Stated Uptake of Physical Activity Rewards Programmes Among Active and Insufficiently Active Full-Time Employees

Semra Ozdemir¹ · Marcel Bilger¹ · Eric A. Finkelstein¹

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Abstract

Background Employers are increasingly relying on rewards programmes in an effort to promote greater levels of activity among employees; however, if enrolment in these programmes is dominated by active employees, then they are unlikely to be a good use of resources.

Objective This study uses a stated-preference survey to better understand who participates in rewards-based physical activity programmes, and to quantify stated uptake by active and insufficiently active employees.

Methods The survey was fielded to a national sample of 950 full-time employees in Singapore between 2012 and 2013. Participants were asked to choose between hypothetical rewards programmes that varied along key dimensions and whether or not they would join their preferred programme if given the opportunity. A mixed logit model was used to analyse the data and estimate predicted uptake for specific programmes. We then simulated employer payments based on predictions for the percentage of each type of employee likely to meet the activity goal.

Results Stated uptake ranged from 31 to 67% of employees, depending on programme features. For each programme, approximately two-thirds of those likely to enrol were insufficiently active.

Conclusion Results showed that insufficiently active employees, who represent the majority, are attracted to rewards-based physical activity programmes, and at approximately the same rate as active employees, even when enrolment fees are required. This suggests that a programme with generous rewards and a modest enrolment fee may have strong employee support and be within the range of what employers may be willing to spend.

Key Points for Decision Makers

There is a high demand for physical activity rewards programmes among both active and insufficiently active employees, even when enrolment fees are required.

Offering rewards greatly increases programme uptake, which could be as high as 67% of employees, depending on programme features.

A programme with generous rewards and a modest enrolment fee may have strong employee support and may be within the range of what employers would be willing to spend.

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✉ Eric A. Finkelstein
eric.finkelstein@duke-nus.edu.sg

Semra Ozdemir
semra.ozdemir@duke-nus.edu.sg

Marcel Bilger
marcel.bilger@duke-nus.edu.sg

¹ Programme in Health Services and Systems Research, Duke-NUS Medical School, 8 College Road, Level 4, Singapore 169857, Singapore

1 Introduction

Data from the Singapore National Health Survey (2010) revealed that only 61% of adults reach government recommendations of at least 150 min of moderate-intensity

physical activity per week [1]. This figure is even lower among full-time employees [2]. Because inactivity is a primary contributor to rising rates of noncommunicable diseases, increased medical expenditures, and reduced productivity on the job, employers are increasingly looking to identify strategies to promote greater levels of activity among employees [3].

Several randomised controlled trials (RCTs) have shown that offering rewards for reaching activity goals can be an effective strategy for encouraging greater levels of activity [4, 5]. However, because these studies are based on randomised designs, often with strict enrolment criteria, they provide little guidance on who would willingly sign up for such programmes and to what extent signup would be dominated by already active employees (a form of adverse selection). Rewards programmes would not be a good use of funds if mostly active employees sign up. This concern can be minimised by charging an enrolment fee, which would serve several purposes. First, the fee raises money that can be used to offset the employer's cost of providing rewards. Second, it may encourage greater changes in behaviour because people have been shown to work harder to avoid a loss than to obtain a gain of equal value. Third, because insufficiently active employees are less likely to obtain the reward, an enrolment fee also minimises employer concerns about adverse selection. The fee can be used to offset the employer's costs of paying rewards for active employees; however, it may also discourage some of the insufficiently active employees from signing up.

To shed light on these issues, we aimed to quantify stated uptake by active and insufficiently active employees in hypothetical physical activity programmes that vary in key features, including the amount of rewards offered and size of the enrolment fee. We hypothesized that larger rewards and lower enrolment fees will encourage greater uptake, and that participants will prefer to receive their rewards in cash as opposed to vouchers, credits in health savings accounts or charitable donations. We tested these hypotheses for active and insufficiently active employees using a discrete-choice experiment (DCE) survey. Because DCE surveys allow for measuring the relative value of select features of a product or programme (e.g. efficacy versus safety of a drug), they have been extensively used in health applications [6–10].

The results of this study will prove useful in identifying the extent to which key programme features differentially influence programme uptake, predict third-party payouts of offering select programmes, and quantify the percentage of payouts that go to active and insufficiently active employees. This information can be used by employers or governments who aim to develop rewards programmes to increase physical activity among full-time employees.

2 Methods

2.1 Participants

The survey was administered by a local survey research firm to a national sample of 950 full-time employees in Singapore from August 2012 to January 2013. Eligible respondents were defined as Singaporean citizens or permanent residents aged between 18 and 65 years who were working for at least 35 h in a week. A screener restricted potential respondents to those who were able to do at least 10 min of continuous moderate to vigorous physical activity (MVPA). A total of 1900 addresses of potential respondents were drawn from the Department of Statistics' National Database on Dwellings and used as the sampling frame. Using systematic random sampling, half of the addresses were randomly selected as replacement addresses to account for refusal, non-contact after five visits, or noneligibility. Once the eligible household was identified, a Kish Grid randomiser was used to identify a respondent in a household by matching the number of eligible household members with the selected respondent number.

Respondents were approached at their homes and the survey was administered by trained enumerators via face-to-face interviews (the questionnaire is provided in Online Appendix A). The response rate was 46% among eligible respondents, and the survey lasted approximately 30 min on average.

2.2 Survey Development

This study focused on physical activity rewards programmes that lasted for 6 months and where the activity levels would be tracked by the built-in GPS and step-counter function in a smartphone. Smartphone programmes allow users to personalise physical activity goal-setting and review their performance anywhere and at any time, reflecting their accessibility, scalability and cost effectiveness [11, 12]. Respondents were presented with alternatives for physical activity programmes that were defined by multiple features, termed 'attributes'. The programme attributes were (i) the value of rewards for meeting a weekly activity goal; (ii) a one-time enrolment fee; (iii) the minimum number of minutes someone would be required to spend on moderate-to-vigorous physical activity (MVPA) per week to obtain rewards; and (iv) type of rewards. The type of reward was included as a programme feature because many employers prefer to offer noncash rewards, such as gift vouchers, to avoid direct cash transfers [13]. Nonetheless, it is likely that not all rewards are equally attractive to employees. The type of rewards considered in this study include cash payments, vouchers (such

Table 1 Physical activity programme attributes and levels

Programme attributes	Levels
Weekly activity goal: minimum number of minutes required to spend on moderate to vigorous physical activity per week to obtain rewards	60 min (1 h) per week
	100 min (1.7 h) per week
	150 min (2.5 h) per week
	210 min (3.5 h) per week
Type of rewards for meeting weekly activity goals	Cash
	Vouchers to major chains
	MediSave (national health savings scheme in Singapore) credits
	Donation to a charity of choice
Value of rewards for meeting weekly activity goals	\$60 per week (maximum payout \$1440)
	\$40 per week (maximum payout \$960)
	\$30 per week (maximum payout \$720)
	\$15 per week (maximum payout \$390)
Enrolment fee: the one-time fee to join the programme	No fee
	\$50
	\$150
	\$300

Dollar values are based on Singapore dollars

as for a major grocery store or shopping mall), MediSave (a local health savings account) credits, and donations to a charity of the respondent's choice. The latter may be especially attractive to employers because of the tax-deductible nature of these expenses in many countries and the positive public relations that result from donating to charity. Table 1 lists the programme attributes and the levels of

each attribute used in the study. These attributes and levels were selected based on a literature review [14, 15], expert opinions, and interviews with employees and human resources staff (see Online Appendix B for details).

The survey introduced each programme attribute before the DCE tasks. In each DCE task, respondents were asked to first choose between two alternative programmes (Option 1 vs. Option 2), and were then asked a follow-up question on whether they would enrol in their preferred programme if it was offered. Figure 1 provides an example DCE trade-off task. The DCE tasks were constructed via an experimental design that required identifying the specific level for each attribute and pairing of two programmes in one choice task. The experimental design was created in Sawtooth version 8.2.4 (Sawtooth Software Inc., Orem, UT, USA) using a choice-based conjoint approach that provides near-orthogonal and near-optimal efficient randomised designs for measuring main effects [16]. Each respondent was randomly assigned to one of the four versions of ten tasks to reduce cognitive burden. The survey instrument also asked questions related to health, smartphone ownership and usage, and socioeconomic characteristics, and included a Global Physical Activity Questionnaire (GPAQ) to assess baseline physical activity levels.

To pretest the survey, we conducted cognitive interviews with five randomly selected eligible respondents, with each cognitive interview lasting approximately 1 h. Feedback from cognitive interviews was used to revise and rephrase survey items. Furthermore, the revised survey was pilot tested with 40 randomly selected respondents to test whether it was comprehensive and understandable, and whether respondents could complete it within 30 min. Based on feedback from the pilot interviews, some questions were

Fig. 1 An example DCE task

Programme feature	Which programme do you prefer?	
	Option 1	Option 2
Weekly activity goal	150 minutes (2.5 hrs) per week	60 minutes (1 hr) per week
Type of rewards	Vouchers	MediSave credits
Value of rewards	\$60 per week	\$15 per week
Enrolment fee	No enrolment fee	\$50
Code	1	2

Follow-up question	Would you join your preferred programme if it was offered to you?	
Code	Yes	No

revised to clarify the meaning of the questions, or were dropped to shorten the survey to prevent fatigue. Moreover, some sections of the survey were rearranged to improve the flow. The survey was administered in English, the primary language of working-age adults in Singapore, and in Mandarin, the language of the main ethnic group (69% of the population). The survey was developed in English and was then translated to Mandarin using the back-translation technique to ensure the quality of the translation. The study received ethics approval from the National University of Singapore's Institutional Review Board (IRB).

2.3 Analysis

The first step in the analysis was to subdivide respondents into three groups: (i) 'always enrol' group (those who chose to enrol in a programme in every task); (ii) 'never enrol' group; and (iii) 'sometimes enrol' group (those who sometimes chose enrolling in a programme and sometimes not). We then used a logistic model to identify characteristics most likely to predict group membership for respondents who chose to never enrol in any programme offered to them. We expect that older employees and employees who are insufficiently active are more likely to be in the 'never enrol' group compared with others ('always enrol' and 'sometimes enrol' groups).

The responses of the 'always enrol' and 'never enrol' groups to the DCE questions were not included in the analysis of the choice data because their responses were deterministic. Choice data from the 'sometimes enrol' group were analysed using a random utility model (RUM) to identify factors that influence programme uptake. The RUM assumes that individual n 's utility for programme i (U_{ni}) consists of a deterministic part (V_{ni}) and an error term (ε_{ni}) that is not observable, and the deterministic utility associated with each activity programme will be a function of programme attributes:

$$U_{ni} = V_{ni}(\beta_n X_i) + \varepsilon_{ni} \quad (1)$$

where X_i denotes a vector of attributes of programme i , and β_n denotes a vector of individual-specific preference weights associated with these programme attributes. Employees are expected to choose the programme that provides the highest expected utility. Given this framework, the probability that individual n chooses programme i over programme j is $\Pr(U_{ni} > U_{nj}) = \Pr(\varepsilon_{nj} - \varepsilon_{ni} < V_{ni} - V_{nj})$. The random error terms are assumed to be the independently and identically distributed extreme value.

We analysed the answers to the questions "Which programme do you prefer?" and "Would you join your preferred programme if it was offered to you?" jointly to investigate whether or not a respondent enrolls in a specified (Option 1 or 2) programme. If a respondent

chose 'Option 1' in the former and 'yes' in the latter, this was coded as 'Option 1'. If 'no' was chosen in the latter, this was coded as 'no programme'. We defined an alternative specific constant (ASC) to denote 'no programme' in the empirical model such that $V_{ni}(\alpha_n \text{ASC}; \beta_n X_i)$, where α_n denotes individual n 's coefficient for ASC and can be interpreted as the preference weight for not enrolling in any physical activity programme defined in the study. We investigated an interaction effect between ASC and being physically active (at baseline) to inform the difference in importance of opting out among the active and insufficiently active respondents. We also included interaction effects between programme attributes and a dummy variable indicating being physically active to quantify programme uptake separately for active and insufficiently active employees in the 'sometimes enrol' group. Interaction effects between the type of rewards and value of rewards were not found to be statistically significant.

The empirical model is defined as follows:

$$V_{ni} = \alpha_n \text{ASC} + \beta_n' X_i + \delta_n (\text{ASC} * \text{Active}_n) + \gamma_n' (X_i * \text{Active}_n) \quad (2)$$

where β_n and $(\beta + \gamma)_n$ provide a vector of individual-specific preference weights associated with the programme attributes for insufficiently active and active individuals in the 'sometimes enrol' group, respectively.

The RUM was estimated using a mixed logit regression, which is commonly used for analysing choice data in DCE surveys [17]. The mixed logit specification provides population estimates that allow for random variables, indicating the distribution of taste among respondents. The population estimates were used to obtain individual specific means and standard deviations of taste coefficients for each individual conditional on an observed panel of choices [18]. Prior to finalising the model, we tested for linearity of numerical attributes and interactions between each attribute and activity status.

For the 'sometimes enrol' group, predicted uptake for a specific programme was defined as the proportion of respondents whose utility associated with the programme was higher than the utility associated with not joining a programme, and was calculated separately for active and insufficiently active respondents. The probability of uptake of a specific programme was assumed to be 100% and 0% for the 'always enrol' and 'never enrol' groups, respectively. Overall programme uptake was calculated by taking a weighted average of uptake of those who sometimes enrol, those who never enrol (0% uptake) and those who always enrol (100% uptake). We used STATA 12 (StataCorp LLC, College Station, TX, USA) for all statistical analysis.

We simulated net payouts per employee, defined as the difference between rewards paid and enrolment fee collected,

for a candidate programme, as defined in Online Appendix C. The net payout takes into account the probability of joining the programme and the likelihood of meeting the activity goal conditional on joining. We do this separately for insufficiently active and active employees to quantify the extent to which the rewards are generating increased activity as opposed to rewarding those already active at baseline.

3 Results

Table 2 presents the descriptive statistics for respondents. The mean age of the sample was 41 years, the percentage of males was 57%, and the mean monthly household

income was SG\$2500 (approximately US\$1755). The corresponding statistics for the national sample of full-time employees in Singapore is a mean age of 45 years, 55% males, and a mean income of SG\$3000 (approximately US\$2142) [19], which shows that our sample is younger and poorer than the general population of full-time employees. Nearly 80% of the respondents reported their health status as good, very good or excellent. Almost all (99%) respondents owned a mobile phone, while 75% owned a smartphone. Approximately 21% of respondents paid to participate in physical activities (for gym memberships, classes, or races, etc.) in the previous year, and nearly 39% of respondents have previously participated in health promotion activities organised by their employer.

Table 2 Background characteristics of respondents

Characteristics	
Mean age (SD)	41 (11)
Mean household income	SG\$2500
Male (%)	57
Ethnicity (%)	
Chinese	69
Malay	13
Indian	15
Others	4
Married (%)	71
Self-rated health status (%)	
Poor	1
Fair	18
Good	52
Very good	23
Excellent	6
Calculated measure of obesity [on the basis of BMI ^a] (%)	
Underweight (BMI <18.4)	7
About the right weight (BMI between 18.5 and 22.9)	38
Slightly overweight (BMI between 23 and 27.4)	36
Very overweight (BMI >27.5)	19
Paid to participate in physical activities in the last 12 months (%)	21
Participated in the health promotion activities organised by employer (%)	39
Owens a smartphone (%)	75
Being physically active (%)	
Active (meeting physical activity guidelines based on self-report) ^b	72
Active (meeting physical activity guidelines based on adjusted activity minutes) ^c	32

Dollar values are based on Singapore dollars

SD standard deviation, BMI body mass index, MVPA moderate to vigorous physical activity, GPAQ General Physical Activity Questionnaire

^a BMI was computed as a measure of obesity and is defined as a person's weight in kilograms divided by the square of his height in meters (kg/m²). BMI categories were classified according to the Health Promotion Board Singapore classification

^b Self-reported MVPA minutes were computed according to the answers to the GPAQ and guidelines developed by the World Health Organization

^c Adjusted MVPA minutes were calculated based on the model explained in Online Appendix D

Based on respondents' reported activities in the GPAQ, 72% met the Health Promotion Board guidelines of 150 min of MVPA per week; however, we suspect actual levels to be much lower given that adults tend to overreport their activity levels by 40% or more [20–22]. Therefore, we adjusted the self-reported levels downward based on a field trial in Singapore that collected both self-reported and accelerometer-measured physical activity. In that study, 73% of employees claimed to have met the HBP guidelines based on GPAQ self-report, but only 34% met the guidelines based on accelerometer data [3]. We thus calculated adjusted MVPA minutes for each participant based on the ratio of objective MVPA minutes (as measured by accelerometers) to self-reported MVPA minutes (as measured by GPAQ) separately by sex and education level (see Online Appendix D for details). After adjusting for self-report, this figure is reduced to 32%.

3.1 Discrete-Choice Experiment Results

Based on responses to the DCE choice tasks, 30% of respondents chose to always enrol in a programme and 21% chose to never enrol. The remaining 49% would sign up for some programmes but not for others. A similar split was observed for active and insufficiently active respondents (Table 3). Table 4 reveals that those who chose to never enrol in the programmes offered were more likely to be older than 41 years (mean age), to not own a smartphone, and to have not previously paid to participate in physical activity programmes.

After testing different functional forms, goal and value of rewards were coded as linear, and type of rewards and enrolment fee were effects coded. We also tested for interaction effects by activity status and found significant effects for goal and value of rewards and for the ASC (no

Table 3 Programme participation by activity status^a

Respondents who always, sometimes, or never enrol	Active [<i>n</i> = 307] ^a	Insufficiently active [<i>n</i> = 643]	Total [<i>n</i> = 950]
Always enrol ^b	95	187	282
Sometimes enrol ^c	146	319	465
Never enrol ^d	66	137	203

Dollar values are based on Singapore dollars

MVPA moderate to vigorous physical activity, DCE discrete-choice experiment

^a 'Active' group included those respondents who meet the Health Promotion Board guidelines of 150 min of MVPA per week based on the adjusted MVPA minutes. Those who did not meet 150 min of MVPA per week were defined as 'insufficiently active'

^b 'Always enrol' group included those respondents who always chose to enrol in their preferred programme in every DCE task

^c 'Sometimes enrol' group included those who sometimes chose to enrol, and sometimes chose not to enrol, in their preferred programme

^d 'Never enrol' group included those who never chose to enrol in their preferred programme in every DCE task

Table 4 Logistic regression results for odds of never enrolling^a in a programme

	OR (95% CI)
Age: above 41 years	1.392* ^b (0.994–1.950)
Male	1.078 (0.782–1.486)
Self-rated health status: good or above	0.824 (0.556–1.221)
Owns a smartphone	0.649** (0.451–0.934)
Participated in the health promotion activities organised by employer	1.126 (0.806–1.574)
Paid to participate in physical activities such as gym membership, classes or races, etc.	0.599** (0.385–0.932)
Physically active (meeting physical activity guidelines based on self-reported MVPA minutes) ^c	1.166 (0.813–1.673)
Constant	0.325*** (0.183–0.578)
Log-likelihood	–481.13
McFadden's <i>R</i> ²	0.024

OR odds ratio, CI confidence interval, MVPA moderate to vigorous physical activity, DCE discrete-choice experiment, GPAQ General Physical Activity Questionnaire

^a 'Never enrol' group included those who never chose to enrol in a programme in every DCE task. OR is relative to the 'always enrol' and 'sometimes enrol' groups

^b ***, ** and * denote the 1, 5 and 10% levels of significance, respectively

^c Self-reported MVPA minutes were computed according to the answers to the GPAQ and guidelines developed by the World Health Organization

Table 5 Mixed logit model estimates for attributes of a physical activity programme for the 'sometimes enrol' group^a

Attributes	Mean [coefficient (95% CI)]	Standard deviation [coefficient (95% CI)]
Goal ^b	−0.651*** ^c (−0.808 to −0.493)	0.386*** (0.251–0.521)
Type of rewards		
Cash	0.467*** (0.353–0.580)	0.587*** (0.428–0.746)
Vouchers	0.137** (0.023–0.250)	0.434*** (0.211–0.647)
MediSave credits	−0.082 (−0.195 to 0.031)	0.068 (−0.223 to 0.359)
Donation	−0.521*** (−0.662 to −0.380)	0.733*** (0.573–0.894)
Value of rewards	0.935*** (0.484–1.386)	0.687* (−0.041 to 1.415)
Enrolment fee, SG\$		
0	1.505*** (1.333–1.678)	1.378*** (1.189–1.567)
50	0.390*** (0.264–0.516)	0.822*** (0.657–0.987)
150	−0.490*** (−0.605 to −0.374)	0.013 (−0.191 to 0.218)
300	−1.406*** (−1.629 to −1.184)	1.604 *** (1.412–1.797)
No programme	0.408*** (0.139–0.677)	0.590*** (0.358–0.822)
Interaction with being active ^d (meeting physical activity guidelines) ^e		
Goal*active	0.299** (0.033–0.564)	Not applicable
Value*active	1.124*** (0.350–1.899)	
No programme*active	0.899*** (0.432–1.367)	
No. of observations	465	
Log likelihood	−3715.12	

Dollar values are based on Singapore dollars

CI confidence interval, MVPA moderate to vigorous physical activity, NA not applicable

^a Respondents in the 'always enrol' and 'never enrol' groups were excluded from the analysis

^b Goal and value of rewards are linear attributes, and type of rewards and enrolment fee are effects coded. We tested for the linearity condition for attributes (goal, value of rewards and enrolment fee) and failed to reject it for goal and value of rewards

^c ***, ** and * indicate the 1, 5 and 10% levels of significance, respectively

^d Being 'active' was defined as meeting physical activity guidelines of practicing 150 min of MVPA per week based on the adjusted MVPA minutes

^e We checked for the interaction effects of being active with type of rewards and enrolment fee, and, as they were insignificant, they were not included in the model

programme). These interactions were included in the model. The mixed logit estimates for those in the 'sometimes enrol' group are shown in Table 5. As expected, both active and insufficiently active employees preferred higher values of rewards, lower enrolment fees and lower weekly activity goals. The most preferred reward type was cash, followed by vouchers, MediSave credits, and donations, respectively. The interaction effects show that, although all participants prefer lower activity goals as it makes it easier to meet the reward threshold, the disutility of a higher goal is greater for insufficiently active employees who presumably require greater effort to meet the goal. For the same reason, the marginal value of higher rewards is relatively greater for active employees as they are more likely to obtain the reward. Nonetheless, *ceteris paribus*, active employees have a stronger preference for not enrolling in any programme relative to insufficiently active employees. The highly significant standard deviations in nearly all cases reveal heterogeneity of preferences for these

attributes, especially for type of reward and enrolment fee. However, given the range of levels shown in the DCE, enrolment fee is the most important attribute in determining programme uptake.

Figure 2 reveals how stated uptake of the most attractive programme to achieve the weekly target physical activity goal (150 min of weekly activity goal to obtain cash rewards of \$60 per week) and least attractive programme (210 min of weekly activity goal to obtain rewards of \$15 per week for charity) are influenced by the enrolment fee. Stated uptake for the most attractive programme for the overall sample is 67% when there is no fee, dropping to 39% when the fee is \$300 (Table 6). Stated uptake for the least attractive programme with no enrolment fee is 47%, but uptake for this programme is less influenced by the enrolment fee. After a large drop from the free programme, between enrolment fees of \$50 and \$300 stated uptake decreases only slightly, to 31%. Because active employees are only 32% of the total and there is little difference in

Fig. 2 Average predicted programme uptake as a function of enrolment fee. The most attractive programme was defined as a programme that requires 150 min of exercise per week to obtain rewards and offers cash rewards of \$60 per week. The least attractive programme requires 210 min of exercise per week and provides donations of \$15 per week to charity. Predicted uptake of the full sample is the weighted average of “sometimes enrol”, “always enrol” and “never enrol” groups based on their representation among active and insufficiently active individuals. Dollar values are based on Singapore dollars

uptake by activity status, insufficiently active employees are predicted to constitute approximately 68% of those who sign up, regardless of programme features.

Figure 3 simulates net payouts per employee (rewards paid minus enrolment fee) as a function of the probability of joining a given programme and the likelihood of meeting the goal for insufficiently active participants. All active participants are assumed to meet goal. We simulate net payouts for the highest reward value of \$60 per week, or a maximum payment over 6 months of \$1440. When the enrolment fee is \$300, if the success rate for insufficiently active employees is very low, then there is no cost to employers as all programme costs are paid through the enrolment fee of insufficiently active participants.

Insufficiently active participants only begin to earn rewards, on average, when their success rate exceeds 20%. At a \$300 enrolment fee, the maximum net payout per employee is SG\$448 for 6 months, with 66% going to insufficiently active employees. When there is no enrolment fee, there is no cross-subsidy resulting from insufficiently active employees not meeting the goal. As a result, net payouts per employee are significantly higher for all success rates for insufficiently active employees. In this case, the maximum net payout per employee is SG\$969 over a 6-month period. Note that this figure is below \$1440 because not all employees will sign up for the programme and, as a result, some will receive no reward. Also note that even though insufficiently active employees are less likely to meet the goal than active employees, because they are the majority as long as the success rate exceeds 50%, the majority of reward payments will go to them.

4 Discussion

Studies have shown that offering rewards increases the effectiveness of physical activity programmes [4, 14, 23]; however, no studies have examined the extent to which rewards, with or without an enrolment fee to offset the costs, influences programme uptake. We studied this question among full-time employees in Singapore, a highly sedentary group. We focused on a smartphone-based programme as most employees own smartphones, and fitness applications (apps) for tracking steps are readily available at little to no cost.

Results showed that stated uptake for rewards-based programmes could be as high as 67% among full-time employees. Rewards were also found to influence stated

Table 6 Predicted uptake of participation in a physical activity programme with different levels of enrolment fee for an average respondent

Enrolment fee, SG\$	'Sometimes enrol' group only (49% of the sample)				Full sample ^c	
	Active ^a		Insufficiently active		Most attractive ^b	Least attractive ^b
	Most attractive ^b	Least attractive ^b	Most attractive ^b	Least attractive ^b		
0	0.78	0.35	0.75	0.37	0.67	0.47
50	0.57	0.11	0.51	0.12	0.56	0.35
150	0.28	0.01	0.22	0.02	0.41	0.31
300	0.21	0.03	0.18	0.04	0.39	0.31

Dollar values are based on Singapore dollars

MVPA moderate to vigorous physical activity

^a Being ‘active’ was defined as meeting physical activity guidelines for practicing 150 min of MVPA per week based on the adjusted MVPA minutes. Those who did not meet 150 min of MVPA per week were defined as ‘insufficiently active’

^b The most attractive programme was defined as the programme that required meeting the target of 150 min of exercise per week to obtain rewards, and offers cash rewards of \$60 per week, while the least attractive programme was defined as the programme that required 210 min of exercise per week and provides donations of \$15 per week

^c Predicted uptake of the full sample is the weighted average of the ‘always enrol’, ‘sometimes enrol’ and ‘never enrol’ groups based on their representation among active and insufficiently active individuals

Fig. 3 Total and insufficiently active net payout per employee for varying likelihood of meeting the activity goal (assuming \$60 rewards per week and that the weekly target goal is achieved by all active employees). Dollar values are based on Singapore dollars

uptake in previous studies, albeit for different population subsets [14, 15]. We also found that smartphone-based activity programmes appeal more to younger employees who are generally more technically savvy, respondents prefer goals that maximise their chances of receiving the reward, and not all rewards are equally valued. Respondents strongly preferred cash (or cash-like) rewards as opposed to health insurance subsidies or charitable donations. This is an important finding that complements other studies which show that programme effectiveness is influenced by the type of reward offered, even when the values are equated [14, 24].

This study also addresses two concerns often raised about rewards programmes. First, they only appeal to active employees, yet our results show that insufficiently active employees, who represent the majority, are also attracted to these programmes, and at approximately the same rate as active employees. The second concern relates to the high cost of offering rewards. We show that these costs can be partially offset by charging an enrolment fee. Although this fee will discourage some employees from joining the programme, in our simulations uptake remained above 50% for the most attractive programme, even when the fee rose to \$50. This shows that a programme with generous rewards and a fairly high enrolment fee may have strong employee support and may be within the range of what employers would be willing to spend [25]. Although there is a partial subsidy that goes to those who are already active, this can be considered a reward for healthy behaviours and may also help to attract and retain active employees. Based on these findings, an enrolment fee of at least a modest amount should be considered for a behaviour-based rewards programme such as this.

Our findings recommend that RCTs or awards programmes in Singapore would be more attractive if they offered cash or vouchers instead of health-savings credits or charitable donations; however, this finding may not generalise to other countries as the tendency to donate to charities varies substantially across countries [26].

Because the study is based on a DCE, several limitations should be noted. Although DCEs are a powerful tool for assessing preferences for products, services or programmes that do not exist in the market, and for quantifying how changes in a product attribute affect product demand, they are hypothetical. Uptake for actual programmes offered by select employers is likely to differ from our estimates due to differences in employee characteristics, actual versus stated behaviour, and other unmeasurable factors. In our estimation strategy, the responses of the ‘always enrol’ and ‘never enrol’ groups were not included in the analysis. Although it is possible that these individuals might have enrolled in a programme not seen, we make the simplifying assumption that those who always (never) enrol in the hypothetical programmes offered in the DCE will (not) enrol in a similar programme if offered in the real world (however, this is only an assumption). Testing uptake and effectiveness of actual programmes within select worksites should be an area of future research.

5 Conclusion

Results suggest there is likely to be a high demand for physical activity rewards programmes among both active and insufficiently active Singaporean employees, even when enrolment fees are required. These fees may be used

to offset the costs of the programme with minimal concerns about adverse selection.

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Author contributions EAF conceptualised the study and participated in acquisition of data and designing the survey questionnaire. All authors contributed to the analysis and interpretation of data, drafting of and critically revising the manuscript.

Compliance with Ethical Standards

Ethics approval This study received IRB approval from the National University of Singapore.

Informed consent Consent was secured from all the respondents who participated in the study.

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Competing interests Semra Ozdemir, Marcel Bilger and Eric A. Finkelstein declare that they have no competing interests.

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