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Does participation in municipality-initiated incentivized health promotion programs promote physical activity among the physically inactive? Verification in six Japanese municipalities

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Abstract

Background: Physical activity can prevent lifestyle-related diseases, such as hypertension and diabetes. However, many people in society are physically inactive, especially middle-aged and older adults over 40. Therefore, this study examined the effects of a municipality-led incentivized health promotion program to clarify: (1) whether the average number of steps increased from the preparticipation period to the 18th month following the program; and (2) whether such increases were influenced by financial incentives.

Design and methods: This study analyzed gender, age, step, and incentive type data from 5688 middle-aged and elderly participants in an incentivized health promotion program. The incentives were regional gift certificates that could only be used in local areas, national gift certificates, common points that could be used in department and convenience stores nationwide, and donations. The incentives were worth a maximum of 24,000 yen per year.

Results: Both the physically active group and the physically inactive group had increased the step count markedly 18 months post-participation; however those participants chosing financial incentives showed significantly higher steps after 18 months than those who opted for non-financial incentives (time: $p < 0.05$, time × group: $p < 0.05$).

Conclusions: Municipality-led financially incentivized health promotion programs could motivate increases in the average number of steps taken by those physically inactive residents.

Keywords

Incentive, step, physical inactivity, local government-led, middle-aged and elderly

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Introduction

It is well-known that physical activity can help address lifestyle-related diseases, such as hypertension and diabetes. However, as around 30% of Japanese people are somewhat physically inactive,[1] novel efforts are needed to promote physical activity.

Incentives have been recently suggested as an approach to promote physical activity. A systematic review reported that incentives were effective in promoting

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short-term (within 6 months) physical activity in physically inactive individuals.[2] Specifically, it was shown that the group that received monetary incentives, such as cash or gift certificates, had greater increases in their physical activity than the group that did not receive such incentives.[3–5]

However, even though there have been positive research findings regarding the offering of incentives and increased physical activity, most studies have been intervention studies conducted in laboratory settings with small samples (<100 participants) and short follow-up periods.[2–5] More recently there have been several scaled-up incentive interventions that demonstrated the potential of incentives in encouraging physical activity. For example, a 12-week incentive program in Canada reported an average increase of 116 steps per day,[6] and a mobile health-based incentive program in Singapore reported an increase of 1579 average daily steps.[7] Therefore, incentivized health promotion programs have shown the potential to increase the number of steps taken. However, because of the limited number of scaled-up studies, the long-term impact of scaled-up incentivized physical activity interventions remains unclear and there have been no studies examining whether scaled-up incentive interventions can increase the physical activity of physically inactive individuals.

Many local governments in Japan have introduced health promotion programs with incentives (hereinafter referred to as "incentivized health promotion programs"), with the number of such programs increasing every year.[8] Fujihara et al. reported that participants in an incentivized health promotion program spent significantly more time walking than those who did not participate.[9] However, as the study did not target physically inactive persons and was conducted in only one municipality, it is not clear whether similar results would be obtained in other municipalities. Because incentive-based health promotion programs are becoming more common in Japan, it is important to gather evidence from local communities on their efficacy.

Therefore, to go some way to filling this research gap, this study examined municipality-led incentivized health promotion programs in six municipalities, each of which had different population sizes.[10–12] The incentivized health promotion programs were designed so that participants could choose several options; local gift certificates, national gift certificates, common points, or donations; and could earn up to 24,000 points per year (1 point = 1 yen).

The study's purpose was to clarify: (1) whether the average number of steps increased from the preparticipation period to 18 months after the program commencement; and (2) whether such increases were influenced by the financial incentives.

Design and methods

Overview of incentivized health promotion programs

Sample. The municipality-led incentivized health promotion programs in Japan started in November 2014 in six municipalities: A (Chugoku), B (Kanto), C (Kanto), D (Tohoku), E (Kinki), and F (Hokuriku); with 7622 participants. Although all of the 7622 elderly and middle-aged participants 40 years or older living in these six municipalities were eligible for participation. However, since the purpose of this analysis was to identify changes in the step counts before and 18 months after participation in a way that took gender and age into account, 5688 individuals with their gender, age, and attendant step count data were included in the analysis. Also, in the municipality, establishing a control group was not pursued because of the various issues that needed to be resolved (e.g. resident buy-in, staff labor, and cost) to establish a control group.

Recruitment method. A poster, flyer, and pamphlet were prepared for the six municipalities to solicit applications for the project, with the posters placed at train stations, public facilities, and private sports clubs, and the flyers and pamphlets inserted in newspapers and distributed at events. In addition to the aforementioned activities, we also conducted publicity activities such as producing newspaper articles, website postings, and appearances on TV programs to increase awareness of the project with a wider audience.

Incentive designs. In this project, seven types of incentives were given based on: exercise class participation, physical activity (number of steps taken), continued participation in the project, and health improvements. The details of each incentive offered and the amount subsequently earned are shown in Table 1.[12]

The points earned could be exchanged for gift certificates (local or national), common points, or donations. The local gift certificates could be used in local supermarkets and restaurants in increments of 1000 yen (no change given), the national gift certificates could be used in units of 1000 yen at department stores, shopping centers, convenience stores throughout Japan (no change given), the common points could be used in units of 1 yen at convenience stores nationwide and for online shopping, and the donations could be made to local facilities, such as elementary schools, communities, and sports clubs. Program participants could earn up to 24,000 points per year (1 point = 1 yen) for their daily exercise efforts and achievements.

Analysis items

Dependent variables. Physical activity was assessed using a pedometer with a built-in accelerometer (HJ-740IT, Omron

Table 1. Types and number of points.

Type	Criteria for earning points	Maximum points
Enrolling in optional programs	Enrolling in a paid optional program at the same time as participating in the incentivized health promotion programs (1000 pt for programs from 1000 yen to less than 5000 yen per month, 3000 pt for programs more than 5000 yen per month)	1000 or 3000 pt (Only at the time of participation)
Physical activity (number of steps taken)	If the increase in steps is greater than a certain amount compared to the number of steps taken at the time of participation, or if the recommended number of steps is achieved regardless of the number of steps taken at the time of participation	800 pt/month 9600 pt/year
Exercise class participation	Points are determined by the number of days of participation in given programs (Only up to a maximum of 10 days of participation per month are eligible for points)	20 pt/day 200 pt/month 2400 pt/year
Body composition improvement	If BMI or muscle mass ratio improves at every 3-month measurement, or if those values remain within the standard range	4000 pt/year
Continued participation in the project	If points have been earned for six consecutive months	1000 pt/year
Having a health checkup	If having an annual health checkup is confirmed	1000 pt/year
Getting healthy	If the annual health checkup data have improved, or if those values are within the standard range	3000 pt/year
Total		24,000 pt/year

Healthcare Co., Ltd., Kyoto), which was given to participants on registration. This pedometer with built-in accelerometer uses Omron's unique signal processing to capture changes in body movement and posture, enabling the accurate measurement not only of walking activity but also of those activities other than walking.[13] Physical activity status was determined from the participants' uploaded pedometer data from pre-participation and through months 16 to 18. Participants who uploaded less than twice in months 16–18 were thereby excluded from the analysis. As recruitment took place between November 2014 and March 2015, the "pre-participation" registration start date differed for each participant. Therefore, pedometer data up to the 18th month was used for each participant.

Independent variables

A. The physically active group and the physically inactive group. The physically active and inactive classifications were based on the standard recommended number of steps set by the government : 9000 steps/day for men under 65 years old, 8500 steps/day for women under 65 years old, 7000 steps/day for men over 65 years old, and 6000 steps/day for women over 65 years old).[14] Participants were thereby classified as a "physically active group" or a "physically inactive group" using pre-participation data. At the time of application, the participants were informed that they would be required to carry out their normal daily activities for the next week, and that the data would be sent once every 1–2 weeks.

B. Financial and nonfinancial incentives. The incentives; local gift certificates, national gift certificates, and common points; selected by the participants were classified as monetary incentives and the donations were classified as nonmonetary incentives.

Adjustment variables. The adjustment variables were: municipality (municipalities A, B, C, D, E, and F), gender (male and female), and age (under 65 and over 65).

Analysis methods

Table 2 displays the aggregate values for all participants. Specifically, the municipality, gender, age category, and type of incentive selected at the time of participation, corresponding to the nominal variables, are shown as the percentages and number of participants, while the continuous variable, the number of steps taken before participation, is shown as mean ± standard deviation (Table 2). Crosstabulations were created for the municipality, sex, age group, and incentives selected to allow for a comparison of the physically active and inactive group characteristics before participation and were presented as percentages (number of people), for which a χ^2 test was used (Table 2). An independent *t*-test was performed and the mean ± standard deviation was calculated for the number of steps taken before participation (Table 2).

The changes in the mean number of steps before and after the intervention for each group were then subjected to a repeated measures analysis of variance (ANOVA), for which municipality, gender, age category, and incentive selected were taken as the adjustment variables, and the estimated values ± standard error and 95% Confidence Interval (95% CI) were calculated (Table 3). The percentage of participants who achieved the recommended number of steps at 18 months compared to before participation

Table 2. Baseline characteristics/attributes of the participants.

	All subjects ($n = 5688$)	Physically active group ($n = 3523$)	Physically inactive group ($n = 2165$)	p Value (active vs inactive)
Municipality				
A city	42.1 (2396)	41.3 (1454)	43.5 (942)	0.031
B city	7.6 (434)	8.3 (292)	6.6 (142)	
C city	8.0 (455)	8.2 (289)	7.7 (166)	
D city	14.6 (830)	15.3 (538)	13.5 (292)	
E city	13.2 (752)	12.7 (448)	14.0 (304)	
F city	14.4 (821)	14.2 (502)	14.7 (319)	
Sex				
Male	37.0 (2106)	40.5 (1428)	31.3 (678)	0.001
Female	63.0 (3582)	59.5 (2095)	68.7 (1487)	
Age				
Under 65 years old	46.9 (2666)	40.6 (1431)	57.0 (1235)	0.001
65 years old and over	53.1 (3022)	59.4 (2092)	43.0 (930)	
Incentive type				
Financial incentive	97.7 (5560)	97.4 (3432)	98.3 (2128)	0.031
No financial incentive	2.3 (128)	2.6 (91)	1.7 (37)	
Pre-participation steps	6261.5 ± 3390.7	7381.3 ± 3676.1	4439.3 ± 1690.3	0.001

p-Values represent the values obtained by comparing the physically active group with the physically inactive group.
Indicates percentage (number of persons) or mean ± standard deviation.
Comparisons by proportions adapt the χ^2 test. Comparison by means adapted the independent t-test correspondence.

Table 3. Step count changes.

	N	Pre		~18th month		Change	p Value		
		Estimated ± SE	95% CI	Estimated ± SE	95% CI	Estimated ± SE	Time	Group	Time × group
All subjects	5688	6261.5 ± 43.8	6175.7–8227.0	8326.6 ± 50.8	8227.0–8426.2	2065.1 ± 44.3	$p < 0.05$–	-	-
Physically inactive group	2165	4471.1 ± 65.1	4343.5–4598.7	6914.9 ± 79.7	6758.6–7071.2	2399.1 ± 66.4	$p < 0.05$	$p < 0.05$	$p < 0.05$
Physically active group	3523	7361.7 ± 50.8	7262.0–7461.3	9194.1 ± 62.3	9072.1–9316.2	1859.9 ± 58.6			

Estimated ± standard error (SE).
Repeated measures ANOVA, covariates: municipality, sex, age, and incentive type.

was then calculated (Table 4). Finally, to check whether the financial incentives were associated with the changes in the average number of steps before and after the intervention, the estimated values ± standard error and the 95% CI were calculated using the repeated measures ANOVA, for which the financial and nonfinancial incentives were categorized, with the municipality, gender, and age group entered as the adjustment variables (Table 5). SPSS Statistics 25.0 was used for all analyses, with the statistical significance set at 5%.

Results

Baseline characteristics/attributes of the participants

Table 2 shows the baseline characteristics/attributes of the overall and pre-participation of the physically active group and the physically inactive group. Of the participants, 63% were female, 53.1% were 65 or older, and 38.1% were in the physically inactive group before participation. Group comparison showed that there were statistically significant differences in the municipality, gender, age, incentive selected at the time of participation, and number of steps taken before participation (Table 2).

Step count changes

Table 3 shows the step count changes overall and for the physically active group and the physically inactive group from before participation through to the 18 months point. All subjects' results showed a significant increase of 2065.1 ± 44.3 steps/day from pre-participation to the 18 months point. When categorized into the physically active group and the physically inactive group, The physically inactive group's results showed an increase of

Table 4. Percentage of those who achieved the recommended steps at 18 months.

Physically inactive group	Pre	~18th month	Physically active group	Pre	~18th month
	% (*n*)	% (*n*)		% (*n*)	% (*n*)
Physically inactive	100.0 (2165)	66.0 (1428)	Physically inactive	0 (0)	35.9 (1264)
Physically active	0.0 (0)	34.0 (737)	Physically active	100.0 (3523)	64.1 (2259)

Indicates percentage (number of persons).

Table 5. Financial incentive effects on step count changes.

	N	Pre		~18th month		Change	*p* Value		
		Estimated ± SE	95% CI	Estimated ± SE	95% CI	Estimated ± SE	Time	Group	Time × group
No financial incentive	128	6590.6 ± 293.0	6016.1–7165.0	7131.2 ± 340.0	6167.1–6340.7	646.7 ± 270.3	$p < 0.05$	n.s.	$p < 0.05$
Financial incentive	5560	6253.9 ± 44.3	6464.7–7797.8	8354.1 ± 51.4	8253.4–8454.8	2097.8 ± 44.8			

Estimated ± standard error (SE).
Repeated measure ANOVA, covariates: municipality, sex, age.

2399.1 ± 66.4 steps/day, while the physically active group's results showed an increase of 1859.9 ± 58.6 steps/day. Therefore, the number of steps increased significantly in both groups, and there was a crossover between the groups that achieved and did not achieve the recommended number of steps (time: $p < 0.05$, time × group: $p < 0.05$).

The percentage that achieved the recommended number of steps at 18 months

Table 4 shows the results for the physically active group and the physically inactive group participants who achieved the recommended number of steps at the 18 months stage. Of the physically inactive group, some 34% achieved the recommended number of steps at the 18 months stage, and of the physically active group, 64.1% achieved the recommended number of steps at the 18 months stage.

Financial incentive effects on step count changes

Table 5 shows the results for the step change comparisons by the selected incentive type. The results of participants who had chosen non-monetary incentives showed an increase of 646.7 ± 270.3 steps/day, while the results of participants who had chosen monetary incentives showed an increase of 2097.8 ± 44.8 steps/day. The significant increase in the steps by both groups indicated that there was an interaction effect (time: $p < 0.05$, time × group: $p < 0.05$).

Discussion

A total of 7622 people participated in the study, of whom 5688 remained in the program through to the 18th month. It was found that the average steps taken by the physically inactive group had increased significantly at 18 months compared to preparticipation, which may have been because of the financial incentives that were given to this group. While previous studies have found that financial incentives can motivate increased physical activity in physically inactive groups,[2–5] few studies have demonstrated this effect in social environments.

Financial incentive impact on increased steps

A laboratory-based incentive intervention for the inactive group in a small samples (<100 participants) and a short follow-up RCT study reported a significant increase in the average number of steps taken by the intervention group compared to the control group of approximately 1000–2000 steps.[4,5] What these studies had in common was that they found an increase in the number of steps taken by program participants when a better financial incentive was provided. Therefore, in this study, the relatively high monetary incentive of 24,000 yen-worth of points per year (2000 yen per month) in gift certificates and common points was provided. Participants who chose the monetary incentives were found to have increased their average number of steps by 1451 more than those who chose non-monetary incentives, which was a similar result to a previous study.[3–5,7] These results suggested that high-value cash incentives could motivate increased resident physical activity, including those physically inactive residents.

More recently there have been several scaled-up incentive interventions that demonstrated the potential of incentives in encouraging physical activity. For example, a 12-week program in Canada reported an average increase of 116 steps per day,[6] and a 6-month program in Singapore reported an average increase of 1579 steps per day.[7] Although this study differed from these previous studies in terms of the number of participants, intervention duration, and types of incentives, a similar increase of 2065 steps/day on average was observed, with the physically inactive group increasing its steps total significantly by 2399 steps/day at the 18 month point. This study is considered valuable in showing the potential to promote physical activity in a physically inactive group, even if the study on financial incentives for health promotion interventions is scaled up. However, if municipalities wish to conduct long-term health promotion programs with incentives, the funding sources for the points redemptions must be both valid and available. Although incentivized health promotion programs are being developed nationwide in Japan, it is necessary to consider for how long and to what extent local governments should continue to provide financial incentives.

Limitations

Irrespective of the results, this study had several limitations. First, although this study looked at monetary incentives, the analysis focused on a comparison between participants who had chosen monetary incentives and those who had chosen non-monetary incentives. Because it was not possible to conduct a comparative analysis of the participation and control groups, the study results obtained cannot be attributed solely to the financial incentive effect. Second, previous studies have reported that a variety of factors, including personal, psychological, and environmental factors, influence the increase in physical activity.[15] Although this study was not able to take psychological and environmental factors into account, six municipalities with different population sizes and urban environments were included in the analysis as adjustment variables to take them into account as required. However, the adjustment factors input in this analysis were somewhat limited in scope. Similar future studies should take into account participants' willingness to exercise and their health literacy, as well as seasonal variations, in addition to each of the factors indicated in previous studies. Third, although the results were verified in six municipalities with different population sizes, it was not clear whether similar results could be obtained by conducting similar analyses in other municipalities with different city sizes. Fourth, the type and number of incentives may have had different effects on the step increases. Therefore, future studies need to confirm the connection between the type and number of incentives and the number of steps taken. Fifth, pedometers were given to all participants in this study. A previous study reported that wearing a pedometer increased the number of steps by approximately 2000[16]; therefore, it is possible that the use of the pedometer, de facto, influenced the step increases in this study.

Conclusion

This study compared the step increases in physically active and inactive middle-aged and older adult Japanese participants in a health promotion program that offered both financial and non-financial incentives. Significant increases were found in the mean number of steps for both the physically active group and the physically inactive group after 18 months as compared to before participation. Participants who had chosen financial incentives had a greater increase in their average steps after 18 months than those who had chosen the non-financial incentive, which indicated that municipality-led financially incentivized health promotion programs could motivate physically inactive residents to increase their average number of steps.

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Author contributions

The research plan was designed by all authors. Authors SC, KT, and AT participated in the data collection, and author SC was responsible for the statistical analysis and draft writing. All authors critically reviewed and revised the manuscript and approved its submission.

Declaration of conflicting interest

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Coauthor Akiko Tsukao is vice president of Tsukuba Wellness Research, Inc. Otherwise, there are no conflicts of interest.

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Ethics approval and consent to participate

Prior to this study, approval was obtained from the Ethics Review Committee of the Graduate School of Comprehensive Human Sciences, University of Tsukuba (Proposal No.: Body 26-40, Title: Research on Incentive Measures to Promote Increased Physical Activity among People with No Interest in Health Promotion, Approved on August 9, 2014). The survey was anonymous and the data collected were kept private and used only for research purposes.

Significance for public health

Prior research has shown that financial incentives could motivate an increase in physical activity by people who were not meeting their recommended number of steps. However, very few studies have examined the incentive intervention effects in a scaled-up form. This study showed that participation in an incentivized health promotion program increased the steps taken after 18 months. The data presented could be used to promote the nationwide development of incentivized health promotion programs.

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