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Cardiovascular disease patients' views on using financial incentives for health behavior change: Are deposit contracts acceptable?

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ABSTRACT

Background: There is an urgent need to find new approaches that improve long-term adherence to a healthy lifestyle for people with cardiovascular disease (CVD). Deposit contracts (a financial incentive in which the participant deposits own money) are inexpensive and effective, but acceptability among CVD patients is unclear. This study investigated the acceptability of a deposit contract intervention for physical activity among CVD patients.
Methods: We approached CVD patients through the Harteraad patient panel of the Dutch CVD patient organization and asked them to fill in an online survey. In total (N = 659) CVD patients with a mean age of 66.2 years completed the survey. The survey assessed acceptability of deposit contracts, responses to a concrete example of a deposit contract for physical activity behavior change, and suitable moments for implementation.
Results: Overall, half of the participants (45.6%) confirmed needing extra commitment to maintain life-style change. Yet, a small part of the sample was convinced by the idea that losing money could be moti-vating (18.8%) and indicated that they would be willing to deposit money themselves (13.2%). Responding to a concrete example of a deposit contract for physical activity, a quarter of the sample (26.2%) reported there was a chance they would participate. Furthermore, 27.1% of the participants found the deposit contract effective and 27.4% found it acceptable. Exploratory analyses showed that a sub-group of younger and lower educated participants responded more favorably. Opinions on when to start with a deposit contract were mixed.
Conclusions: Because acceptability was generally found to be low, future research should also investigate strategies to leverage commitment principles for CVD patients without a cash deposit requirement. When deposit contracts are offered to CVD patients in practice, we recommend offering them as an optional, additional element to existing interventions that patients can opt-in to.
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1. Introduction

People with cardiovascular diseases (CVD) are often referred to cardiac rehabilitation (CR), a comprehensive 12-week program during which they receive psycho-education, support with lifestyle change and guided physical exercise training.[1] At the same time, people with CVD are commonly advised to adhere to their medica-tion, quit smoking, lose weight, eat more healthily and exercise more. While people often initiate lifestyle changes during CR,[2] many relapse when they return to their everyday life, and changes in lifestyle are often not sustained.[3,4] Therefore, there is an urgent need to find new approaches that could serve as a supplement to CR and improve long-term adherence to a healthy lifestyle for CVD patients.[5]

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The field of behavioral economics (a fusion of traditional economic theory and psychology) helps explain why adhering to lifestyle changes is difficult, even for people with CVD.[6] Rather than making optimal decisions, people often fall for immediate temptations when decisions require short term sacrifice (e.g., exercising instead of relaxing on the couch with a spouse) to foster long-term goal achievement (e.g., preventing CVD related readmission to the hospital).[7] The finding that people tend to be most strongly driven by consequences in the here and now has been coined the present bias.[8] Present bias also helps explain why introducing immediate financial incentives is effective for promotion of (at least short term) health behavior change. Rather than having to wait for the long-term benefits of a healthy lifestyle to emerge, immediate financial incentives provide short term benefits in the here and now. Financial incentives require objective verification of behavior to avoid cheating and are therefore ideally combined with eHealth solutions. There is overwhelming evidence that adding financial incentives to existing interventions for health behavior change improves their efficacy.[9–13] However, financial incentive interventions are costly (US$ 1.5 /day/person),[13] and achieved intervention effects tend to disappear when incentives are withdrawn.[9–12] Deposit contracts, a form of incentive wherein people deposit their own money and risk losing it when not successful,[14] could be a solution to allow for large scale implementation without the need for external funding. Besides their implementation advantage, deposit contracts could have additional advantages over regular financial incentives, such as exploiting the mechanism of loss aversion.[15] Deposit contracts have proven to effectively support behavior change in various domains crucial to lifestyle change after a cardiovascular event: smoking cessation,[16] weight loss,[17] and physical activity.[18–20] Deposit contracts have also been applied specifically to a CVD population to increase medication adherence.[21]

Besides evidence of effectiveness, for implementation in practice it is important to determine acceptability of deposit contracts. Others have outlined objections to using financial incentives and stated that they can be perceived as unfair, coercive, inequitable, inconsistent with shared social values and threaten privacy.[7] The available evidence on the acceptability of financial incentives and deposit contracts is mixed. Studies have shown that, for smoking cessation[22,23] and weight loss[23] regular financial incentives and deposit contracts had similarly high levels of acceptability. On the other hand, a study on acceptability of financial incentives for weight loss showed that deposit contracts were about two times less acceptable compared to regular financial incentives.[24] Furthermore, low support for any type of financial incentive was found, but especially for deposit contracts.[24] More specifically, another study explored acceptability of financial incentives among a sample of cardiac rehabilitation patients.[25] Results show that acceptability of cash-based incentives was highly divided and nearly all participants preferred voucher-based incentives over cash incentives.[25] Although speculative, since deposit contracts are often operationalized as cash-based incentives, this might indicate low acceptability of deposit contracts among CVD patients.

The current study

To the best of our knowledge, it is currently unknown whether CVD patients find deposit contracts for lifestyle change acceptable. The available evidence implies that, despite their effectiveness in helping people achieve lifestyle goals, deposit contracts might not be acceptable to people with CVD. The primary aim of this study was to investigate the acceptability of a deposit contract for lifestyle change in CVD patients. Secondly, we evaluated responses to a concrete example of a deposit contract for physical activity and at what point in time during their patient journey CVD patients would like to start with a deposit contract.

2. Methods

2.1. Participants

Participants were recruited through an email sent to 2625 panel members of the Dutch Harteraad Patient Panel, the official national Dutch CVD patients' association. The panel consists of people who were diagnosed with cardiovascular disease or who were a close relative or caregiver to someone with cardiovascular disease. We included participants who were 18 years and older and were diagnosed with heart disease (diseases related to the heart, e.g. coronary heart disease), vascular disease (diseases related to the blood vessels, e.g. peripheral artery disease), or both. We excluded participants who were a relative or caregiver to someone else with CVD. In total, 659 CVD patients completed the survey (for more detail on demographic information of the sample see Table 1 below).

2.2. The survey

This cross-sectional survey study was approved by the Psychology Research Ethics Committee of Leiden University (2020-03-18-T. Reijnders-V1-2312). The survey was administered in Dutch and took about 15 minutes to fill in. The panel manager of the Harteraad Patient Panel shared a description of the study and a link to the survey with all members via email. After agreeing to the online consent form, participants were first asked to provide demographic information (gender, age, education, income, partner status, level of social support), and their disease status. Thereafter, the survey was separated into two parts. The first part belonged to a related research project and assessed preferences with regard to digital coaching. The latter half of the survey was analyzed for the current study and will be further explained below under section 2.3 Measures (see appendix A for the original items used in the current study). Responses to questions on education and income were categorised into low, middle and high.[26–28] After completing the survey, participants were debriefed, thanked for their participation,

Table 1
Demographic information (N = 659).

Age (N = 653)	
Years	66.18 (11.00) (minimum 22 years, maximum 94 years)
Gender (N = 659)	
Male	429 (65.1%)
Female	230 (34.9%)
Income (Monthly) (N = 659)	
Low (<€1500)	148 (22.5%)
Medium (€1500 – €2500)	278 (42.2%)
High (>€2500)	233 (35.4%)
Education (N = 643)	
Low	134 (20.3%)
Middle	196 (29.7%)
High	320 (49.8%)
Partner status (N = 659)	
No partner	143 (21.7%)
Partner not living together	19 (2.9%)
Partner living together	497 (75.4%)
Disease status (N = 659)	
Heart disease	343 (52.1%)
Vascular disease	149 (22.6%)
Heart and Vascular disease	167 (25.3%)
Social support score (N = 659)	
5-point Likert scale	4.09 (1.13)

*data are means (SD) or frequencies (%).

and received a short summary of the results a few weeks later (see appendix C).

2.3. Measures

Here, we describe which items were used to measure responses to deposit contracts. For more detail on the survey items, see appendix A.

2.3.1. Acceptability of deposit contracts

People were explained what a deposit contract is and told they could use it to help them reach a concrete lifestyle change goal: *"Many people need extra commitment to sustain a long-term lifestyle change. With a lifestyle challenge, you set a concrete goal for lifestyle change and put your own money on the line. You can lose this money if you don't sustain the lifestyle change. Because you do not want to lose the money, you have an extra incentive to maintain a lifestyle change at difficult times."*. They were then asked to reply to the following three statements on a 5-point Likert scale (1 = totally disagree, till 5 = totally agree): *I need extra commitment to maintain my lifestyle change; I think the risk of losing money can motivate me to maintain my lifestyle change; I would be willing to deposit an amount of money for a lifestyle challenge.* Furthermore, we asked *"What amount of money would you like to deposit in a lifestyle challenge?"*.

2.3.2. Responses to a concrete example for physical activity

Next, we provided a concrete example of a deposit contract for physical activity: *"Imagine you want to exercise more and therefore set the goal to take 1000 steps more per day than you normally do. For extra motivation, we now ask you to put in 10 euros of your own money as a challenge. Every day you will receive a message from us in which we tell you whether you succeeded in achieving your goal that day. Every day that you reach the goal, you earn back part of your own investment. The more goals you achieve, the more money you will get back."*. We then asked participants to reply to the following three questions on a 5-point Likert scale (1 = very small; totally not effective; totally not acceptable, 5 = very large; totally effective; totally acceptable): *How big is the chance that you would participate in this lifestyle challenge yourself; How effective do you think this lifestyle challenge is; How acceptable do you think this lifestyle challenge?*

2.3.3. Suitable moments for implementation

Finally, to identify suitable moments for implementation, we used multiple choice questions, and asked participants at what time they would find starting with a deposit contract most appropriate. Firstly, on a general level, we asked *"What would be the right time for you to start a lifestyle challenge?"*. More specifically, we then asked *"Imagine that you are/have been admitted to the hospital for a problem with your heart. What would be the right time for you to start a lifestyle challenge?"*.

2.4. Design and analysis

We used 5-point Likert scales for items on deposit contract acceptability and responses to a concrete example for physical activity. We interpreted the percentage of participants that replied above the neutral midpoint of scale, thus indicating some or strong agreement (4 = agree or 5 = totally agree) with the presented statements. We used multiple choice questions to assess suitable moments for implementation. Data was analyzed using pairwise exclusion and no outliers were removed for the reported analyses. To analyze data and create graphs and tables, we used SPSS version 25 and Microsoft Word. In all tests, we used alpha = 0.05 for determining statistical significance.

2.4.1. Subgroup analysis

To explore whether subgroups within our patient population may differ in their responses to our outcome variables, we analyzed the relationship between the predictors age, social support, gender, education, income, disease and partner status and the outcome items. For continuous variable such as *age,* we used linear regressions to investigate the relationship with continuous outcome items, binary logistic regressions for binary outcome items, and multinomial logistic regressions for categorical outcome items. For categorical variables such as *education* (low/high) we ran MANOVAS to investigate the relationship with continuous items, and Chi Square tests for binary and categorical outcome items. For a full overview of all exploratory analyses. please see appendix D. Please note that although we performed multiple comparisons, due to the exploratory nature of these analyses, we did not apply any corrections. Therefore, we are very careful to interpret the findings.

3. Results

3.1. Descriptives

In total 659 (N = 659) CVD patients with a mean age of 66.2 (*SD* = 11.0) years old completed the survey (See Table 1 above). The sample consisted of a majority of males, with mostly medium or high incomes, educational level was spread evenly and most were living together with a partner. Furthermore, the majority of participants reported suffering from heart disease and scores for social support were relatively high.

3.2. Main findings

3.2.1. Acceptability of deposit contracts

Almost half of the sample reported needing extra commitment to maintain their lifestyle change (45.6%). However, a smaller part of the sample was convinced by the idea that losing money could be motivating (18.8%) or reported to be willing to deposit money themselves (13.2%). When asked what amount they would deposit, more than half responded with 'nothing' (57.8%) and the rest (42.2%) responded they would be willing to deposit some of their own money. See Fig. 1 below for more detail. Descriptives are reported in more detail in appendix B.

3.2.2. Responses to a concrete example for physical activity

Responding to a concrete example of a deposit contract for physical activity, around a quarter of the sample (26.2%) reported there was a chance they would participate. Furthermore, around a quarter of the sample found the deposit contract effective (27.1%) and acceptable (27.4%). See Fig. 2 below for more detail.

Suitable moments for implementation

About half of the participants would start a deposit contract directly when they started with lifestyle change (50.1%), and the other half would like to start a deposit contract only when they would experience difficulties maintaining their lifestyle change (49.9%). When asked when to start a deposit contract after a cardiac incident occurred, answers were spread across the answer options with no clear preference emerging. See Fig. 3 below for more detail.

3.3. Subgroup analyses

Generally, most of the predictor variables we explored were barely related to our outcome variables, with the exception of *age* and *education*. With regards to age, older participants reported a lower need for extra commitment (β = -0.181), lower willingness

"I need extra commitment to maintain my lifestyle change" (N = 561)

102 (18.2%)	95 (16.9%)	108 (19.3%)	164 (29.2%)	92 (16.4%)
Totally disagree		Neutral		Totally agree

"I think the risk of losing money can motivate me to maintain my lifestyle change" (N = 561)

198 (35.3%)	124 (22.1%)	134 (23.9%)	80 (14.3%)	25 (4.5%)
Totally disagree		Neutral		Totally agree

"I would be willing to deposit an amount of money for a lifestyle challenge" (N = 561)

253 (45.1%)	132 (23.5%)	102 (18.2%)	59 (10.5%)	15 (2.7%)
Totally disagree		Neutral		Totally agree

"What amount would you like to deposit in a lifestyle challenge?" (N = 561)

324 (57.8%)	43 (7.7%)	64 (11.4%)	63 (11.2%)	67 (11.9%)
Nothing	€0-10	€10-20	€20-50	> €50

Fig. 1. Results on acceptability of deposit contracts. *data are frequencies (%).

"How big is the chance that you would participate in this lifestyle challenge yourself ?" (N = 548)

223 (40.7%)	69 (12.6%)	98 (17.9%)	87 (13.2%)	71 (13.0%)
Very small		Neutral		Very large

"How effective do you think this lifestyle challenge is?" (N = 550)

171 (31.1%)	94 (17.1%)	129 (23.5%)	116 (21.1%)	40 (6.1%)
Totally not effective		Neutral		Totally effective

"How acceptable do you think this lifestyle challenge is?" (N = 548)

185 (33.8%)	81 (14.8%)	132 (24.1%)	115 (21.0%)	35 (6.4%)
Totally not acceptable		Neutral		Totally acceptable

Fig. 2. Results on a concrete example for physical activity. *data are frequencies (%).

"What would be the right time for you to start a lifestyle challenge?" (N = 561)

281 (50.1%)	280 (49.9%)
As soon as I start my lifestyle change	Only when I encounter struggles in maintaining my lifestyle change

"Imagine that you are/have been admitted to the hospital for a problem with your heart. What would be the right time for you to start a lifestyle challenge?" (N = 561)

167 (29.8%)	147 (26.2%)	157 (28.0%)	90 (16.0%)
Directly after hospitalization	Shortly after hospitalization	At start of cardiac rehabilitation	At end of cardiac rehabilitation

Fig. 3. Results on suitable moments for implementation. *data are frequencies (%).

to deposit money (β = -0.103) and less preference to deposit something rather than nothing into a deposit contract (β = −0.023). Furthermore, older participants reported that they found the deposit contract example less acceptable (β = −0.089). These effects however were small. With regards to education, participants with lower education reported a higher need for extra commitment

than participants with higher education (M = 3.28, SD = 1.35 versus M = 2.92, SD = 1.33). Also, participants with lower education reported that losing money could motivate them more than participants with higher education (M = 2.46, SD = 1.28 versus M = 2.18, SD = 1.14). Furthermore, participants with lower education reported that they found the deposit contract example more effective than participants with higher education (M = 2.71, SD = 1.29 versus M = 2.44, SD = 1.31), and there was a trend towards significance where participants with lower education had a higher odd of participating than participants with higher education (M = 2.59, SD = 1.45 versus M = 2.35, SD = 1.48). Interestingly, regarding suitable moments for implementation preferences reversed according to educational level. For participants with lower education, the majority (n = 157) would start a deposit contract only when they would experience troubles with maintaining lifestyle change, while among participants with higher education, the majority (n = 150) would start a deposit contract directly. For the full overview of all exploratory analyses see Appendix D.

4. Discussion

We studied acceptability of deposit contracts for lifestyle change among CVD patients and found that, although participants often reported to need extra commitment, opinions on acceptability were divided. A large part of the sample was not convinced that depositing some of their own money - and possibly losing that - would be a suitable tool to support maintenance of lifestyle change. At the same time there was a small part of the sample that reported higher acceptability. This pattern of results was also found when participants responded to a concrete example of a deposit contract for improving physical activity. Most participants rejected the deposit contract in the example, while a minority responded positively. Exploratory subgroup analyses showed that a subgroup of younger and lower educated participants responded more favorably. Finally, opinions on suitable moments for implementation of a deposit contract were split across the answer options.

Deposit contracts did not appear acceptable to a large part of the sample. This finding is consistent with the two studies that indicated low or divided acceptability of cash deposit contracts.[24,25] Possibly, CVD patients have ethical objections to deposit contracts and do not want to risk losing their own money. At the same time, our finding is in contrast with the two studies that indicated high acceptability.[22,23] Importantly, these studies[22,23] that show high acceptability studied samples with a mean age of around 41 years, whereas the two studies that showed lower acceptability studied samples with a mean age of 64 years[24] or that ranged between 54 and 84 years.[25] The mean age of our sample was 66 years and we suspect this might explain why our results are more in line with work that showed lower acceptability. Further support for the idea that age is related to acceptability comes from our subgroup analyses which showed that, within our sample, younger participants reported higher acceptability of deposit contracts. Possibly, because younger participants are more risk prone,[29] they show higher acceptability of an intervention that involves risking some of their own money. Whether risk proneness indeed explains why younger CVD patients report higher acceptability of deposit contracts should be further studied.

In response to a concrete example of a deposit contract for physical activity, again we found that for the majority of the sample acceptability was low. When asked about the chance that they would participate, the effectiveness and the acceptability of this deposit contract, consistently around 75% of participants rejected the deposit contract while 25% responded positively. Again, this result is in line with other studies[24,25] and shows that a cash deposit contract for physical activity will not appeal to the major-

ity of CVD patients. Importantly, there appears to be a subgroup of patients to whom deposit contracts do have an appeal and it is this subgroup that should be targeted when implementation of deposit contracts is considered. Future research should investigate what characterizes the subgroup of CVD patients who are open to using deposit contracts to maintain their lifestyle change.

Finally, with regards to when participants would like to start with a deposit contract, we found that answers were split across the answer options. To intervention providers, offering a deposit contract at the end of cardiac rehabilitation might make intuitive sense to help patients bridge the gap between cardiac rehabilitation and the 'unsupported' home environment. However, starting a deposit contract at the end of cardiac rehabilitation was the least preferred option among our sample. Most CVD patients indicated preference for starting a deposit contract either directly after hospitalization, shortly after hospitalization or at the start of cardiac rehabilitation. Perhaps patients believe that it is best to start a deposit contract early, because motivation to commit to lifestyle change (with a deposit contract) might then be at its peak. Based on these findings we recommend offering a deposit contract to CVD patients earlier rather than later in their rehabilitation process.

Interestingly, lower educated participants more often reported needing extra commitment, and were more accepting of deposit contracts. This finding is promising since CVD patients with lower socio-economic position (SEP), of which educational level is an indicator, are much less likely to make lifestyle changes after myocardial infarction.[30] Therefore, others have argued that increasing lower SEP groups' participation in CR and other secondary prevention programs should be a priority.[30] It is possible that lower educated participants are aware that they will experience more issues in maintaining their lifestyle changes and therefore are more open to receive support in the form of a deposit contract. Future work should further investigate whether and why lower educated people are indeed an appropriate target group for deposit contracts.

A limitation of the current study is that we asked participants to respond to hypothetical deposit contracts. While this setup allowed us to gain first insight in acceptability, actually offering them in practice would provide more realistic insights. Also, this study did not assess acceptability of other types of financial incentives or commitment strategies. Therefore, no direct comparison can be made between the acceptability of deposit contracts and other strategies that might support maintenance of physical activity behavior change among CVD patients. Another limitation is that the external validity of our findings is limited because the sample consisted of patient panel members. CVD patients who decide to participate in a patient panel might not be representative of the entire population of CVD patients. For example, our sample appeared to have a relatively high income and high level of education. This sample might have more active coping with their cardiovascular condition and could also be more motivated to change their lifestyle. Future research should actually offer a deposit contract to CVD patients and investigate the real-world uptake, effects and acceptability. Since only a subgroup of CVD patients responded positively to deposit contracts, we recommend that intervention providers offer them as an additional element to existing interventions that CVD patients can opt-in to. Implementing deposit contracts in this way avoids issues with acceptability among those who refuse them, but allows uptake by those who are interested. Furthermore, future research should investigate strategies to leverage commitment principles for CVD patients that do not have a cash deposit requirement. For example, perhaps one could similarly capitalize on the principle of loss aversion by having CVD patients commit to a bet with some level of social discomfort (e.g., bad hair day picture will be spread on social media if challenge is failed).

4.1. Conclusion

This study in a large sample of CVD patients showed that opinions on acceptability of deposit contracts for lifestyle change were divided. The majority of CVD patients did not find deposit contracts acceptable. Only a subgroup of CVD patients found deposit contracts for lifestyle change acceptable. When deposit contracts are offered to CVD patients in practice, we recommend offering them as an optional, additional element to existing interventions that patients can opt-in to.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Authors' contributions

Study design (DB, TR); data acquisition (DB, TC, IDB); data analysis and interpretation (DB, TR, AE); drafting the manuscript (DB, TR, AE); manuscript revision (DB, TR, TC, VJ, RK, HK, AE). All authors gave final approval and agreed to be accountable for all aspects of the work ensuring integrity and accuracy.

Appendix A:. Original survey items in Dutch and English

Acceptability of deposit contract principles (DUTCH)	
Explanation: Veel mensen hebben een stok achter de deur nodig om leefstijlverandering op lange termijn vol te houden. Bij een leefstijl uitdaging stel je een concreet doel voor leefstijlverandering en zet je eigen geld op het spel. Dit geld kun je verliezen als je de leefstijlverandering niet volhoudt. Doordat je het geld niet wilt verliezen, heb je op moeilijke momenten een extra stok achter de deur voor het volhouden van leefstijlverandering.	
Items:	**Answer options**
Ik heb een stok achter de deur nodig om mijn leefstijlverandering lang vol te blijven houden	5-point Likert *1 = Helemaal mee oneens* *5 = Helemaal mee eens*
Ik denk dat het risico om geld te verliezen mij kan motiveren om mijn leefstijlverandering op lange termijn vol te blijven houden	5-point Likert *1 = Helemaal mee oneens* *5 = Helemaal mee eens*
Ik zou bereid zijn om een geldbedrag in te zetten voor een leefstijluitdaging	5-point Likert *1 = Helemaal mee oneens* *5 = Helemaal mee eens*
Welk bedrag zou je in willen zetten bij een leefstijluitdaging?	Multiple choice *Niets* *0–10 euro* *10–20 euro* *20–50 euro* *Meer dan 50 euro*
Suitable moments for implementation	
Wat zou voor jou een geschikt moment zijn om een leefstijluitdaging te starten?	Multiple choice *Zodra ik start met gezonder te gaan leven* *Pas als ik merk dat ik moeite heb om gezonder leven lang vol te houden*
Stel je voor dat je voor een hartprobleem bent opgenomen (geweest) in het ziekenhuis. Wat zou voor jou dan een geschikt moment zijn om een leefstijluitdaging te starten?	Multiple choice *Direct nadat ik in het ziekenhuis ben opgenomen* *Kort nadat ik uit het ziekenhuis ben ontslagen* *Bij de start van de hartrevalidatie* *Aan het einde van de hartrevalidatie*
Concrete example for physical activity	
Explanation: Stel je voor: je wil meer gaan bewegen en stelt daarom het doel om per dag 1000 stappen meer te zetten dan je normaal doet. Voor extra motivatie vragen we je nu om 10 euro van je eigen geld in te leggen als een uitdaging. Elke dag krijg je een bericht van ons waarin we vertellen of het jou die dag is gelukt om je doel te halen. Elke dag dat je het doel haalt, verdien je een gedeelte van je eigen inleg terug. Hoe meer doelen je haalt, hoe meer geld je terugkrijgt.	
Items:	
Hoe groot is de kans dat jij deze leefstijl uitdaging zelf zou doen?	5-point Likert *1 = Hele kleine kans*

Appendix A (*continued*)

Acceptability of deposit contract principles (DUTCH)

Explanation: Veel mensen hebben een stok achter de deur nodig om leefstijlverandering op lange termijn vol te houden. Bij een leefstijl uitdaging stel je een concreet doel voor leefstijlverandering en zet je eigen geld op het spel. Dit geld kun je verliezen als je de leefstijlverandering niet volhoudt. Doordat je het geld niet wilt verliezen, heb je op moeilijke momenten een extra stok achter de deur voor het volhouden van leefstijlverandering.

	5 = Hele grote kans
Hoe effectief denk je dat deze leefstijl uitdaging is?	5-point Likert
	1 = Helemaal niet effectief
	5 = Helemaal wel effectief
Hoe acceptabel vind je deze leefstijl uitdaging?	5-point Likert
	1 = Helemaal niet acceptabel
	5 = Helemaal wel acceptabel

Acceptability of deposit contract principles (ENGLISH)

Explanation: *Many people need extra commitment to sustain a long-term lifestyle change. With a lifestyle challenge, you set a concrete goal for lifestyle change and put your own money on the line. You can lose this money if you don't sustain the lifestyle change. Because you do not want to lose the money, you have an extra incentive to maintain a lifestyle change at difficult times*

Items:	Answer options:
I need extra commitment to maintain my lifestyle change/ I would be willing to deposit an amount of money for a lifestyle challenge.	5-point Likert *1 = Totally disagree* *5 = Totally agree*
I think the risk of losing money can motivate me to maintain my lifestyle change	5-point Likert *1 = Totally disagree* *5 = Totally agree*
I would be willing to deposit an amount of money for a lifestyle challenge	5-point Likert *1 = Totally disagree* *5 = Totally agree*
What amount would you like to deposit in a lifestyle challenge?	Multiple choice *Nothing* *0–10 euro* *10–20 euro* *20–50 euro* *More than 50 euro*

Suitable moments for implementation

What would be the right time for you to start a lifestyle challenge?	Multiple choice *As soon as I start my lifestyle change/* *Only when I encounter struggles in* *maintaining my lifestyle change*
Imagine that you are/have been admitted to the hospital for a problem with your heart. What would be the right time for you to start a lifestyle challenge?	Multiple choice *Directly after hospitalization* *Shortly after hospitalization* *At the start of cardiac rehabilitation* *At the end of cardiac rehabilitation*

Concrete example for physical activity

Explanation: *Imagine you want to exercise more and therefore set the goal to take 1000 steps more per day than you normally do. For extra motivation, we now ask you to put in 10 euros of your own money as a challenge. Every day you will receive a message from us in which we tell you whether you succeeded in achieving your goal that day. Every day that you reach the goal, you earn back part of your own investment. The more goals you achieve, the more money you will get back*

Items:

How big is the chance that you would participate in this lifestyle challenge yourself?	5-point Likert *1 = Very small chance* *5 = Very large chance*
How effective do you think this lifestyle challenge is?	5-point Likert *1 = Totally not effective* *5 = Totally effective*
How acceptable do you think this lifestyle challenge is?	5-point Likert *1 = Totally not acceptable* *5 = Totally acceptable*

Appendix B:. Descriptive results

Table 2.

Table 2
Main results.

Acceptability of deposit contract principles	
I need extra commitment (N = 561)	3.09 (1.36)
Losing money can motivate me (N = 561)	2.30 (1.21)
I would be willing to deposit money (N = 561)	2.02 (1.14)
What amount would you deposit? (N = 561)	
Nothing	324 (57.8%)
0–10 euro	43 (7.7%)
10–20 euro	64 (11.4%)
20–50 euro	63 (11.2%)
More than 50 euro	67 (11.9%)
Response to concrete example	
Your odds of participating? (N = 548)	2.48 (1.47)
How effective? (N = 550)	2.56 (1.32)
How acceptable? (N = 548)	2.51 (1.32)
Suitable moments for implementation	
When to start a challenge? (N = 561)	
Directly at the start	281 (50.1%)
When troubles occur	280 (49.9 %)
After a cardiac incident, when to start a challenge? (N = 561)	
Directly after hospitalization	167 (29.8 %)
Shortly after hospitalization	147 (26.2 %)
At the start of cardiac rehabilitation	157 (28.0 %)
At the end of cardiac rehabilitation	90 (16.0%)

*Data are means (SD) or frequencies (%).
*Means are based on 5-point Likert scales (1–5).

Appendix C:. Summary of results that was shared with patient panel

This appendix contains the summary of results that was shared with members of the patient panel. The original version was written in Dutch, and we have added a translation in English.

Dutch version (original)

Een stok achter de deur nodig? Panelstudie naar coaching en uitdagingen voor een gezondere leefstijl.

Enkele weken geleden hebben onderzoekers van Universiteit Leiden jullie uitgenodigd voor een vragenlijststudie naar gezond leefgedrag. Dankzij de grote respons (waarvoor dank!) hebben wij meer inzicht gekregen in de voorkeuren voor leefstijlcoaching en -uitdagingen onder mensen met hart- en vaatziekten. Graag geven wij een korte samenvatting van de antwoorden van de 792 respondenten die de vragenlijst hebben ingevuld.

Leefstijlcoaching

De eerste opvallende bevinding is dat, wanneer er aan de leefstijl gewerkt wordt, 1 op de 4 mensen dit het liefst helemaal zelfstandig doet. Mocht er toch begeleiding aan te pas komen, dan is begeleiding op locatie door een coach favoriet. Begeleiding door familie of vrienden, of via een app of internet, heeft minder de voorkeur.

Gedurende een leefstijlprogramma, zijn haalbare en relevante taken het meest belangrijk. Dit wordt gevolgd door passende leefstijldoelen en het aanbod van feedback. Een gevoel van controle over en vertrouwen in het leefstijlprogramma worden ook als belangrijke aspecten benoemd.

Wanneer het leefstijlprogramma begeleid wordt door een computer, is bijna 1 op de 2 respondenten er (in min of meerdere mate) van overtuigd dat bovenstaande aspecten vervuld kunnen worden. Een uitzondering hierop is het gevoel van vertrouwen: slechts 1 op de 3 respondenten heeft vertrouwen in leefstijlbegeleiding door een computer. Het lijkt dus dat een computer wel de praktische zaken van de begeleiding (zoals het geven van taken en doelen) kan overnemen, maar dat vertrouwen toch alleen weggelegd is voor een menselijke coach.

Leefstijluitdagingen

Ongeveer de helft van de respondenten geeft aan dat zij in meer of mindere mate een stok achter de deur nodig hebben om leefstijlverandering op lange termijn vol te houden. Hiervoor blijkt het inzetten van een eigen geldbedrag echter niet populair.

Aan een leefstijl uitdaging waarbij men iedere dag 10.000 stappen moet zetten om een ingelegd geldbedrag van 10 euro terug te verdienen wil ongeveer de helft van de respondenten zeker niet meedoen. De andere helft geeft aan hier wellicht interesse in te hebben, en hiervan ziet een kleine minderheid van ongeveer 80 mensen dit idee wel zitten. Als beloning komt korting op de aanvullende zorgverzekering heel duidelijk naar voren als voorkeursoptie.

Bij het voorleggen van een aantal concrete leefstijl uitdagingen, geeft ongeveer één derde van de deelnemers aan helemaal geen leefstijl uitdaging te willen gebruiken. Van de overige mensen geeft een ruime meerderheid de voorkeur aan een leefstijl uitdaging waarbij men door gezond te leven minder medicijnen hoeft te gebruiken en daardoor korting krijgt op de premie van de zorgverzekering.

www.benefitforall.nl voor meer informatie over ons onderzoek, en alle ontwikkelingen van het BENEFIT leefstijlplatform.

English translation

Need a stick behind the door? Panel study on coaching and challenges for a healthier lifestyle.

A few weeks ago, researchers from Leiden University invited you to participate in a questionnaire study into healthy lifestyles. Thanks to the large response (thanks for that!) we have gained more insight into the preferences for lifestyle coaching and challenges among people with cardiovascular disease. We would like to provide a short summary of the answers of the 792 respondents who completed the questionnaire.

Lifestyle coaching

The first striking finding is that when working on lifestyle, 1 in 4 people prefer to do this completely independently. If guidance is required, guidance on location by a coach is a favorite. Guidance from family or friends, or via an app or the internet, is less preferred.

During a lifestyle program, attainable and relevant tasks are most important. This is followed by appropriate lifestyle goals and the offer of feedback. A sense of control over and confidence in the lifestyle program are also mentioned as important aspects.

When the lifestyle program is guided by a computer, almost 1 in 2 respondents is (to a greater or lesser extent) convinced that the above aspects can be fulfilled. An exception to this is the feeling of trust: only 1 in 3 respondents has confidence in lifestyle guidance provided by a computer. It therefore seems that a computer

can take over the practical matters of the guidance (such as giving tasks and goals), but that trust is only reserved for a human coach.

Lifestyle challenges

About half of the respondents indicate that they need a big stick to a greater or lesser extent to sustain lifestyle change in the long term. However, using your own amount of money for this is not popular.

About half of the respondents certainly do not want to participate in a lifestyle challenge in which people have to take 10,000 steps every day to earn back an amount of money invested of 10 euros. The other half indicates that they may be interested in this, and a small minority of about 80 people like this idea. As a reward, a discount on the supplementary health insurance clearly emerges as a preferred option.

When presented with a number of concrete lifestyle challenges, about one third of the participants indicate that they do not want to use a lifestyle challenge at all. Of the other people, a large majority prefers a lifestyle challenge in which people have to use fewer medicines by living a healthy life and therefore receive a discount on the premium of the health insurance.

In conclusion, it can be said that opinions are divided. Yet in lifestyle coaching in general there is a preference for human guidance, but a computer also seems to be able to fulfill aspects of this guidance. In lifestyle challenges, a small group may benefit from financial incentives, and rewards are best given in the form of discounts on health insurance. These insights are valuable for science, but they are particularly important for practice. Thanks in part to you, we can develop new (eHealth) interventions, or improve existing ones, that can help in starting and maintaining a healthy lifestyle. Visit https://www.benefitforall.nl for more information about our research and all developments of the BENEFIT lifestyle platform.

Appendix D:. Exploratory analyses

1. Exploratory analyses outcomes: acceptability of deposit contracts

Firstly, to explore the relationship between the three Likert items on deposit contract acceptability and the continuous independent variables (*age, social support*) we ran 6 (2 IVs × 3 DVs) simple linear regressions (see Table 3). Secondly, we explored the relationship between the three Likert items on deposit contract

acceptability and the categorical independent variables (*gender, income, education, partner status, disease status*) with 5 MANOVAS (see Table 4). We used simple contrasts to follow up on significant results. During data exploration we noticed that responses on the item for how much money participants would be willing to deposit resulted in a floor effect. About half the participants chose the answer option 'nothing' and the other half was about evenly divided over the other answer options. Therefore, we decided to analyze this as a binary variable (nothing/something) using binary logistic regression analysis. We ran 2 binary logistic regressions for continuous independent variables (see Table 5) and 5 Chi square tests for categorical independent variables (see Table 6).

2. Exploratory analyses outcomes: responses to a concrete example for physical activity

To investigate the relationship between the three Likert items on responding to a concrete example of a deposit contract for physical activity and the continuous independent variables (*age, social support*) we ran 6 (2 IVs × 3 DVs) simple linear regressions (see Table 7). Additionally, to explore the relationship between the categorical independent variables (*gender, income, education, partner status, disease status*) and the three Likert items we performed 5 separate MANOVAS (one for each categorical independent variable) with the three Likert items as dependent variables (see Table 8). We used simple contrasts to follow up on significant results.

3. Exploratory analyses outcomes: Suitable moments for implementation

To investigate the relationship with the item 'when to start a challenge' we ran 2 binary logistic regressions for continuous independent variables (*age, social support*) (see Table 9) and 5 Chi square tests for categorical independent variables (*gender, income, education, partner status, disease status* (see Table 10). For the item 'after an incident, when to start a challenge' we ran 5 Chi square tests for categorical independent variables (see Table 11). Thereafter, we set the reference category as 'first = directly after hospitalization' and ran 2 multinomial logistic regressions for continuous independent variables (see Table 10).

1. Exploratory analyses: acceptability of deposit contracts

Tables 3–6

Table 3

Univariate linear regression analyses of demographic variables age and social support on three Likert items outcome variables acceptability of deposit contracts.

Independent variable	Survey Item																				
	I need extra commitment						Losing money can motivate me						I would be willing to deposit money								
	B	b	SE	P-value	95% CI for (B)		B	b	SE	P-value	95% CI for (B)		B	b	SE	P-value	95% CI for (B)	
					Lower	Upper					Lower	Upper					Lower	Upper
Age	−0.181	−0.022	1.34	0.000*	−0.032	−0.012	−0.053	−0.006	1.21	0.209	−0.015	0.003	−0.103	−0.010	1.14	0.015*	−0.019	−0.002
Social support	−0.107	−0.127	1.35	0.011*	−0.224	−0.029	−0.007	−0.007	1.21	0.872	−0.095	0.081	0.018	0.018	1.14	0.663	−0.064	0.101

*, significant values (p <.05).
CI, confidence interval.
B = standardized regression coefficient.
b = unstandardized regression coefficient.
SE = standard error.

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Table 4
Multivariate Analysis of Variance (MANOVA) of demographic variables gender, education, income, disease status, partner status on three Likert items outcome variables acceptability of deposit contracts.

Independent Variable	Survey Item: I need extra commitment						Losing money can motivate me						I would be willing to deposit money					
Gender Univariate:	*Multivariate:* F (3, 557) = 4.35, η² = 0.023, P =.005*																	
	Male M = 3.00 SD = 1.35	**Female** M = 3.26 SD = 1.37		F (1, 559) = 4.64	η² = 0.008	P =.032*	**Male** M = 2.28 SD = 1.19	**Female** M = 2.34 SD = 1.26		F (1, 559) = 2.80	η² = 0.001	P =.597	**Male** M = 2.10 SD = 1.14	**Female** M = 1.87 SD = 1.12		F (1, 559) = 5.56	η² = 0.010	P =.019*
Education Univariate:	*Multivariate:* F (3, 542) = 4.97, η² = 0.027. P =.002*																	
	Low M = 3.28 SD = 1.35	**High** M = 2.92 SD = 1.33		F (1, 544) = 9.85	η² = 0.018	P =.002*	**Low** M = 2.46 SD = 1.28	**High** M = 2.17 SD = 1.14		F (1, 544) = 7.86	η² = 0.014	P =.005*	**Low** M = 2.03 SD = 1.14	**High** M = 2.02 SD = 1.15		F (1, 544) = 0.024	η² = 0.000	P =.878
Income Univariate:	*Multivariate:* F (6, 556) = 2.77 η² = 0.015, P =.011*																	
	Low M = 3,14 SD = 1.50	**Middle** M = 3.18 SD = 1.27	**High** M = 2.95 SD = 1.36	F (2, 558) = 1.65	η² = 0.006	P =.193	**Low** M = 2.54 SD = 1.40	**Middle** M = 2.30 SD = 1.11	**High** M = 2.16 SD = 1.18	F (2, 558) = 3.92	η² = 0.014	P =.020*	**Low** M = 1.94 SD = 1.16	**Middle** M = 2.00 SD = 1.12	**High** M = 2.10 SD = 1.14	F (2, 558) = 0.852	η² = 0.003	P =.427
							Simple contrast	**Low VS middle**	P =.065 SE = 0.133									
							Simple contrast	**Low VS high**	P =.005* SE = 0.136									
Disease status Univariate:	*Multivariate:* F (6, 556) = 2.64, η² = 0.014, P =.015*																	
	Heart M = 2.96 SD = 1.29	**Vascular** M = 3.15 SD = 1.41	**Heart & Vascular** M = 3.29 SD = 1.42	F(2, 558) = 3.24	η² = 011	P =.040*	**Heart** M = 2.38 SD = 1.22	**Vascular** M = 2.20 SD = 1.13	**H & V** M = 2.24 SD = 1.26	F (2, 558) = 1.26	η² = 0.005	P =.284	**Heart** M = 1.99 SD = 1.11	**Vascular** M = 2.14 SD = 1.16	**H & V** M = 1.98 SD = 1.18	F (2, 558) = 0.836	η² = 0.003	P =.434
	Simple contrast	**Heart vs Vacsular**	P =.171 SE = 0.145															
	Simple contrast	**Heart vs Heart & Vascular**	P =.014* SE = 0.137															
Partner status Univariate:	*Multivariate:* F (6, 556) = 2.89, η² = 0.015, P =.008*																	
	No partner M = 3.20 SD = 1.44	**Partner not living together** M = 2.94 SD = 1.35	**Partner living together** M = 3.06 SD = 1.33	F (2, 558) = 0.616	η² = 0.002	P =.540	**No partner** M = 2.39 SD = 1.30	**Partner not living together** M = 2.83 SD = 1.34	**Partner living together** M = 2.26 SD = 1.18	F (2, 558) = 2.38	η² = 0.008	P =.094	**No partner** M = 1.82 SD = 1.04	**Partner not living together** M = 1.89 SD = 1.02	**Partner living together** M = 2.09 SD = 1.17	F (2, 558) = 2.90	η² = 0.010	P =.056
														Simple contrast	**No partner VS partner not living together**	P =.019* SE = 0.116		
														Simple contrast	**No partner VS partner living together**	P =.799 SE = 0.286		

*, significant values (p <.05).
F = F-test statistic.
η2 = Partial eta squared.
M = Mean.
SD = Standard deviation.

Table 5
Univariate logistic regression analysis of demographic variables age and social support on dichotomous item of outcome variables acceptability of deposit contracts.

Independent variable	Survey Item *What amount would you deposit? (something/nothing)*						
	B	SE	Wald	P-value	Exp (B)	95% CI for Exp (B)	
						Lower	Upper
Age	-0.023	0.008	8.40	0.004*	0.978	0.963	0.993
Social support	-0.056	0.074	0.573	0.449	0.945	0.817	1.094

*, significant values (p <.05).
CI, confidence interval.
B = standardized regression coefficient.
Exp (B) = Exponential B.
Wald = Wald test statistic.
SE = standard error.

Table 6
Chi Square test cross tabulations of demographic variables gender, education, income, disease status, partner status on dichotomous item outcome variables acceptability of deposit contracts.

Independent variable	Survey Item *What amount would you deposit? (something/nothing)*					
		Nothing	Something	Chi square		
		Frequency	Frequency	X²	φ	P-value
Gender	**Total**	**324**	**237**	**1.082**	**0.044**	**0.298**
	Male	205	160			
	Female	119	77			
Education	**Total**	**316**	**230**	**1.85**	**-0.058**	**0.174**
	Low	149	122			
	High	167	108			
Income	**Total**	**324**	**237**	**1.25**	**0.047**	**0.535**
	Low	80	49			
	Middle	129	100			
	High	115	88			
Disease status	**Total**	**324**	**237**	**3.52**	**0.079**	**0.172**
	Heart	175	116			
	Vascular	62	61			
	Heart & vascular	87	60			
Partner status	**Total**	**324**	**237**	**0.456**	**0.029**	**0.796**
	No partner	75	50			
	Partner not living together	11	7			
	Partner living together	238	180			

*, significant values (p <.05).
φ, Phi = effect size for Chi square test.
X², Chi squared = Chi square test statistic.

2. Exploratory analyses outcomes: responses to a concrete example for physical activity

Tables 7 and 8

Table 7
Univariate linear regression analyses of demographic variables age and social support on three Likert items outcome variables responses to a concrete example for physical activity.

Independent variable	Survey Item																				
	How big is the chance you would participate in this lifestyle challenge yourself?						*How effective do you think this lifestyle challenge is?*						*How acceptable do you think this lifestyle challenge is?*								
	B	b	SE	P-value	95% CI for (B)		B	b	SE	P-value	95% CI for (B)		B	b	SE	P-value	95% CI for(B)				
					Lower	Upper					Lower	Upper					Lower	Upper			
Age	-0.057	−007	0.006	0.182	-0.019	0.004	-0.033	-0.004	0.005	0.441	-0.014	0.006	-0.089	-0.010	0.005	0.039*	-0.020	-0.001			
Social support	0.012	0.016	0.056	0.774	-0.093	0.126	0.105	0.121	0.049	0.013*	0.025	0.217	0.096	0.111	0.049	0.024*	0.015	0.207			

*, significant values (p <.05).
CI, confidence interval.
B = standardized regression coefficient.
b = unstandardized regression coefficient.
SE = standard error.

Table 8

Univariate Analysis of variance (ANOVA) of demographic variables gender, education, income, disease status, partner status on three Likert items outcome variables responses to a concrete example for physical activity.

Independent variable	Survey Item — How big is the chance you would participate in this lifestyle challenge yourself?						How effective do you think this lifestyle challenge is?						How acceptable do you think this lifestyle challenge is?					
Gender	*Multivariate:* $F_{(3, 542)} = 1.43$, $\eta^2 = 0.008$, $P = .233$																	
Univariate	**Male** M = 2.45 SD = 1.44	**Female** M = 2.54 SD = 1.53		$F_{(1, 544)} = 0.478$	$\eta^2 = 0.001$	$P = .489$	**Male** M = 2.58 SD = 1.30	**Female** M = 2.55 SD = 1.35		$F_{(1, 544)} = 0.057$	$\eta^2 = 0.000$	$P = .812$	**Male** M = 2.55 SD = 1.32	**Female** M = 2.45 SD = 1.31		$F_{(1, 544)} = 0.743$	$\eta^2 = 0.001$	$P = .389$
Education	*Multivariate:* $F_{(3, 527)} = 3.90$, $\eta^2 = 0.022$, $P = .009^*$																	
Univariate	**Low** M = 2.59 SD = 1.45	**High** M = 2.35 SD = 1.48		$F_{(1, 529)} = 3.663$	$\eta^2 = 0.007$	$P = .056$	**Low** M = 2.71 SD = 1.29	**High** M = 2.44 SD = 1.31		$F_{(1, 529)} = 5.86$	$\eta^2 = 0.011$	$P = .016^*$	**Low** M = 2.54 SD = 1.28	**High** M = 2.48 SD = 1.35		$F_{(1, 529)} = 0.230$	$\eta^2 = 0.000$	$P = .632$
Income	*Multivariate:* $F_{(6, 541)} = 1.92$, $\eta^2 = 0.011$, $P = .075$																	
Univariate	**Low** M = 2.41 SD = 1.50	**Middle** M = 2.64 SD = 1.48	**High** M = 2.34 SD = 1.43	$F_{(2, 543)} = 2.50$	$\eta^2 = 0.009$	$P = .083$	**Low** M = 2.55 SD = 1.39	**Middle** M = 2.69 SD = 1.33	**High** M = 2.45 SD = 1.24	$F_{(2, 543)} = 1.84$	$\eta^2 = 0.007$	$P = .160$	**Low** M = 2.35 SD = 1.32	**Middle** M = 2.63 SD = 1.32	**High** M = 2.49 SD = 1.30	$F_{(2, 543)} = 1.80$	$\eta^2 = 0.007$	$P = .167$
Disease status	*Multivariate:* $F_{(6, 541)} = 0.956$, $\eta^2 = 0.005$, $p = .454$																	
Univariate	**Heart** M = 2.43 SD = 1.46	**Vascular** M = 2.58 SD = 1.50	**Heart & vasculur** M = 2.49 SD = 1.49	$F_{(2, 543)} = 0.433$	$\eta^2 = 0.002$	$P = .65$	**Heart** M = 2.61 SD = 1.31	**Vascular** M = 2.55 SD = 1.31	**Heart & vasculur** M = 2.51 SD = 1.34	$F_{(2, 543)} = 0.270$	$\eta^2 = 0.001$	$P = .764$	**Heart** M = 2.51 SD = 1.31	**Vascular** M = 2.57 SD = 1.31	**Heart & vasculur** M = 2.49 SD = 1.34	$F_{(2, 543)} = 0.136$	$\eta^2 = 0.001$	$P = .873$
Partner status	*Multivariate:* $F_{(6, 541)} = 0.491$, $\eta^2 = 0.003$, $P = .816$																	
Univariate	**No partner** M = 2.51 SD = 1.44	**Partner not living together** M = 2.78 SD = 1.67	**Partner living together** M = 2.46 SD = 1.48	$F_{(2, 543)} = 0.435$	$\eta^2 = 0.002$	$P = .648$	**No partner** M = 2.64 SD = 1.28	**Partner not living together** M = 3.00 SD = 1.41	**Partner living together** M = 2.53 SD = 1.32	$F_{(2, 543)} = 1.28$	$\eta^2 = 0.005$	$P = .279$	**No partner** M = 2.57 SD = 1.31	**Partner not living together** M = 2.78 SD = 1.40	**Partner living together** M = 2.49 SD = 1.32	$F_{(2, 543)} = 0.520$	$\eta^2 = 0.002$	$P = .595$

*, significant values (p <.05).

F = F-test statistic.

η2 = Partial eta squared.

M = Mean.

SD = Standard deviation.

3. Exploratory analyses outcomes: suitable moments for implementation

Tables 9–11

Table 9
Univariate logistic regression analyses and multinomial logistic regression analyses of demographic variables age and social support on categorical items outcome variables B: Suitable moments for implementation.

Independent variable	Survey Item													
	When to start a challenge *(Directly at the start/after troubles occur)*						*After a cardiac incident, when to start a challenge?* *(Directly after hospitalization, Shortly after hospitalization. At the start of cardiac rehabilitation, At the end of cardiac rehabilitation)*							
	B	SE	Wald	P-value	Exp (B)	95% CI for Exp (B)			*B*	SE	Wald	P-value	Exp (B)	95% CI for Exp (B)	
						Lower	Upper							Lower	Upper
Age	0.010	0.008	1.65	0.199	1.01	0.995	1.025	Shortly after hospitalization (VS directly after hospitalization)	-0.001	0.010	0.005	0.944	0.999	0.980	1.02
								At the start of CR (VS directly after hospitalization)	0.003	0.010	0.114	0.735	1.00	0.984	1.02
								At the end of CR (VS directly after hospitalization)	-0.005	0.011	0.195	0.659	0.995	0.973	1.02
Social support	-0.027	0.074	0.135	0.713	0.973	0.842	1.125	Shortly after hospitalization (VS directly after hospitalization)	-0.007	0.104	0.005	0.945	0.993	0.810	1.22
								At the start of CR (VS directly after hospitalization)	-0.150	0.098	2.341	0.126	0.861	0.711	1.04
								At the end of CR (VS directly after hospitalization)	-0.179	0.113	2.54	0.111	0.836	0.670	1.04

*, significant values (p <.05).
CI, confidence interval.
B = standardized regression coefficient.
Exp (B) = Exponential B.
Wald = Wald test statistic.
SE = standard error.

Table 10
Chi Square test cross tabulations of demographic variables gender, education, income, disease status, partner status on dichotomous item outcome variables B: Suitable moments for implementation.

Independent variable	Survey Item *When to start a challenge (directly at the start/after troubles occur)*					
		Directly	After troubles	Chi square		
		Frequency	Frequency	X^2	φ	P-value
Gender	**Total**	**281**	**280**	**0.840**	**-0.039**	**0.359**
	Male	188	177			
	Female	93	103			
Education	**Total**	**278**	**268**	**8.45**	**-0.124**	**0.004***
	Low	121	150			
	High	157	118			
Income	**Total**	**281**	**280**	**3.70**	**0.081**	**0.158**
	Low	58	71			
	Middle	111	118			
	High	112	91			
Disease status	**Total**	**281**	**280**	**5.71**	**0.101**	**0.058**
	Heart	159	132			
	Vascular	59	64			
	Heart & vascular	63	84			
Partner status	**Total**	**281**	**280**	**1.31**	**0.048**	**0.519**
	No partner	57	68			
	Partner not living together	9	9			
	Partner living together	215	203			

φ, Phi = effect size for Chi square test.
X^2, Chi squared = Chi square test statistic.

Table 11

Chi square test cross tabulations of demographic variables gender, education, income, disease status, partner status on categorical item outcome variables B: Suitable moments for implementation.

Independent variable	Survey Item						
	After a cardiac incident, when to start a challenge? (Directly after hospitalization, Shortly after hospitalization. At the start of cardiac rehabilitation, At the end of cardiac rehabilitation)						
		Directly after hospitalization Frequency (%)	**Shortly after hospitalization** Frequency (%)	**At the start of cardiac rehabilitation** Frequency (%)	**At the end of cardiac rehabilitation** Frequency (%)	**Chi square**		
						X^2	φ	P-value
Gender	**Total**	**167**	**147**	**157**	**90**	**4.67**	**0.091**	**0.197**
	Male	118	87	103	57			
	Female	49	60	54	33			
Education	**Total**	**164**	**143**	**150**	**89**	**5.82**	**0.103**	**0.121**
	Low	70	71	79	51			
	High	94	72	71	38			
Income	**Total**	**167**	**147**	**157**	**90**	**11.97**	**0.146**	**0.063**
	Low	36	33	36	24			
	Middle	54	65	69	41			
	High	77	49	52	25			
Disease status	**Total**	**167**	**147**	**157**	**90**	**3.23**	**0.076**	**0.780**
	Heart	83	80	76	52			
	Vascular	36	31	39	17			
	Heart & vascular	48	26	42	21			
Partner status	**Total**	**167**	**147**	**157**	**90**	**7.68**	**0.117**	**0.262**
	No partner	32	27	45	21			
	Partner not living together	5	4	7	2			
	Partner living together	130	116	105	67			

*, significant values (p <.05).

φ, Phi = effect size for Chi square test.

X^2, Chi squared = Chi square test statistic.

References

1. Brouwers RWM, Houben VJG, Kraal JJ, Spee RF, Kemps HMC. Predictors of cardiac rehabilitation referral, enrolment and completion after acute myocardial infarction: an exploratory study. *Neth Heart J..* 2021;29 (3):151–157. https://doi.org/10.1007/s12471-020-01492-0.
2. Long L, Mordi IR, Bridges C, et al. Exercise-based cardiac rehabilitation for adults with heart failure. *Cochrane Database Syst Rev..* 2019;1:CD003331. https://doi.org/10.1002/14651858.CD003331.pub5.
3. Kotseva K, De Backer G, De Bacquer D, et al. Lifestyle and impact on cardiovascular risk factor control in coronary patients across 27 countries: Results from the European Society of Cardiology ESC-EORP EUROASPIRE V registry. *Eur J Prev Cardiol..* 2019;26(8):824–835. https://doi.org/10.1177/2047487318825350.
4. Zullo MD, Dolansky MA, Jackson LW. Cardiac rehabilitation, health behaviors, and body mass index post-myocardial infarction. *J Cardiopulm Rehabil Prev..* 2010;30(1):28–34. https://doi.org/10.1097/HCR.0b013e3181c8594b.
5. Peters RJG. Lifestyle changes in secondary prevention of coronary heart disease: breaking the chains of unhealthy habits. *Neth Heart J..* 2013;21(7):322–323. https://doi.org/10.1007/s12471-013-0437-4.
6. Hare AJ, Patel MS, Volpp K, Adusumalli S. The Role of Behavioral Economics in Improving Cardiovascular Health Behaviors and Outcomes. *Curr Cardiol Rep..* 2021;23(11):153. https://doi.org/10.1007/s11886-021-01584-2.
7. Halpern SD, Madison KM, Volpp KG. Patients as Mercenaries?: The Ethics of Using Financial Incentives in the War on Unhealthy Behaviors. *Circ Cardiovasc Qual Outcomes..* 2009;2(5):514–516. https://doi.org/10.1161/CIRCOUTCOMES.109.871855.
8. Laibson D. Golden Eggs and Hyperbolic Discounting. *Q J Econ..* 1997;112 (2):443–478. https://doi.org/10.1162/003355397555253.
9. Giles EL, Robalino S, McColl E, Sniehotta FF, Adams J. The Effectiveness of Financial Incentives for Health Behaviour Change: Systematic Review and Meta-Analysis. Baradaran HR, ed. *PLoS ONE.* 2014;9(3):e90347. doi:10.1371/journal.pone.0090347.
10. Kurti AN, Davis DR, Redner R, et al. A Review of the Literature on Remote Monitoring Technology in Incentive-Based Interventions for Health-Related Behavior Change. *Transl Issues Psychol Sci..* 2016;2(2):128–152. https://doi.org/10.1037/tps0000067.
11. Mantzari E, Vogt F, Shemilt I, Wei Y, Higgins JPT, Marteau TM. Personal financial incentives for changing habitual health-related behaviors: A systematic review and meta-analysis. *Prev Med..* 2015;75:75–85. https://doi.org/10.1016/j.ypmed.2015.03.001.
12. Strohacker K, Galarraga O, Williams DM. The Impact of Incentives on Exercise Behavior: A Systematic Review of Randomized Controlled Trials. *Ann Behav Med Publ Soc Behav Med..* 2014;48(1):92–99. https://doi.org/10.1007/s12160-013-9577-4.
13. Mitchell MS, Orstad SL, Biswas A, et al. Financial incentives for physical activity in adults: systematic review and meta-analysis. *Br J Sports Med.* Published online May 15, 2019:bjsports-2019-100633. doi:10.1136/bjsports-2019-100633.
14. Rogers T, Milkman KL, Volpp KG. Commitment Devices: Using Initiatives to Change Behavior. *JAMA.* 2014;311(20):2065. https://doi.org/10.1001/jama.2014.3485.
15. Tversky A, Kahneman D. Advances in prospect theory: Cumulative representation of uncertainty. *J Risk Uncertain..* 1992;5(4):297–323. https://doi.org/10.1007/BF00122574.
16. Halpern SD, French B, Small DS, et al. Randomized Trial of Four Financial-Incentive Programs for Smoking Cessation. *N Engl J Med..* 2015;372 (22):2108–2117. https://doi.org/10.1056/NEJMoa1414293.
17. Sykes-Muskett BJ, Prestwich A, Lawton RJ, Armitage CJ. The utility of monetary contingency contracts for weight loss: a systematic review and meta-analysis. *Health Psychol Rev..* 2015;9(4):434–451. https://doi.org/10.1080/17437199.2015.1030685.
18. Budworth L, Prestwich A, Sykes-Muskett B, et al. A feasibility study to assess the individual and combined effects of financial incentives and monetary contingency contracts on physical activity. *Psychol Sport Exerc..* 2019;44:42–50. https://doi.org/10.1016/j.psychsport.2019.04.021.
19. Donlin Washington W, McMullen D, Devoto A. A matched deposit contract intervention to increase physical activity in underactive and sedentary adults. *Transl Issues Psychol Sci..* 2016;2(2):101–115. https://doi.org/10.1037/tps0000069.
20. Stedman-Falls LM, Dallery J. Technology-based versus in-person deposit contract treatments for promoting physical activity. *J Appl Behav Anal..* 2020;53(4):1904–1921. https://doi.org/10.1002/jaba.776.
21. Putt ME, Reese PP, Volpp KG, et al. The Habit Formation trial of behavioral economic interventions to improve statin use and reduce the risk of cardiovascular disease: Rationale, design and methodologies. *Clin Trials.* Published online May 31, 2019:1740774519846852. doi:10.1177/1740774519846852.
22. Stedman-Falls LM, Dallery J, Salloum RG. Discrete Choice Experiments on The Acceptability of Monetary-Based Health Treatments: A Replication and Extension to Deposit Contracts. *Psychol Rec..* 2018;68(4):501–512. https://doi.org/10.1007/s40732-018-0296-x.
23. Raiff BR, Jarvis BP, Turturici M, Dallery J. Acceptability of an Internet-based contingency management intervention for smoking cessation: Views of smokers, nonsmokers, and healthcare professionals. *Exp Clin Psychopharmacol..* 2013;21(3):204–213. https://doi.org/10.1037/a0032451.
24. McGill B, O'Hara BJ, Grunseit AC, et al. Acceptability of financial incentives for maintenance of weight loss in mid-older adults: a mixed methods study. *BMC Public Health.* 2018;18:244. https://doi.org/10.1186/s12889-018-5136-z.

25. Mitchell MS, Goodman JM, Alter DA, Oh PI, Faulkner GEJ. "Will walk for groceries": Acceptability of financial health incentives among Canadian cardiac rehabilitation patients. *Psychol Health.*. 2014;29(9):1032–1043. https://doi.org/10.1080/08870446.2014.904863.

26. Opleidingsniveau. Accessed October 28, 2022. https://www.cbs.nl/nl-nl/nieuws/2019/33/verschil-levensverwachting-hoog-en-laagopgeleid-groeit/opleidingsniveau.

27. Nagelhout GE, de Korte-de BD, Kunst AE, et al. Trends in socioeconomic inequalities in smoking prevalence, consumption, initiation, and cessation between 2001 and 2008 in the Netherlands. Findings from a national population survey. *BMC Public Health*. 2012;12(1):303. https://doi.org/10.1186/1471-2458-12-303.

28. Reinwand DA, Crutzen R, Zank S. Online activities among elder informal caregivers: Results from a cross-sectional study. *Digit Health*. 2018;4:2055207618779715. doi:10.1177/2055207618779715.

29. Albert SM, Duffy J. Differences in Risk Aversion between Young and Older Adults. *Neurosci Neuroeconomics.*. 2012;2012(1). https://doi.org/10.2147/NAN.S27184.

30. Gaalema DE, Elliott RJ, Morford ZH, Higgins ST, Ades PA. Effect of Socioeconomic Status on Propensity to Change Risk Behaviors Following Myocardial Infarction: Implications for Healthy Lifestyle Medicine. *Prog Cardiovasc Dis.*. 2017;60(1):159–168. https://doi.org/10.1016/j.pcad.2017.01.001.