Message framing, self-efficacy and physical activity

A study examining the effects of message framing and self-efficacy on physical activity among healthy college students

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Abstract

The overall aim of the study was to examine the effectiveness of loss or gain-framed messages promoting physical activity among participants. Also, to examine the effects of self-efficacy on physical activity and the possible interactive effect of self-efficacy and message framing on physical activity. The study was done in collaboration with the digital therapeutics company Sidekick health. Participants were recruited via e-mail and Facebook, 63 individuals started the three-week program, and were randomly assigned into three groups, each receiving different messages; framed as loss of not participating in physical activity, gain from engaging in physical activity or reminders to use the app, as a control. Participants reported their physical activity via the Sidekick app. Results showed no differences between the three groups and that self-efficacy did not influence physical activity. A small sample size was considered a contributing factor. Future studies should take note of this and replicate the study with a larger sample.
Útdráttur

Markmið rannsóknarinnar var að kanna hvort ávinningsskilaboð (e. gain-framed messages) eða tapskilaboð (e. loss-framed messages) í gegnum snjallsímaforrit, höfðu hvetjandi áhrif á hreyfingu meðal þátttakenda. Einnig voru áhrif sjálfstíltrúar (e. self-efficacy) könnuð ásamt mögulegri samvirkni sjálfstíltrúar og skilaboða á hreyfingu. Rannsóknin var gerð í samstarfi við fyrirtækið Sidekick health. Leitast var eftir þátttakendum í gegnum tölvupóst og Facebook. Rannsóknin stóð yfir í þrjár vikur og 63 einstaklingar hófu þátttöku. Þátttakendur greindu frá hreyfingu sinni í gegnum Sidekick forritið og var þeim raðad af handahöfði í þrjá hópa sem fengu mismunandi skilaboð; skilaboð sem lögðu áherslu á tap af því að hreyfa sig ekki, ávinning af hreyfingu eða áminningar um að nota forritið, til samanburðar. Niðurstöður sýndu að enginn munur var á milli hópanna þriggja og að sjálfstíltrú hafði ekki áhrif á hreyfingu. Lítið úrtak er talin vera helsta skýringin á niðurstöðunum. Næstu rannsóknir ætlu að taka mið af þessu og endurtaka rannsóknina í stærri úrtaki.
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Introduction

Physical activity

It could be stated that it is in our nature to be physically active. We take our first steps and learn to walk and later we go on to ride a bike, often with the help of our parents who were taught by their parents. Some of us will then take physical activity to the next level by taking part in various group activities. Physical activity is all around us, it is what unites us and is what makes us human in so many ways. Therefore, it is surprising that many opt for a sedentary lifestyle, especially since evidence suggests that regular physical activity of at least 150 minutes of moderate intensity throughout the week or at least 75 minutes of vigorous intensity, is a highly effective way to help reduce risk for chronic diseases and disabilities in healthy individuals (Bull et al., 2020; Haskell et al., 2007). Physical activity in this sense has been defined as “any bodily movement produced by skeletal muscles that results in energy expenditure” (Caspersen, Powell, & Christenson, 1985).

The many health benefits of physical activity

Physical activity has a variety of health benefits, it has been shown to improve psychological well-being in the form of reduced stress and help reduce symptoms of depression (Hamer, Endrighi & Poole, 2012; Josefsson, Lindwall & Archer, 2013). Regular physical activity has also been shown to have a beneficial effect on sleep quality and total sleep time (Kredlow, Capozzoli, Hearon, Calkins, & Otto, 2015). There is also some indication that physical activity can have positive influence on academic achievement. Researchers at the California Department of Education demonstrated a positive relationship between academic achievement and physical activity among approximately 884,000 students in fifth, seventh and ninth grades in California (Grissom, 2005).

Despite these numerous benefits of engaging in regular physical activity, in 2016 almost one out of four adults globally were not getting enough physical activity, though it varies across
regions and income groups (Guthold, Stevens, Riley, & Bull 2018; OECD, 2019). Concurrently, overweight, obesity and diabetes rates have increased severely over the past decade, with 1.9 billion adults being overweight, thereof 650 million were obese (World Health Organization [WHO], 2020).

Since physical activity is such a fundamental and vital behavior, researchers have studied the effects of different persuasive appeals to encourage people to be more active. One strand of research studies whether framing messages in terms of what is gained by being physically active or what is lost by not being physically active, is more persuasive to encourage physical activity. This line of research is derived from Prospect theory (Tversky & Kahneman, 1981; Rothman & Salovey, 1997).

**Prospect theory**

Tversky’s and Kahneman’s (1981) Prospect Theory suggests that individuals tend to be sensitive to and respond differently to the same information, depending on how the information is framed. People tend to be risk seeking when confronted with information about losses and risk averse when confronted with information about gains (Tversky & Kahneman, 1981). Tversky and Kahneman used a value function that passes through a reference point, to explain these changes in preferences. An increase in potential losses has a rapidly decreasing impact on the perceived value of the negative outcome, in that way people are more willing to run the risk of a larger loss to try avoiding any losses. However, the satisfaction derived from an increase in potential gains is associated with smaller increases in the perceived value of the positive outcome. In simpler terms, the value function that passes through a reference point is s-shaped, and steeper for losses than for gains. This might explain why people tend to avoid risk when considering the gains or benefits (risk averse) but prefer taking risks when considering losses (risk seeking) (Tversky & Kahneman,
1981; Rothman & Salovey, 1997). For example, when choosing between two treatment programs, people’s preferences towards the treatment differs, depending on whether they are framed in terms of the number of lives that will be lost or saved. When framed as number of lives lost, people risk the possibility of greater losses to avoid a certain loss. When the same information is described in terms of number of lives that will be saved, people are more risk averse in their actions. They opt for the alternative that provides a certain gain, and therefore forego the opportunity for greater gains (Rothman & Salovey, 1997). In other words, what this assumption of Prospect theory proposes is that when faced with two choices, one with little risk and the other with higher degree of risk, people’s preferences will be influenced by how the choices are framed. If the choices highlight potential losses, people often tend to choose a risky option to prevent those losses. But if the choices highlight potential gains, people are less willing to go with the option involving risk to secure those gains (Tversky & Kahneman, 1981; Gallagher & Updegraff, 2012).

This proposition can be applied to the health promotion domain. Messages can be framed to highlight the benefits of engaging in a particular behavior (a gain-frame) or the consequences of failing to engage in a particular behavior (a loss-frame; Gallagher, & Updegraff, 2012). A gain-framed message aimed at increasing physical activity might be: “Physical activity might help you reduce your stress level” and a loss-framed message might be: “Not engaging in physical activity might increase your stress level” (Gallagher & Updegraff, 2012). Gain- and loss-framed messages tend to be differently persuasive and depend on the nature of the behavior, namely whether it is a detection behavior (illness-detecting) or a preventive behavior (health-affirming) (Rothman & Salovey, 1997).
Detection and prevention behavior in message framing

The main difference between detection behavior and preventive behavior is based on whether the action taken specifies some kind of risk or uncertainty (Rothman et al., 1993). Detection behavior refers to any action taken to detect the presence or absence of a potential health problem, but not necessarily to inform people they are healthy. An example would be regular health checks, like screening or breast exams. In such cases, there is always a possibility to receive rather significant and unpleasant information, a certain risk is therefore involved. For example, when initiating breast cancer screening there is always the possibility of detecting a lump. This may predispose women to think about breast cancer checks in terms of potential losses and since individuals tend to take risks when considering potential losses, like in the case of breast cancer screening, this suggests that loss-framed messages should be more appropriate in relation to detection behaviors (Rothman & Salovey, 1997; Tversky & Kahneman, 1981). Research supports this, for example in mammography (Abood, Black, & Coster, 2005), and HIV testing, where 6 HIV clinics in California were used to test the efficacy of brief sex counseling, among 585 HIV positive persons. The outcome measure was self-reported unpredicted anal or vaginal intercourse (UAV). Two clinics used a gain-framed approach (positive consequences of safe sex) two used a loss-framed approach (negative consequences of unsafe sex) and two implemented attention (control) intervention to focus on medication adherence of UAV. Even though no difference was seen in participants with only one sex partner at baseline, results showed that when the loss-framed approach was used, UAV reduced by 38% among participants who had two or more sex partners at baseline. No significant changes were observed when the messages were gain-framed, neither with one sex partner nor two or more sex partners (Richardson et al., 2004).

Prevention behaviors, on the other hand, refers to any action taken towards maintaining health status and reduce the risk of future illnesses, with very little risk involved. Often the only
risky thing in prevention behavior is not engaging in it. The main function of a prevention behavior is to provide a fairly certain and desirable outcome (Rothman & Salovey, 1997). For example, by applying sunscreen, people can prevent the onset of skin cancer. People tend to prefer less risky or more certain options when presented with gain framed information (Rothman et al., 1993), gain-framed messages should therefore be more appropriate in relation to prevention behaviors since they often come with various gains and less risk is involved, compared to detection behavior where certain risk is involved (Rothman & Salovey, 1997). This is also in line with Prospect theory which states that people are risk averse when confronted with information about gains (Tversky & Kahneman, 1981). This was further supported in Gallagher’s & Updegraff’s (2012) meta-analytic review, which indicated that gain-framed messages were more effective than loss-framed messages to encourage preventive behavior. Research agrees to this point of view, for example in sunscreen use (Detweiler, Bedell, Salovey, Pronin, & Rothman, 1999), and smoking cessation (Toll et al., 2008). Furthermore, in Lim & Noh’s study (2017), participants who received gain-framed messages rated higher levels of intention to use a fitness app than those who received loss-framed messages.

**Physical activity in message framing**

Since physical activity is fundamentally a preventive behavior and an effective way to reduce the risk of non-communicable diseases in generally healthy people, a gain-framed message should be more effective to encourage people to be more physically active (World Health Organization, 2020; Rothman & Salovey, 1997). This was partly the case in Lim’s & Noh’s study (2017), which tested the effects of message framing on user’s intention to use a fitness app. Results showed that participants who received gain-framed messages rated higher levels of intention to use a fitness app than those who received loss-framed messages. However, the study was confined to the
intention to use the fitness app and did not extend to the actual behavior of using the fitness app (Lim & Noh, 2017). This highlights a common puzzle among health psychologists, referred to as the intention-behavior gap (Sheeran & Webb, 2016); what we intend to do does not always lead to action. People might intend to change their health behavior but fail to take any action to change their behavior, which often is the focal point of research (Sheeran & Webb, 2016). Despite this limitation, intentions are considered a direct determinant of physical activity and consequently an important target for physical activity messages (Ajzen, 1991).

With the intention-behavior gap in mind, studies that looked at the relationship between message framing on physical activity, have generated mixed findings. Gain-framed messages have for example resulted in stronger intentions to engage in physical activity than loss-framed messages, but not an increase in actual physical activity (Van’t Riet, Ruiter, Werrij, & Vries, 2010). While other studies have demonstrated both stronger intentions as well as more physical activity, when framed as gain messages compared to loss or mixed-framed messages (Latimer et al., 2008). A systematic review of 22 studies examined the evidence of three optimal message approaches regarding physical activity, including message framing. Researchers concluded that there was no support for any optimal message content on physical activity. However, in regard to message framing, they recommended the use of gain-framed messages when possible to encourage physical activity, rather than loss-framed messages. All the studies reviewed used an assessment of intentions. Out of the four studies that assessed message framing, three studies reported stronger intentions to be active, when the messages were gain-framed compared to loss-framed (Latimer, Brawley, & Bassett, 2008).

The relationship between physical activity and message framing may, thus, be more complex than the propositions of Prospect theory suggest (i.e. when confronted with potential
negative consequences associated with a choice, individuals tend to seek out risks and when confronted with the potential benefits associated with a choice, individuals tend to avoid risks). In addition to message framing, there could be other factors than purely loss or gain framed messages that might influence why some people are motivated by the messages but others not. For example, many individual characteristics may influence this relationship between physical activity and message framing (Covey, 2014). Self-efficacy, an individual’s ability to perform the particular behavior successfully, has been suggested as a potential moderating factor (Bandura, 1977).

**Self-efficacy**

Self-efficacy is one of several key concepts in Albert Bandura’s influential Social Learning Theory (1977) and has since then appeared in various theories within the health psychology domain, including the Theory of Planned Behavior (Ajzen, 1991) and Transtheoretical Model (Prochaska & DiClemente, 1982). Bandura has defined the construct as follows: “Self-efficacy is concerned with the judgments of how well one can execute courses of action required to deal with prospective situations” (Bandura, 1982). In other words, self-efficacy refers to the confidence an individual has in his/her ability to successfully perform a given behavior in different situations and can impact anything from psychological states to motivation (Marcus, Shelby, Niarua, & Rossi, 1992; Bandura, 1977). An individual’s self-efficacy beliefs can also vary depending on the context and the specific behavior they are engaging in (Maibach & Murphy, 1995).

**Self-efficacy in prevention and detection behavior**

Even though self-efficacy is crucial in many of our daily activities, the role of self-efficacy is believed to be more important in preventive behavior than in detection behavior. The main reason behind this is that preventive behaviors are often more complex and require more repetitive adherence in order for the individual to achieve the health benefits she/he needs, compared to
detection behavior, which often is a one-time occurrence (Strecher, DeVellis, Becker, & Rosenstock, 1986; Gallagher & Updegraff, 2012).

Several studies have supported the role of self-efficacy as an important predictor in various preventive health behaviors, including smoking cessation (Baldwin et al., 2006) and reduced alcohol consumption (Oei & Burrow, 2000). With self-efficacy being less important in one-time detection behavior (Gallagher & Updegraff, 2012).

**The role of self-efficacy in physical activity and exercise adherence**

Self-efficacy has been shown to be a valid predictor of physical activity and exercise adherence in populations ranging from children (Trost et al., 1997) to the elderly (Li et al., 2001). In a study among 137 physically active adults, that looked at how perceived benefits, perceived barriers and self-efficacy predicted physical activity, results indicated that self-efficacy was the only variable to predict physical activity (Stutts, 2002). Similarly, in a sample of 277 university students, which used a structural equation model to look at how self-efficacy, social support, outcome expectation and self-regulation affected physical activity, self-efficacy ($\beta = .71$) had the greatest total effect on physical activity. However, the effect of self-efficacy on physical activity was largely mediated by self-regulation ($\beta = .57$). Furthermore, the total effects of social support ($\beta = .28$) on physical activity was mediated completely by self-efficacy. The results demonstrate that self-efficacy is an important predictor of physical activity, but also that self-efficacy can act as a mediator (Rovniak, Anderson, Winett, & Stephens, 2002).

Results have not agreed on the importance of self-efficacy in predicting long-term physical activity. In a two-year randomized trial assessing the impact of an exercise program, baseline self-efficacy predicted physical activity in the early adoption stages of an exercise program, but to a lesser extent in the later stages of the program (Oman & King, 1998). A study which looked at
long-term exercise adherence among the elderly, indicated that those with higher self-efficacy were more likely to show greater adherence to physical activity at 6 and 18-month follow up, compared to those with low self-efficacy. (McAuley, Jerome, Elavsky, Marquez, & Ramsey, 2003). In yet another study, approximately 100 young adults were recruited to an 11-week exercise program, that included 2 sessions per week. After the program, participants were categorized as either adherers or dropouts based on how many sessions, they took part in during the period. Not surprisingly, self-efficacy was higher among adherers than dropouts (Desharnais, Bouillon, & Godin, 1986).

**Self-efficacy in message framing**

Since self-efficacy plays a role in health behavior (Strecher, DeVellis, Becker, & Rosenstock, 1986), researchers have wondered if self-efficacy might affect how successful differently framed messages are at persuading people to become more physically active (Covey, 2014). A review of over 50 studies looked at how 23 different dispositional factors, like motivation and self-efficacy might affect the effectiveness of health messages. Results indicated a significant small to medium sized interaction effect in 37 of the studies. Of these 37 studies, four studies examined self-efficacy and three of them suggested an interaction effect between self-efficacy and a loss framed message on intention of the behavior in hand; smoking cessation, skin examination and breast self-examination. Levels of self-efficacy influenced whether or not the loss-framed messages were effective. The interaction did not extend to gain-framed messages and the interaction effect was limited to behavioral intention (Covey, 2014).

Having high self-efficacy might be especially important when responding to loss-framed messages, because people with high self-efficacy believe they can successfully perform the given behavior (Bandura, 1982; Witte, 1992). Extending this to the research on fear appeal and the
Extended Parallel Process Model (EPPM) (Witte, 1992); which states that when the combination of high self-efficacy and high levels of threat are present, people feel more capable of averting the threat by adopting the recommended action. These propositions from the EPPM might explain why some people are more receptive to loss-framed messages than gain-framed messages (Witte, 1992).

In a randomized controlled trial among 539 adult smokers, participants with high self-efficacy reported higher motivation to quit smoking when receiving a loss-framed message compared to a gain-framed or no message. Meanwhile, among participants with low self-efficacy, there was no difference in motivation to quit smoking depending on if the participants received the gain, loss or control framed messages (van’t Riet, Ruiter, Werrij, & De Vries, 2008).

**The use of a pedometer to track physical activity**

It is evident from the definition in the beginning, that physical activity can include a variety of different activities and therefore the question arises what the best way is to measure physical activity. One easy and affordable way is to use a pedometer. In recent years, pedometers have been used increasingly in research to track physical activity of participants (Schneider, Crouter, & Bassett, 2004). In addition to tracking participants activity, pedometers can also provide participants with a clear and measurable goal for their activity (Chan, Spangler, Valcour, & Tudor-Locke, 2003). A systematic review of 26 studies, including around 2,800 participants, suggested that the use of a pedometer was associated with significant increases in physical activity, but whether these changes were significant over the long term was inconclusive (Bravata et al., 2007). Studies have not been in agreement on how many steps should be the recommended daily minimum, since it depends on the population and individual characteristics. The World Health
Organization, however, recommends a bare minimum of 5,000 steps daily, with more steps usually preferred (WHO, 2008; Tudor-Locke & Bassett, 2004).

The use of smartphone apps to encourage physical activity

In recent years there has been a rapid development in the design of smartphones, combined with a large increase in smartphone users (Statista, 2021b). With this, the use of various smartphone apps has increased, with many of them categorized as health and fitness apps. (Statista, 2021a). That gives us the chance as researchers to study physical activity through the use of the apps. It has been difficult to identify how many smartphone users are worldwide, since the market is still growing rapidly, but in 2020 it was estimated that there were over 3.6 billion smartphone users worldwide (Statista, 2021b). Due to know many people use smartphones, it is no wonder why apps are believed to be a highly attractive population-based intervention to encourage physical activity (Romeo et al., 2019). Not least because most people have constant access to their smartphone.

The effectiveness of apps to increase physical activity has remained inconclusive (Romeo et al., 2019) but using smartphone apps to increase physical activity is a relatively new field, and therefore the evidence base is still growing. A recent meta-analysis (Romeo et al, 2019) that included 9 randomized controlled trials (RCT) indicated modest evidence in supporting smartphone apps to increase physical activity. The apps were more effective in the short term rather than in the long term. Authors added that further research with more RCTs, larger sample sizes and longer study periods is needed to assess better the effectiveness of smartphone apps to increase physical activity (Romeo et al., 2019).

Hypothesis and aim

This study was done in collaboration with the digital therapeutics company Sidekick, who provided participants with the Sidekick smartphone app, via which they received personal
messages. The questionnaires were also programmed into the app. Based on the tenets of Prospect theory; the main aim of this research was to test the effectiveness of message framing on physical activity in a sample of college students. Furthermore, it was tested whether self-efficacy might affect participants’ physical activity as well as how self-efficacy might mediate the relationship between message framing and physical activity.

With this in mind I hypothesize that:

*Hypothesis 1a:* People in the gain-framed group will engage in more physical activity during the intervention phase of the physical activity program, than the loss-framed group.

*Hypothesis 1b:* People in the gain-framed group will engage in more physical activity during the intervention phase of the physical activity program, than the control group.

*Hypothesis 2:* People with high self-efficacy at baseline will engage in more physical activity and show greater adherence to the program during the three-week period, than people with low self-efficacy.

*Hypothesis 3:* Self-efficacy will interact with the effectiveness of message framing on physical activity. People with high self-efficacy in the loss-framed group will engage in more physical activity, compared to people with low self-efficacy in the same group, and compared to the gain-framed or control group.

**Method**

**Participants and procedure**

Participants were recruited via university email as well as advertisements on university social media sites. This resulted in a convenience sample of 63 participants. They were randomly assigned to one of three groups, \(N_{\text{gain}} = 22; N_{\text{loss}} = 21; N_{\text{control}} = 20\). One participant in the control group dropped out before the program began. As is common in studies relying on volunteers, the
majority of the participants were women, 48 (76.2 %) and 15 were men (23.8 %). However, this harmonizes well with the distribution of students in the University of Iceland, which is around 70% female and 30% men (Háskóli Íslands, 2019). The mean age in the sample was 29.95 years (SD = 7.87) with a range of 20-53 years. The age distribution between the groups was similar. The gains group had a mean age of 28.09 years (SD = 5.92), the loss group had a mean age of 30.75 years (SD = 7.21) and the control group a mean age of 30.71 years (SD = 9.82).

Advertisements originally in Icelandic [translated to English] (see Appendix A/B) asked for volunteers who wished to increase their physical activity while getting the chance to try out the Sidekick app for three weeks. Conditions were that a) participants were older than 18; b) had no diagnosed diseases of any kind that prevented them in engaging in physical activity and lastly c) they were students at the University of Iceland. Individuals who were interested were requested to communicate via e-mail enclosed with the advertisement. All participants were volunteers and did not receive payment nor course-credits for their participation in the study.

All those who expressed an interest in the study received an information sheet, containing detailed information on the study ethics, the Sidekick app and study procedure as well as a link to an online informed consent form. They were informed that they would be randomly assigned to a group and that each group would receive different messages, without disclosing the study hypotheses.

Experimental design and stimuli

The study is a randomized between subject design with three groups, each receiving a different kind of message. Type of message is the manipulation (IV1). Participants (N=63) were randomized into three groups. In the gains group participants received messages that highlighted the benefits of engaging physical activity. These were messages like: “Physical activity of at least 30 minutes
of moderate-intensity on five or more days of the week can lead to numerous health benefits”. In the loss group participants received messages that highlighted the losses of not engaging in physical activity. These were messages like: “Not getting at least 30 minutes of moderate-intensity physical activity on five or more days of the week can lead to numerous health problems”. Finally, the control group received messages reminding participants to use the app and its features. These were messages like: “In the app you can see various exercises you can do”. Each participant was sent nine messages over the course of the three weeks (see Appendix C). In order to collect baseline measures for a few days, the first message was not sent until the fifth day of the program, and every other day after that. Physical activity recommendations from the Directorate of Health were used as inspiration in the message development (Lýðheilsustöð, 2008).

**Equipment**

In the Sidekick app, participants can log different health related behaviors ranging from their dietary intake to their daily medications. The use of the app has shown good results with people with type 2 diabetes to improve their lifestyle modification (Hilmarsdottir, Sigurdardottir, & Arnardottir, 2019). However, as far as we know, the app has not been tested on a healthy audience nor whether differing messages via the app can influence physical activity between groups.

On the start page of the app, three main missions arise. *Food, Move and Mind*. In the study, the focus was on the latter two. In *Move* is a step counter, which can track participants steps, and in *Mind*, participants rate how their stress, energy level and quality of sleep was on a daily basis (appendix D/E). Over the three-week program, all participants were encouraged to watch four approximately two minute educational videos. Two videos appeared during the first week, and the latter two videos appeared in the second week. No video appeared in the third week. The first video contained an introduction to the app and what Sidekick represents. The second video showed
participants how to track their activity, the third video showed participants how they earn water drops for their activity, which is then converted into clean drinking water for people in developing countries, and the fourth video instructed participants how to best schedule their physical activity.

**Measures**

*Physical activity – baseline and intervention*

Steps and total active days were used to assess participants’ physical activity. Distance in the number of steps was measured over four days to assess participants’ baseline activity. The intervention phase of steps then consisted of steps in the following 17 days. Baseline measures of total active days was assessed as the count over the first week and the intervention phase was assessed as the count of active days over the latter two weeks.

It must be acknowledged, that there was a slight overlap between the baseline and the intervention phases of step count and total active days, due to limitations of the app. Three more total active days were included at the baseline phase of the total active measure compared to the four-day baseline phase of total steps. Consequently, three fewer total active days were included in the intervention phase of total active days compared to the intervention phase of total steps. Participants were also asked in the beginning to complete a six-minute fitness test which measures how far they can walk or run in six minutes, giving an indication of their starting fitness level. Three additional tests were put forward, in the beginning of each week and one at the end of the program. The tests were optional. Participants chose if they walked or ran during the fitness test.
Self-reported physical activity

The physical activity questions were based on daily physical recommendations from the Directorate of Health (Lýðheilsustöð, 2008). These are subjective self-report measures of combined moderate or vigorous activity.

Two questions were used in the beginning of the study. To get an indicator of the number of days people normally engage in moderate or vigorous physical activity, the following question was used: “On how many days of the week do you normally engage in moderate or vigorous physical activities (such as walking, swimming, cycling, aerobics, team sports, jogging)?” (0 days 1-2 - 3 - 4 – 5 - 6 - 7 days). To measure how much time participants allocated normally to physical activity they were asked: “On a typical day, how much time do you spend doing physical activities such as walking, swimming, cycling, aerobic, team sports, jogging?” (1 = none; 2 = less than 15 minutes; 3 = 16-30 minutes; 4 = 31-45 minutes; 5 = more than 45 minutes).

At the end of the study, the same questions were asked, but adjusted to the time interval of the study: "In the past three weeks, how many days per week have you spent doing moderate or vigorous physical activities (such as walking, swimming, cycling, aerobics, team sports, jogging)?" (0 days 1-2 - 3 - 4 – 5 - 6 - 7 days) and “On a typical day for the past three weeks, how much time have you spent doing physical activities such as walking, swimming, cycling, aerobic, team sports, jogging?” (1 = none; 2 = less than 15 minutes; 3 = 16-30 minutes; 4 = 31-45 minutes; 5 = more than 45 minutes).

Self-efficacy

Self-efficacy was measured twice, at the beginning and end of the study. At the beginning of the study self-efficacy was measured with a single item taken from Armitage & Conner (1999), originally designed when predicting consumption of a low-fat diet. The statement “I am confident
that I am able to participate in regular physical activity over the next 3 weeks” has proven reliable as a self-efficacy measurement, and has also been used rephrased in the physical activity domain, with good predictive validity (Armitage & Conner, 1999; Latimer et al., 2008). Respondents rated their level of agreement with the statement on a five-point scale (1 = disagree a lot; 2 = disagree slightly; 3 = neither agree nor disagree; 4 = agree slightly; 5 = agree a lot; Armitage & Conner, 1999).

At the end of the study, self-efficacy was measured with two items. First a slightly rephrased version of the week 1 statement: “How confident are you that you will continue to engage in regular physical activity?” answered on a five-point scale (1 = not at all confident; 2 = not very confident; 3 = neutral; 4 = very confident; 5 = extremely confident). Following that, participants were asked about their agreement with the statement “I believe I have the ability to engage in regular physical activity” on a five-point scale (1 = disagree a lot; 2 = disagree slightly; 3 = neither agree nor disagree; 4 = agree slightly; 5 = agree a lot; Armitage & Conner, 1999). Like the item above, the two items have been used in the physical activity domain with good predictive validity (Latimer et al., 2008). The items were adapted for the present study, taking into account the three-week duration of the study.

Statistical analysis

Data was analyzed using available software of JASP (version 0.9.1) and SPSS (version 26). Nine individuals who did not take any steps neither during baseline nor during the intervention, were excluded from data analysis. Furthermore, two outliers greater than 3SD from the predicted mean of steps at baseline were also excluded from the analysis. This resulted in a final sample of 52 participants, or 82.3 % of the former 62 participants. All hypotheses were tested using regression analyses and a correlation matrix.
To test the first hypothesis that gain-framed messages would result in greater physical activity than loss-framed and control messages during the intervention phase, a regression analysis with planned contrasts was conducted. The groups were dummy coded, with gain-framed condition as the reference group. Participants’ total steps and total active days were used as a measure of physical activity. The baseline phase of total steps consisted of steps participants took during the first four days, and the intervention phase consisted of steps in the following 17 days. Baseline measures of total active days was assessed as the count over the first week and the intervention phase was assessed as the count of active days over the latter two weeks. There was a slight overlap between the baseline and intervention phases of total steps and total active days (see method). For the 17-day intervention phase of total steps, participants total step count was summed up and centered. Furthermore, a z-score was computed for the count of active days over the two-week intervention phase.

To test the second hypothesis that people with high self-efficacy at baseline will engage in more physical activity (assessed with total steps) and show greater adherence (assessed with total active days) to the program during the three-week period than people with low self-efficacy, a correlation matrix was used. Finally, in the third hypothesis, a multiple regression was conducted to test a possible interaction effect of the loss group and self-efficacy.

Results
Descriptive statistics of total steps taken at baseline and total active days can be seen in Table 1. Results from One-way ANOVA showed that the groups were not different in the beginning of the program, neither at total steps $F(2,49) = 0.384$, $p = 0.683$, nor total active days $F(2,49) = 0.368$, $p = 0.694$. Although it appears that the gains group had taken on average more steps during the four-
day baseline phase, and the loss group was slightly more active during the first week (Table 1), this difference is not significant.

Table 1: Means, Standard Deviations and One-Way Analyses of Variance of baseline total steps and total active days in week 1

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Mdn</th>
<th>F(2,49)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total steps – baseline a</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.384</td>
<td>0.683</td>
</tr>
<tr>
<td>Gains (N =19)</td>
<td>3670</td>
<td>2324</td>
<td>2960</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss (N =15)</td>
<td>3132</td>
<td>2632</td>
<td>2211</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control (N =18)</td>
<td>2940</td>
<td>2902</td>
<td>1830</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total active days – baseline b</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.368</td>
<td>0.694</td>
</tr>
<tr>
<td>Gains (N=19)</td>
<td>5.16</td>
<td>2.12</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loss (N =15)</td>
<td>5.47</td>
<td>1.72</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control (N =18)</td>
<td>4.89</td>
<td>1.88</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. a Steps during the four-day baseline phase were averaged. b Count of active days during the first week. ns not significant.

**Hypothesis 1**

The first hypothesis stated that people in the gain-framed group will engage in more physical activity during the intervention phase, than the loss or control group. This was assessed with a step count over a 17-day intervention period and total active days over the latter two-weeks. Results from One-way ANOVA revealed that the groups were not different at the intervention phases (Table 2).
Due to the small sample size, an effect size (Hedge’s g) was computed for total active days and total steps, between the loss and gain-framed group. Hedge’s g is interpreted in the same way as Cohen’s d but is preferred for very small sample size (<20), with 0.2 > small effect, 0.5> medium effect and 0.8 > large effect (Hedges, 1981). Hedge’s g revealed a small effect size (Hedges, 1981) both for total steps (g = .04) and for total active days (g = .249).

Regardless of these results, a regression analysis with planned contrasts was conducted, with the gains group used as a comparison. Not surprisingly, the overall model, predicting that gain-framed messages were more effective than loss-framed or control groups, was not significant. The results extended both to the total steps, $F_{Total\ steps} (2, 49) = 0.427, p = 0.655$, $R^2 = .017$, and total active days $F_{Total\ active\ days} (2,35) = 0.242, p = 0.786$, $R^2 = .014$ (Table 3).

Table 3. The effects of message framing on total step and total active days during the intervention phase.
Hypothesis 2

According to the second hypothesis, participants with high self-efficacy at baseline will engage in more physical activity (total steps) and show greater adherence (total active days) to the program during the three-week period than people with low self-efficacy. The three-week period was assessed by comparing the baseline and intervention phases of total steps and total active days. A correlation matrix between self-efficacy and the measured variables is shown in Table 4. Like in the first hypothesis, there was a slight overlap between the baseline and intervention phases of total steps and total active days (see method).

Table 4. Pearson Correlations between self-efficacy and physical activity measures during the baseline and intervention phase

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total steps- intervention (^a)</th>
<th>Total active days (^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(B)</td>
<td>(SE\ B)</td>
</tr>
<tr>
<td>Gains (^c)</td>
<td>205</td>
<td>0.147</td>
</tr>
<tr>
<td>Gains vs Loss</td>
<td>123</td>
<td>-0.267</td>
</tr>
<tr>
<td>Gains vs Control</td>
<td>-694</td>
<td>-0.197</td>
</tr>
<tr>
<td>(R^2)</td>
<td>0.017</td>
<td>0.014</td>
</tr>
<tr>
<td>(F)</td>
<td>0.427(^{\text{ns}})</td>
<td>0.242(^{\text{ns}})</td>
</tr>
</tbody>
</table>

\(^{a}\) Centered variable. \(^{b}\) Z-score of total active days. \(^{c}\) Comparison. \(^{\text{ns}}\) Not significant

As shown in Table 3, none of the coefficients were significant. However, looking at the centered total steps variable and the standardized total active days, the coefficients imply that the total steps and total active days were higher among the gains group, when compared to the loss and control group (see discussion).
Not surprisingly, total steps at baseline phase significantly predicted total steps at intervention phase (Table 4). Self-efficacy was associated with total steps at baseline phase, but not during the intervention phase (Table 4.). Furthermore, self-efficacy was not associated with total active days at the baseline phase nor during the intervention phase. Therefore, the effects of self-efficacy did not extend to the adherence of physical activity (assessed with total active days) nor physical activity (assessed with total step count) at the intervention phase.

**Hypothesis 3**

According to the third hypothesis, self-efficacy will interact with the effectiveness of message framing on physical activity in that people in the loss-group will benefit from receiving messages only if their self-efficacy is high. Hence, people with high self-efficacy in the loss-framed group will engage in more physical activity than people with low self-efficacy in the loss group compared to gain-framed or control. Results from the regression analysis do not support this (Table 5). However, beta coefficient indicates that the effects of self-efficacy were stronger among the loss group ($\beta = 0.940, p = 0.378$) compared to the control group ($\beta = -0.358, p = 0.634$) when the interaction effect was computed. Although quite small, the overall regression equation explained
proportionately more of the variance when interaction effect between self-efficacy and groups was computed. Finally, $\Delta F$ indicates that the variables added did not improve the prediction.

Table 5. The effect of self-efficacy, relationship between self-efficacy and group, and the interaction effects between self-efficacy and the groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1 $^a$</th>
<th></th>
<th>Model 2 $^b$</th>
<th></th>
<th>Model 3 $^c$</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
<td>$SE$</td>
<td>$\beta$</td>
<td>$B$</td>
<td>$SE$</td>
<td>$\beta$</td>
</tr>
<tr>
<td>Gains *</td>
<td>-2542</td>
<td>1886</td>
<td></td>
<td>-2307</td>
<td>2069</td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>590</td>
<td>429</td>
<td>0.191</td>
<td>561</td>
<td>440</td>
<td>0.182</td>
</tr>
<tr>
<td>Control</td>
<td>-521</td>
<td>927</td>
<td>-0.90</td>
<td>1469</td>
<td>4378</td>
<td></td>
</tr>
<tr>
<td>Loss</td>
<td>239</td>
<td>967</td>
<td>0.039</td>
<td>-5369</td>
<td>6487</td>
<td></td>
</tr>
<tr>
<td>Loss x self-efficacy</td>
<td></td>
<td></td>
<td></td>
<td>1319</td>
<td>1483</td>
<td>0.940</td>
</tr>
<tr>
<td>Control x self-efficacy</td>
<td></td>
<td></td>
<td></td>
<td>-470</td>
<td>981</td>
<td>-0.358</td>
</tr>
<tr>
<td>$F$</td>
<td>1.892</td>
<td></td>
<td>0.831</td>
<td></td>
<td>0.832</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.036</td>
<td></td>
<td>0.049</td>
<td></td>
<td>0.083</td>
<td></td>
</tr>
<tr>
<td>$\Delta F$</td>
<td>1.892</td>
<td></td>
<td>0.326</td>
<td></td>
<td>0.841</td>
<td></td>
</tr>
</tbody>
</table>

Note. * Gains as comparison. $^a$ Effects of self-efficacy. $^b$ Effects of self-efficacy and group. $^c$ Interaction between self-efficacy and group.

**Discussion and conclusion**

The findings failed to support any of the hypotheses. According to these results, a gain frame, highlighting the benefits of physical activity, is not a more effective way to persuade people to be more physically active. Findings indicate that self-efficacy did not affect physical activity during the period, nor that self-efficacy influenced the relationship between message framing and physical activity. Some of the standardized coefficients were quite large, especially the interaction between self-efficacy and message type. The loss-group had higher coefficients than the control group,
when the interaction effect was computed. However, the small effect sizes of total active days and total steps indicates a low possibility of the manipulation having an effect in a larger group.

Self-efficacy (see appendix F) was assessed with one question at the beginning of the three-week program. Self-efficacy was quite large in the beginning of the study with a mean score of 4.30, out of a highest possible score of 5. This indicates a possible ceiling affect that could be mended by using a more heterogeneous sample as well as a more psychometrically sound measure of self-efficacy. Due to the constrictions of the app, we opted for a single item measure, however, future research should consider using more than one item to assess the self-efficacy of participants.

It must also be acknowledged that only a small part of the original measurements were used in the data analyses. There was no use of the measurements of self-reported physical activity at baseline and the end of the program, post-intervention self-efficacy nor the optional fitness test. The main reason behind the exclusion of those measurements was the large dropout of participants as the program progressed, that made it difficult to compare the baseline and intervention phase. Only 28 participants completed the survey at the end of the program. This is of course a drawback to the study and something that future studies must bear in mind.

As mentioned above, the small sample size of the study is a major limitation. Other studies, like Latimer and colleagues (2008) and Gallagher & Updegraff (2012) had a fairly large sample size, and consequently more estimated data power. Another possible limitation is that our sample was limited to healthy college students who wanted to increase their physical activity and try the Sidekick app. During the recruitment phase, no emphasis was on whether participants were sedentary or already fulfilling the daily recommendation of physical activity, but some studies have shown that messages promoting physical activity tend to be more effective among previously sedentary individuals (Latimer et al., 2008; Kroeze, Verkman, & Brug, 2006). Therefore, the
participants might have been less receptive to the messages in the study. Future studies could look closer at whether differences in message framing impact physical activity more among sedentary individuals compared to individuals who are already physically active and perhaps have the motivation present.

No pretesting was done on the messages prior to the three-week program to see whether some messages were better suited than others (see appendix C). For example, whether messages about cancer or messages about stress were more persuasive, but people are more likely to give their attention to messages when they find the topic personally relevant (Petty & Wegener, 1999). As a sample of college students, messages about cancer or heart disease were perhaps not personally relevant among the participants (Petty & Wegener, 1999). Future studies could take note of this and use time series analysis to see whether messages that are sent out on particular days are more suited than others. For example, if there is a trend or a spike in physical activity in the following days, that is possibly an indication the messages are more effective than other messages. Moreover, whether some types of messages are better suited towards different target groups where age could be a moderating factor. The time length of the program was three weeks. As a comparison, the study of Latimer and colleagues (2008) took nine weeks. Therefore, our study was possibly too short to see if the message framing had any effects on physical activity of the participants.

One of the major strengths of the study is that participants received messages via their smartphone app. In the short time of three weeks, nine messages were sent out to the participants. Without the app, approaching the participants would have been more complex and time consuming. This not only eased the procedure but also facilitated data processing, since the time
frame was predetermined to three weeks. This highlights the advantage of integrating technology in the research process.

The study was done in collaboration with a digital therapeutics company which is growing in size. As a small country with various connections, Iceland is the perfect place for collaboration between the private sector and academia. The relationship should be intertwined, with the academia focusing on the theoretical background and the private sector focusing on realistic projects the companies need to address. In that way, both parties can benefit from the collaboration. It can also be an opportunity for companies to implement projects that otherwise would have laid dormant or not put into execution. Furthermore, this can be a chance for students to utilize their theoretical knowledge where improvements are most needed.
References


Covey, J. (2014). The role of dispositional factors in moderating message framing effects. *Health Psychology, 33*(1), 52.


Appendix A- Participant information (Icelandic)

Kæri þátttakandi,

Takk fyrir að sýna áhuga á að taka þátt í rannsókninni okkar. Að neðan eru nokkur praktísk atríði um rannsóknina sem við biðum þig um að lesa yfir. Auk þess er hér að neðan slóð á upplýst samþykki sem við biðum þig að lesa yfir áður en hakað er við samþykkið.

Lýsing: Þér er boðið að taka þátt í rannsókn Sálfræðideildar Háskóla Íslands og SidekickHealth þar sem kannð er hvaða tegundir skilaboða eru ahrifaríkastar til að hvetja fólk til að hreyfa sig.

Áhætta og ávinningur: Engin áhætta er fólgin í rannsókninni, önnur en sú sem þú mætir í daglegu lífi. Þér ber ekki skylda til að svara spurningum sem þig langar ekki til að svara og þér ber ekki skylda til að ljúka rannsókninni, en gögnin koma að mestu gagni ef þú tekur fullan þátt.

Tímalengd: Þátttaka þín í rannsókninni mun taka um það bil 4 vikur frá upphafi til enda, en þú munt ekki þurfa að verja nema nokkrum mínútur á dag í snjallforritinu (appinu).

Til hvers er ælast af mér?:
1. Þú verður beðin/n um að hlaða niður appinu Sidekick í símann þinn. Forritið og öll skilaboð sem þú munt fá verða á ENSKU.
2. Þú verður beðin/n um að svara örfúum spurningum um hreyfingu í upphafi og við lok rannsóknar.
3. Við viljum fyrst og fremst vita hve mórg skref þú tekur yfir daginn. Þú verður því beðin/n um að leyfa Sidekick appinu að skrá skrefafjöldann þinn. Hér eru leiðbeiningar um hvernig það er gert:
   • Þytu á „Move“ dálkinn sem er undir „Missions“.
   • Þar næst skaltu velja Step counter.
   • Íni í Step counter getur þú valið hvort þú skráð skrefin með skrefamæli sem er innbyggður í appinu, tengt heilsuúr við appið (t.d. fitbit) eða skráð skrefin handvirk. Í „Move“ dálkinum getur þú að auki skráð inn annarskonar hreyfingu (t.d. hjólreiðar).
4. Við biðum þig líka um að skrá á hverjum degi hvernig þér líður, hvernig þú svað og hversu mikla orku þú ert með.
   • Þytu á „Mind“ dálkinn sem er undir „missions“
   • Undir reflection birtast þríf valkostir: Stress level (streitustig), Quality of sleep (svefngæði) og Energy level (orkustig).
   • Þar notarðu „sliderinn“ frá 0 – 10 til að gefa til kynna hvernig þér líður, hver orka þín er og hvernig þú svað.
   • Þetta ætti ekki að taka meira en 5 mínútur.

Þú hefur einnig tækifæri til að taka þátt í hinum ýmsum æfingum sem eru hluti af appinu, t.a.m. hugleiðsla og slökunaræfingum.


Ef þú samþykkir að taka þátt í þessari rannsókn biðum við þig að smella á þessa slóð sem opnar eyðublað fyrir upplýst samþykki.
Appendix B- Participant information (English)

Dear participant,

Thank you for showing interest in participating in our study. Below are few practical points about the study that we would like you to read over. Also, below is a link that opens informed consent that we would like you to read over before checking the consent.

**Description:** You are invited to take part in a collaboration study with the Psychology department of University of Iceland and Sidekickhealth, which is exploring different kinds of messages are most effective to encourage people to move.

**Risk and benefit:** No risk is involved in the study, other than you will meet in your daily life. You are not obligated to answer questions which you do not want to answer and you are not obligated to finish the study if you do not want to. However, the data will be most useful to us if you fully participate.

**Timelength:** Your participation will take approximately 4 [3] weeks from start to finish of the program, but you will only need to devote a few minutes each day in the smartphone (app).

**What is expected of me?:**
1. You will be asked to download the app Sidekick in your smartphone. The program and all the messages you will receive will be in ENGLISH.
2. You will be asked to answer a few questions about your physical activity in the beginning and the end of the study.
3. First and foremost we would like to know how many steps you accumulate over the day. Therefore, you will be asked to allow the Sidekick app to track your step counter. Here are instructions on how that is done:
   - Press on the „Move“ column under „Missions“
   - Next choose Step counter.
   - In Step counter you can choose if you register the step with the step counter which is built-in (innbyggður) the app, connect a health watch to the app (e.g. fitbit) or log the steps manually. In the „Move“ column you can also register different kinds of physical activity (e.g. cycling).
4. We would also like you to record how you are feeling each day, how you slept and how much energy you have.
   - Press on the „Mind“ column under „missions“
   - Under reflection three alternatives appear: Stress level, Quality of sleep and Energy Level.
   - There you use the slider from 0-10 to indicate how you are feeling, how you're energy level is and how you slept.
   - This should not take more than 5 minutes.

You have also the chance to take part in various exercises which are part of the app, for example meditation and relaxation exercises.

**How the data will be used:** Participants will be randomized into three groups in the beginning of the study, each receiving different kinds of messages. The data will be used to analyze the influence of the message on physical activity of the participants. The data which participants grant are anonymous, not to mention that they will be deleted as soon as the data processing is finished.

If you choose to take part in this research we ask you to click on this link which opens up a form for informed consent.
## Appendix C - Messages sent to participants

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Gains</th>
<th>Loss</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Physical activity of at least 30 minutes of moderate-intensity on five or more days of the week can lead to numerous health benefits.</td>
<td>Not getting at least 30 minutes of moderate-intensity physical activity on five or more days of the week can lead to numerous health problems.</td>
<td>Don’t forget to log your activities.</td>
</tr>
<tr>
<td>2.</td>
<td>Research shows that active people have a much lower risk of being diagnosed with colon cancer</td>
<td>Research shows that inactive people have a much greater risk of being diagnosed with colon cancer.</td>
<td>You will earn water drops for logging your activities.</td>
</tr>
<tr>
<td>3.</td>
<td>Active people experience less stress and are better able to deal with it when they do. In other words, they feel more relaxed.</td>
<td>Inactive people experience more stress and have more trouble dealing with stress. In other words, they feel more tense.</td>
<td>Don’t forget to tell us how you are feeling today.</td>
</tr>
<tr>
<td>4.</td>
<td>Physical activity can improve your well-being. Get active and get your daily endorphin dose!</td>
<td>Physical inactivity can lower your well-being. If you are inactive, you won’t get your daily endorphin dose!</td>
<td>In the app you can see various exercises you can do.</td>
</tr>
<tr>
<td>5.</td>
<td>Being active reduces women’s risk of being diagnosed with breast cancer, the most common form of cancer in women.</td>
<td>Being inactive increases women’s risk of being diagnosed with breast cancer, the most common form of cancer in women.</td>
<td>Remember to complete the fitness test.</td>
</tr>
<tr>
<td>6.</td>
<td>Being physically active can improve your sleep and mood.</td>
<td>Being inactive can impair your sleep and worsen your mood.</td>
<td>Remember to log your sleep quality.</td>
</tr>
<tr>
<td>7.</td>
<td>Did you know that physical activity is a great way to help you deal with the stresses of your daily life.</td>
<td>Did you know that failing to engage in physical activity can reduce your ability to deal with the stresses of your daily life.</td>
<td>In the app you can do various relaxation exercises.</td>
</tr>
<tr>
<td>8.</td>
<td>Physical activity can reduce the risk of heart diseases</td>
<td>Physical inactivity can increase the risk of heart diseases</td>
<td>Remember to log your physical activity.</td>
</tr>
<tr>
<td>9.</td>
<td>Get active now, you will not regret it</td>
<td>If you don’t get active now, you might regret it later.</td>
<td>Remember to tell us how you are feeling today.</td>
</tr>
</tbody>
</table>
## Appendix D- Correlation between measures at week 1

### Correlation between measures: Week 1

<table>
<thead>
<tr>
<th>Measure</th>
<th>Stress level</th>
<th>Quality of sleep</th>
<th>Energy level</th>
<th>Step count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress level</td>
<td>r</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>$p$-value</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Quality of sleep</td>
<td>$r$ = -0.203</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>$p$-value</td>
<td>0.154</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Energy level</td>
<td>$r$ = -0.477***</td>
<td>0.432**</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>$p$-value</td>
<td>&lt; .001</td>
<td>0.002</td>
<td>—</td>
</tr>
<tr>
<td>Step count</td>
<td>$r$ = -0.140</td>
<td>-0.072</td>
<td>0.130</td>
<td>—</td>
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<tr>
<td></td>
<td>$p$-value</td>
<td>0.332</td>
<td>0.620</td>
<td>0.367</td>
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</table>

* $p < .05$, ** $p < .01$, *** $p < .001$
### Appendix E- Correlation between measures at week 2 and 3

**Correlation between measures – Weeks 2 and 3**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Stress level</th>
<th>Sleep quality</th>
<th>Energy level</th>
<th>Total steps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stress level</td>
<td>r</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>p-value</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Sleep quality</td>
<td>r</td>
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<td>—</td>
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<td>p-value</td>
<td>0.012</td>
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<tr>
<td>Energy level</td>
<td>r</td>
<td>-0.405 *</td>
<td>0.536 **</td>
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<td>0.001</td>
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<td>Total steps</td>
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<td>-0.281</td>
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<td>p-value</td>
<td>0.107</td>
<td>0.938</td>
<td>0.273</td>
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* p < .05, ** p < .01, *** p < .001
Appendix F - Self efficacy

Self-efficacy – Beginning survey

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<tr>
<td>Valid</td>
<td>52</td>
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<tr>
<td>Mean</td>
<td>4.308</td>
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<tr>
<td>Std. Deviation</td>
<td>0.8975</td>
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<tr>
<td>Minimum</td>
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<tr>
<td>Maximum</td>
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</table>

Self-efficacy between groups

<table>
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<th>Loss</th>
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<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participants</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>M</td>
<td>4,167</td>
<td>4,474</td>
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<tr>
<td>SD</td>
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<td>0,8412</td>
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</table>