. All 3 strategies tested-behaviorally-designed game-playing (gamification), loss-framed financial incentives, and the combination of gamification plus financial incentives-significantly increased physical activity from baseline more than control over the 12-month intervention period, and a significantly greater increase from baseline versus control was maintained over 6-month post-intervention follow-up in the gamification plus financial incentives arm [3].

However, the interventions were not universally effective, and some participants benefitted more than others [4–6]. Better understanding participants' perceptions about how the program impacted their motivation to exercise-especially how these perceptions differed among those for whom the interventions were more vs. less successful—could potentially improve the design and implementation of future behaviorally-informed interventions to increase physical activity. We therefore conducted semi-structured interviews with trial participants purposively sampled by performance to help understand high and low performing participants' experience in the program and how the interventions affected their motivation to exercise. We organized results using the COM-B Framework that proposes three necessary components for any behavior change to occur [7]: capability, opportunity, and motivation. Capability is an attribute of a person that, together with opportunity makes a behavior possible or facilitates it. Opportunity is an attribute of an environmental system that together with capability makes a behavior possible or facilitates it. Motivation is an aggregate of mental processes that energize and direct behavior. This model has been used to assess barriers and facilitators for various health behaviors including diet [8], medication adherence [9] and physical activity [10]. We sought understand the combination of factors that may be associated with increased step count.

Methods

The be active trial

This qualitative interview study was a study within a clinical trial (SWAT) [11]. BE ACTIVE took place from May 2019 through January 2024; the trial's design and primary results have been reported elsewhere [3]. The trial was approved by the University of Pennsylvania's Institutional Review Board. Briefly, eligible participants were identified using an automated electronic health record algorithm at a large academic medical system in Philadelphia. Participants were eligible if they: (1) were age 18 years or older; (2) had a 10-year risk of major adverse cardiovascular events \geq 7.5% or established ASCVD; (3) were able to provide informed consent; and (4) had a primary care physician in the health system. Key exclusion criteria included participation in another physical activity study, lack of an internet-connected device (i.e. smartphone or tablet) capable of transmitting data from a wearable fitness tracker, and baseline daily step count \geq 7,500. Eligible participants were contacted via email or text and provided with a link to the study website on the Penn Way to Health platform, where they completed informed consent and baseline questionnaires. Participants were then mailed a Fitbit device and were told to wear the device for 2 weeks to get used to it. During this two-week period, data from the second week were used to establish each participant's baseline daily step count. Participants with baseline daily step count <7500 were then asked to set a goal to increase their daily step count by 33-50% - or at least 1500 steps - above their baseline, and they were randomized in a 1:2:2:2 ratio to control, gamification, financial incentives, or the combination of gamification plus financial incentives. See Fig. 1 for the study design.

Participants in the control arm received a text each day for 18 months informing them whether they had met their step goal the day before.

Participants in the gamification arm were entered into a game that leveraged insights from behavioral economics to address barriers to behavior change [3, 12–14]. The game lasted 12 months, after which there was a 6-month post-intervention follow-up period when participants received the same text messages as the control arm. At the start of each week, each gamification participant received 70 points. Each day, if the step goal was achieved, the participant retained their points; if the step goal was not achieved, they were informed that they had



All: 12 month intervention + 6 month follow up

Fig. 1 Be ACTIVE Design

lost 10 points. Participants received a daily text message informing them whether they had met their step goal the previous day and how many points they had retained so far that week. At the end of each week, participants with \geq 40 points moved up a level and those with < 40 points moved down a level; a weekly email informed participants whether they were moving up or down. Every eight weeks, individuals in the two lowest (of five) levels were restarted back at the middle level, and they were offered a chance to adjust their step goal. At the end of the intervention period, participants in the highest level (platinum) received a trophy recognizing their achievement. In addition, at study onset each participant chose a family member or friend as a support partner. The participant, sponsor, and study staff joined in a 3-way call at the start of the study, during which they discussed the details of the intervention and identified three ways that the support sponsor could help the participant achieve their step goal. During the intervention period, the sponsor received a weekly email about the participant's performance during the previous week.

Participants in the financial incentives arm were informed each week by text message that \$14 was placed in their virtual account. Each day, if the step goal was achieved, the balance remained. If the step goal was not achieved, the participant was informed that \$2 was deducted from their account. Financial incentives continued for 12 months, followed by a 6-month post-intervention follow-up period when participants received the same text messages as the control arm.

Participants in the gamification + financial incentives arm received both the gamification and financial interventions.

In all three intervention arms, participants had an 8-week ramp-up period during which goals were increased gradually from baseline to the target.

Participant selection for qualitative interviews

After piloting the interview guide internally and with one participant, we conducted in-depth semi-structured interviews with individuals who were randomized to one of the three intervention arms and completed the trial. We did not interview participants in the control arm. Interviewees were selected using extreme case sampling (a type of purposive sampling), which targets cases at the outer ends of the distribution along a parameter of interest, allowing for comparison of these cases to better understand what might be causing such stark differences [15]. In this case, we identified participants as high or low performers based on change from baseline in their mean daily step count. Initially, we randomly selected five participants for interviews from 6 subgroups: high performers randomized to gamification, financial incentives, or gamification plus financial incentives; low performers randomized to gamification, financial incentives, or gamification plus financial incentives. After conducting these first 30 interviews, we randomly selected additional participants from these subgroups until saturation was achieved, which was defined as when 3 consecutive interviews did not yield new information in response to each question in the interview guide [16].

Qualitative interviews

Participants were invited to schedule an interview via email. If there was no response, a member of the research team made three follow-up attempts to contact the participant by phone. Invitations to participate in an interview were sent after the participant had completed the intervention period and at least one month before they reached the end of the 6-month follow-up period. Interviews were conducted virtually between study participants and a clinical research coordinator (DF) using readily available teleconferencing software (Zoom). All participants were paid \$50 for their participation. Interviews were conducted using a semi-structured guide that included questions focused on thoughts and feelings about the BE ACTIVE study, motivations for participation, and specific aspects of the intervention. (See Appendix 1: interview guide). Interviews were conducted between May 2022 and January 2023. All participants

Data analysis

All recordings were professionally transcribed and loaded into Atlas.ti 23 for analysis. We developed a code book that included deductive a priori themes based on the questions asked as well as inductive emergent themes that came from the data. Initially, two interviews were coded by three members of the team (ER, DF, TK), after which a coding meeting was held to assess disagreements. Any disagreements were discussed, and the coders came to consensus on appropriate codes. Clarifications to code definitions were also made at this time. This process was conducted three times until minimal disagreement occurred. Subsequently, all transcripts were coded by at least two coders and reviewed by all three team members to address any disagreements. Data were coded prior to the trial arms being unblinded, so coders were not aware of which respondents were in which arm until the main quantitative analysis was completed. After all data were coded, we developed theme sheets for each of the themes with summaries and exemplary quotes, and we compared responses between high and low performers to identify variations between the groups. To organize and understand the combination of factors that may be associated with high and low performance, we applied the COM-B Model [17] to analyze themes. Results are presented by each of the COM-B criteria.

Results

We achieved saturation after 55 interviews. Of the 55 interviewees, 19 were participants in the gamification arm (8 high performers and 11 low performers), 19 in the financial incentives arm (12 high performers and 7 low performers), and 17 in the gamification plus financial incentives (10 high performers and 7 low performers); in total 30 were high performers and 25 were low performers. The mean age of interviewees was 67 years; 61.8% (n = 34) were women, 50.9% (n = 28) white, 43.6% (n = 24) Black, and 5.5% (n = 3) Asian. Compared with the overall study population, women and Black participants were over-represented among interviewees.

We identified specific themes that reflected COM-B concepts as noted in Fig. 2.

Capability

The trial's inclusion criteria required participants to be capable of walking and have internet access for data transfers which were necessary aspects of the program. However, understanding the importance of exercise in reducing cardiovascular disease risk was a necessary factor to drive behavior change among enrolled participants.



Fig. 2 COM-B Model applied to Be Active Study

High and low performers both noted the importance of exercise for their health and cardiovascular disease, with participants from both groups describing improvements in their emotional well-being from study participation. Several participants from both groups also made conscious efforts to incorporate exercise into their daily lives due to the program. High performers, however, tended to be more emphatic when speaking on the importance of exercise and the enjoyment derived from physical activity.

It's very important, because I had bypass surgery in 2013... (162923, Gamification + Financial Incentive, High Performer).

It makes me feel like I accomplished something. It makes me feel happy about doing it. (103650, Financial Incentive, High Performer)

Low performers were more likely to say that they did not enjoy exercise or going to the gym.

Oh, I hate it. I mean, I hate to think about it, I hate to get started doing it and- but once I do it, after I get through whatever pain there is involved or whatever, it's helped me to lose weight, because I've continued to exercise...even though I force myself to do it. It's not something that comes natural. (99944 Gamification, Low Performer).

Motivation

The Be Active program offered an opportunity for internal and external accountability which served as a primary motivator for active participation. High performers appreciated receiving texts about whether they met their step counts.

Well, the incentive to do it was not the money that I was given. It was more that somebody was watching me. (100339 Financial Incentive, High Performer) I really like the accountability that goes with targets. (161576 gamification, high Performer)

Low performers also appreciated being held accountable, even if they felt less pressure to meet the goal every day.

I'm pretty goal oriented and knowing that I was gonna get that email the next day saying you met your goal, you didn't meet your goal, it wasn't that I was a 100% that I had to do it, but I definitely had to have a good excuse for not doing it. (106814 Financial Incentive, Low Performer)

It was a way to help me to stay accountable to myself. I didn't, did not want to disappoint myself at the end of the day as far as the number of steps that I took and/or the number of days that I managed to meet my goal each week...And then if one day it was raining, or I forgot to... have the Fitbit on it wasn't a big deal. (115596 Gamification + Financial Incentive, Low Performer)

Participation in the trial led some high performers to change their behaviors to meet their step goals including parking further away from entrances, taking additional walks throughout the day, and even walking through the grocery store multiple times to reach their step goal.

Well, it felt only right to make the goal, because of the recording of my steps. And sometimes I would want to do a little bit more...And I loved when I had to go to the mall or something with my daughter, because it would record maybe 6400 steps. And I would look and say, yeah, that's good. That's good. So, it was a motivator. (576478 Gamification, High Performer)

Many participants continued to maintain their step counts six months after the intervention.

I'm gonna continue wearing my watch. So thank you very much for the watch. I mean really it's fantastic. (95596 Financial Incentive, High Performer)

I guess I liked the best was the Fitbit. I didn't think I could wear it all the time, 24/7. I still do it. I still have it

on. I still leave it on all day. (580755 Gamification, Low Performer)

Opportunity

The BE ACTIVE study gave participants the opportunity to have a step tracking device and receive information about their progress in reaching their goals. Both high and low performers appreciated having a device that gave them data, not only about their steps, but other health parameters as well such as sleep and heart rate. Respondents reported that these factors helped to hold them accountable by giving them useful information. Participants from both performance groups found the FitBit device helpful in displaying health information and results.

I think what it did is it caused me to focus more on the goals, to look and say, okay, you know what, we need 10,000 steps today, that it made me more cognizant of the metrics than I ever was before. I always tried to walk or run and to be active, but I think before the study I had no concept of how many steps I actually took. (104739 Gamification, High Performer)

But without that watch, I mean if you take 2,000 steps you never know how many steps you took, so that is kind of nice that having– keeping track of something that you just had to look at a watch to know what you're– how you are doing. But these kinds of amenities that they were not there before. (108811Gamification + Financial Incentive, Low Performer)

The study also offered participants in the gamification arms the opportunity to choose a support partner who was contacted if the participant did not meet their goals. Most high performers spoke positively of their support partners, describing them as a source of motivation and encouragement. A couple of high performers felt support partners were not as necessary for them because they were already intrinsically motivated. Even in the financial incentive arm, where support partners were not assigned as part of the trial protocol, participants mentioned the importance of social support when initiating behavior change.

That is my husband. And he'd get up and move. He'd say... you need get up and walk. So it was okay. But I basically did it on my own. (167056 Gamification, High Performer)

... I walk with a couple of friends in the morning. If we're not walking, it's really hard for me to walk by myself. So a big support is having somebody to walk with. (109097 Financial Incentive, High Performer) On the other hand, many low performers felt their support partners were not consistently or deeply involved. While some low performers still spoke positively about their support partners as a source of motivation, compared to the high performer group, there were many more low-performer participants who did not feel that their support partners helped their participation. Some low performers also wanted more interaction with the study team for support.

. I had my husband, who wasn't that much of a help. And one suggestion, I would say, for the future, if it would not be too hard to do, would be to maybe identify someone else in the study that could be a partner that understood the goals of the study, who maybe you could FaceTime with or whatever once a week, or whenever you needed to, to encourage each other and find out what each other's goals were. (Gamification 108823, Low Performer)

Maybe my sister wasn't the best because she's likeshe's not gonna give me a hard time and she wasn't like, how'd you do today or how'd you do this week. (99605 Gamification + Financial Incentive, Low Performer)

And I had a lousy support person...As it turned out, I picked the wrong one. (99944 Gamification, Low Performer)

Additional opportunities of the intervention were financial incentives that included money and/or prizes from a competitive game. Respondents felt that the financial incentive amounts were not motivating. High performers were motivated mostly by achieving their step goal but appreciated the financial incentives as a fun part of the intervention. Low performers also felt that the financial incentive was too low to be highly motivating.

The fact that I get \$2 for doing that wasn't really motivating me to, you know... Now, had it been \$10 a day or, you know, \$20 a day just to do exercise, you'd be motivated to do 10,000, 20,000 steps in a day, you know what I mean? (633748 Financial Incentive, High Performer)

Again, I wasn't motivated by it because it wasn't a sufficient amount of money to motivate me. And I'm not really motivated by money... But it was nice to have it, because again, I used it as a little slush fund for the little ones. (40141Gamification + Financial Incentive, High Performer)

And the money is not that much... Give me a thousand bucks a month and I'll be freaking running up and down the sand, but and I mean it's very nice getting the money. I'm not giving it back, but that wasn't the motivation for me. (103641 Gamification, Low Performer)

High performers who were part of the gamification arm in which participants were eligible to receive badges and a trophy for meeting goals - also enjoyed the competition in the program. Some high performers liked getting a trophy at the end of the study.

I liked the competition. The competition of meeting a goal each day. I really liked that because it was like a challenge. (580733 Gamification + Financial Incentive, High Performer)

Low performers were less interested in competing. Others thought the trophy was not a good motivator for someone their age, and some low-performing respondents in the gamification or gamification + financial incentive arms were unaware that there was a game component to the intervention.

I thought it was kinda dumb. It wasn't a motivating feature for me because that wasn't the point... the point for me was I had made this commitment to the study, and I was gonna do that and one of the benefits for me was not getting the trophy, but it was getting healthier and being able to walk better, so. (99944 Gamification, Low Performer)

Not really like I really understood the full– the implication of participating in the game, nor did I really understand or really have an interest in achieving the levels. I just wanted to increase my step count and maintain a step count and be active. It wasn't exactly a motivating factor (100520 Gamification, Low Performer).

Discussion

By analyzing qualitative data that was related to, but independent of, the parent trial, we can offer evidence about why the trial was effective, thereby informing future work in this area [11]. Based on qualitative interviews, the importance of individual accountability via goal setting and feedback appears to be a primary factor in behavior change in this trial; however, the combination of accountability with the opportunity of access to the intervention had additional impact on the results. This finding is underscored by the effectiveness of the control arm in the BE ACTIVE study. Participants in the control arm increased mean daily step count by >1400 steps from baseline through the end of 12-month follow-up, with a sharp increase from baseline immediately after goal setting [3]. Over 12-month follow-up, gamification and financial incentives each increased mean daily step count from baseline by approximately 500 steps/day more than control, and the combination of gamification and financial incentives by approximately 850 steps/day more than control, but the difference between any intervention and control is smaller than the differences between control and baseline. Though points, levels, trophies, and financial rewards were not considered highly motivating by many participants, the step gains with gamification and financial incentives beyond control reflects the supplemental nature of the intervention. While accountability was a primary driver of behavior change, the addition of incentives appears to have had an additional effect.

Comparison of data between high and low performers indicates that high performers appear to have started with increased internal motivation which - combined with the opportunities available in the intervention - was associated with above average increases in step counts that lasted beyond the follow-up period. Other studies have found that intrinsic motivation is associated with increased participation and enjoyment in exercise programs [18, 19]. High performers may have maintained increased step counts without the need for financial incentives/and or gamification as they consistently described their intrinsic desire to meet or exceed their goals as being their primary motivation. Low performers were less concerned about meeting their goals daily, but maintained that accountability did motivate them to try, despite not being upset if the goal was missed. These participants may be extrinsically motivated, and less likely to maintain an exercise regimen [20] without external incentives.

The interviews also highlighted the importance of human connection in driving behavior change. Many high performing participants had strong supportive relationships with their support partner, paralleling studies which showed that social support is beneficial amongst older couples where the partners participate together in the intervention [21]. Many low-performing participants in the gamification arms noted a lack of support from their support partners (or lack of interest in engaging with them), and low-performing participants in the financial incentive arms felt that greater connection with study staff or with other like-minded participants would have better helped them achieve their goals.

Future research should consider assessing heterogeneity in motivation and desire for social support and target intervention design accordingly. Better understanding which participants will be motivated by different intervention types could help target interventions to participants likely to benefit from them. Many participants who appreciated study participation cited internal competitiveness (as a personality characteristic), rather than elements of the intervention, as the motivating factor for improving their physical activity levels. Designing interventions that enhance intrinsic competitiveness and motivation for people with different personality types, and either prospectively targeting individuals with tailored interventions or dynamically adapting intervention design based on early performance may increase the number of patients that benefit from behaviorally designed interventions to increase physical activity.

Limitations

This study had several limitations that should be considered. While we reached out to numerous patients, we were only able to interview those who agreed to participate. Although high and low performers were both represented, participants in the interviews only reflect those who were engaged in the intervention compared to those who chose not to be interviewed and may have been less engaged. Interviews were not representative of the whole study population, and the qualitative sample included higher rates of Black and Asian participants with fewer white participants than the trial sample, and no Hispanic participants. This disparity may have affected representativeness of the results. We also asked people to recall their motivations and experiences, which may have led to recall bias; however, the purpose of the qualitative analysis was to assess factors that were salient to participants, and learning about the things they remembered later helped identify things that were particularly meaningful to them longer term. We also did not interview any participants in the control arm; however, controls maintained improved step counts compared to baseline which offers some evidence that the daily text messages were motivating.

Conclusion

In BE ACTIVE, gamification, financial incentives, and their combination increased physical activity compared with control. The qualitative analysis found that the intervention may have been more effective for those with intrinsic motivation, competitiveness, and social support. Results may be improved by tailoring components based on participants' personal traits and level of social support to optimize motivation. Future research to strengthen the salience of intervention components and to account for varying innate personal traits among participants may help improve the effectiveness of interventions using gamification and financial incentives to increase physical activity.

<< Insert Appendix 1>>.

Supplementary Information

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Supplementary Material 1

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NA.

Author contributions

ER conducted data analysis and drafted the manuscript. DF conducted data collection and analysis and approved the final manuscript. AF conceived of the study and approved the final manuscript. SC managed data collection and approved the final manuscript. NC gave extensive feedback and approved the final manuscript. JZ gave extensive feedback and approved the final manuscript. JZ gave extensive feedback and approved the final manuscript. JZ gave extensive feedback and approved the final manuscript. JSC conceived of the interview protocol and assisted with data collection and approval of the final manuscript. LBR gave extensive feedback and approved the final manuscript. DS implemented the trial and approved the final manuscript. TK oversaw data collection, analysis, and writing of the final manuscript.

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Data availability

The datasets generated and/or analyzed during the current study are not publicly available due to the consent form lacking a future research use statement, but they are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study is in compliance with the Helsinki Declaration, and The University of Pennsylvania IRB approved this study (protocol 831230). All participants gave verbal informed consent to participate.

Consent for publication

Not Applicable.

Competing interests

ACF reports grants to his institution from the National Institutes of Health, American Heart Association, Abbott, and Prolocor, and consulting fees from Abbott, Boston Scientific, Novartis, and Anthos Therapeutics.

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