Field Study

Maintenance of the Rate of Stair Use over a Long-term Period Using a Stair Climbing Campaign

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Abstract: Maintenance of the Rate of Stair Use over a Long-term Period Using a Stair Climbing Campaign: Takuo NOMURA, et al. Department of Rehabilitation Sciences, Kansai University of Welfare Sciences—Objective: This study was a long-term survey of a stair climbing campaign that made use of point-of-choice prompts aimed at achieving exemplary behavior in citizens. Methods: The campaign began in September 2007 at the Kochi Prefectural Office. We monitored office workers who climbed the stairs or used the elevator in the prefectoral office building, excluding weekends, from August 2007 through February 2009. Prompts were placed on the stair risers. A total of 59 days were monitored during the observation period. A questionnaire was distributed to 250 workers to examine the influence of the prompts following completion of the observation period. Results: A total of 16,583 observations of the choice of workers to use the elevators or stairs were made during the observation period. The mean number of stair users was 281.0 ± 66.0 per day. Stair use increased significantly from 31.5 to 58.1% among women and from 26.3 to 62.4% among men during months 1−3 of the campaign. Stair use was maintained in more than 51% of women and 60% of men during the entire campaign period. The following response (valid records: 81) was given by 10% of the respondents regarding the use of stairs: “my use of stairs increased due to the message banners”. Conclusions: The stair climbing campaign was effective for increasing stair use and was maintained over a long-term period. However, most office workers thought that their increased stair use was not due to prompts placed on risers; therefore, the reason for the increased stair use remains unclear. (J Occup Health 2014; 56: 511–518)
not examine the influence on individuals’ attitudes. The influence on individuals’ attitudes has been evaluated in a short-term observation period\(^{10}\); however, such effects have not been examined over long-term investigation periods, and the influence on the attitudes of Japanese office workers is unknown.

We conducted a survey concerning a stair climbing campaign among prefectural office workers. The purpose of this study was to conduct a long-term survey concerning a stair climbing campaign aimed at promoting exemplary behavior among citizens. In addition, a follow-up questionnaire was distributed to assess the effects of the campaign using point-of-choice prompts on individuals’ attitudes towards stair use.

**Subjects and Methods**

**Setting**

The public service workers of Kochi Prefecture decided to take the lead in improving their lifestyle habits in order to encourage changes in behavior among citizens to prevent metabolic syndrome. This policy was carried out from June 2007 to March 2009 and was named the “Metabo-busters major strategy” (Fig. 1). The stair climbing campaign at the Kochi Prefectural Office developed in collaboration with our study team was one of the main components of the action plan of the Metabo-busters campaign. The subjects were office workers in a prefectural office in Kochi City, Japan. The following information was explained to the subjects in each department by the section chief in an internal e-mail before implementation of the stair climbing campaign: “Using the stairs is an effective means of preventing metabolic syndrome. The rate of stair use will be observed by a research team from Kochi Prefectural University. The results, including the total and mean data, will be released to the public. There is no penalty for not climbing the stairs”.

The work site was a seven-story building with a one-floor basement that housed 848 men and 405 women primarily engaging in desk work. Four elevators were located in the center of the building, with a total of three sets of stairs located adjacent to the elevators and on the east and west sides of the building (Fig. 2). The building contains a total of 92 steps, including 20 steps from the first floor to the second floor and 18 steps each from the second floor to the sixth floor. Two observers measured the number of workers who used the east stairs and four elevators. Observer 1 recorded the number of individuals who climbed the stairs from the first floor to the fourth floor and above. Observer 2 moved between a fourth floor landing and the steps from the third floor to the fourth floor and also watched the stairs from the fourth floor to observe the rate of stair use. It was easy to observe subjects climbing from the third floor to the fourth floor from this observational position and possible to completely exclude those subjects who used the stairs from the third floor. However, there was a blind spot, i.e., stair use between the second and third floors, and we could not completely exclude the possibility of subjects using the stairs from the second floor. Observer 2 counted the number of individuals who took an elevator going up from the first floor.

Referring to our previous studies\(^{15,16}\), we placed message banners on the stair risers as point-of-choice prompts. The message banners measured 15 cm in height \(\times\) 75 cm in width and had a colorful background (yellow, red, blue, green, white or orange colors), and the messages were printed in large colorful letters (blue, white, black or red colors). A total of 48 message banners were placed on the stair risers:

![Fig. 1. The observation period and the stair climbing campaign period during the Metabo-busters major strategy implemented in Kochi Prefecture.](image)
15 banners were placed between the first and second floors, nine banners were placed between the second and third floors, eight banners were placed between the third and fourth floors, seven banners were placed between the fourth and fifth floors, and nine banners were placed between the fifth and sixth floors. Table 1 shows the message banners placed between the floors, in ascending order.

No video recordings or facial photographs were used, and this study was performed with the permission and agreement of the prefectural office. The study was approved by the ethics committee of Kochi Prefectural University.

**Procedure**

The survey was conducted by a team from the same laboratory, and all observers received adequate training and practice prior to the study. The data were collected using a hand counter. The monitoring time began 45 minutes before the start of work in order to measure the number of workers who climbed the stairs. Observers monitored use of the stairs and elevators in the building from 7:45 to 8:30 a.m., excluding weekends, from August 2007 through February 2009. A total of 59 days were monitored during the observation period, and the subjects were coded according to gender. First, we obtained data for five days during the first month as a baseline period, and then the message banners were placed on the stair risers at the end of the month (Table 2). Subsequently, we obtained similar measurements for four days per month continuously from the first to the 12th month with the message banners in place. Then, measurements were obtained once a month for six months. The message banners were left in place for five months and then removed, with the exception of those between the first and second floors. The message banners were removed to examine their influence on the rate of stair use. During the campaign period, the banners were changed when damaged, and the messages on the banners between the first and second floors were changed in November 2007 and February 2008.

In addition to the main message banners, other banners were placed between the first and second floors, and these were changed irregularly at intervals ranging from 1−3 months. These other banners included messages about seasonal and cultural activities, and the use of stairs did not show any relationship with seasonal events (e.g., the rice harvest in September, the Christmas season, etc).

**Follow-up questionnaire**

We asked 250 passing office workers on the first floor of the east story for their cooperation in completing a questionnaire survey. The questionnaire survey was conducted between 12:00 and 13:00, and data were collected for workers following completion of the observation period in March 2009. The questionnaire items included "sex", "age", "floor on which the employee worked", "frequency of stair use per day" and the questions "Did you see the message
Table 1. The message banners placed on the stairs

Contents of the messages on the banners

The details of the message banners we placed first in September 2007

Between the first and second floors: total of 15 banners

“Take the stairs!” “Go up the stairs”, “Use good posture”, “Free exercise”, “Walk and be healthy”, “No metabolic syndrome!” “Decrease visceral fat”, “Continue walking”, “Prevent lifestyle-related diseases!” “This is the 10th step of the stairs”, “Walk and be refreshed!” “The answer to question 1 is on the 38th step of the stairs”, “A person’s weight will increases by 5 kg every year”, “Question 1. When I continue an excessive intake of ??? kcal per day”, and “This is the 20th step of the stairs”.

Between the second and third floors: total of 9 banners

“Diet, exercise and resistance training. Using the stairs kills two birds with one stone”, “Aim to walk 10,000 steps per day”, “Exercise in everyday life!” “You use approximately 100 kcal by walking in the local shopping district”, “You use approximately 300 kcal to walk 10,000 steps”, “This is the 30th step of the stairs”, “Metabolic syndrome increases housekeeping costs”, “For yourself and your family” and “The answer to question 1 is you add approximately 100 kcal”.

Between the third and fourth floors: total of 8 banners

“This is the 40th step of the stairs”, “Question 2. How many kcal do you use when you go up the stairs from the first floor to the sixth floor?” “The answer to question 2 is on the 56th step of the stairs”, “Do you walk several steps in a day?” “This is the 50th step of the stairs”, “A wise old man walked and activated his brain” and “The answer to question 2 is approximately 10 kcal”.

Between the fourth and fifth floors: total of 8 banners

“Walking slows the aging process”, “This is the 60th step of the stairs”, “Fatigue from exercise makes you sleep deeply at night”, “Encourage somebody to exercise with you”, “You should walk after drinking”, “This is the 70th step of the stairs”, “Do no forget to rehydrate” and “Have you lost weight recently?”

Between the fifth and sixth floors: total of 8 banners

“Walking back and forth between the first and sixth floors=the number of calories consumed by jogging for three minutes”, “This is the 80th step of the stairs”, “Ten steps remain to the top of the stairs”, “You are needed”, “It is wonderful when you have sweat shining on your forehead”, “This is the 90th step of the stairs”, “This is the 91st step of the stairs” and “Well done!”

The message banners were changed in November 2007

Between the first and second floors: total of 4 banners

“The stair use rate was ## %”, “The stair use rate on <month/day>”, “Walk and be refreshed!”, and “This is the 20th step of the stairs”.

The message banners were changed in February 2008 and then remained in place until February 2009

Between the first and second floors: total of 4 banners

“Stair climbing campaign in Kochi Prefecture”, “Let’s spread this campaign all over Japan!” “The best stair use rate was ## %”, and “The target stair use rate was set at more than 90%”.

Table 2. The observation times and numbers of observations during the baseline period and every three months during the stair climbing campaign periods

<table>
<thead>
<tr>
<th>Observation time (days)</th>
<th>Women (n)</th>
<th>Men (n)</th>
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<tbody>
<tr>
<td>Baseline period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>August 2007</td>
<td>5</td>
<td>317</td>
</tr>
<tr>
<td>Stair climbing campaign period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From September to November 2007</td>
<td>12</td>
<td>1,070</td>
</tr>
<tr>
<td>From December 2007 to February 2008</td>
<td>12</td>
<td>1,137</td>
</tr>
<tr>
<td>From March to May 2008</td>
<td>12</td>
<td>1,301</td>
</tr>
<tr>
<td>From June to August 2008</td>
<td>12</td>
<td>1,061</td>
</tr>
<tr>
<td>From September to November 2008</td>
<td>3</td>
<td>266</td>
</tr>
<tr>
<td>From December 2008 to February 2009</td>
<td>3</td>
<td>281</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>5,433</td>
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banners placed on the stair risers every day?” “How do you feel about the message banners?” and “Did your stair use increase due to the message banners?”

_analysis_

The observation period after the start of the campaign was divided into six phases consisting of three months each according to sex. The data from the baseline period were compared with that obtained during the campaign period using a chi-square analysis and logistic regression analysis. We compared the rate of stair use between men and women using a chi-square analysis in order to examine the influence of any gender differences. A logistic regression analysis was applied to elevator or stair use as dichotomous outcome variables (coded as elevator use=1, stair use=2). The data obtained before and after the stair climbing campaign (coded as before campaign=0, after campaign=1) were incorporated as independent variables in a logistic regression analysis of the outcome variables. The follow-up questionnaire data were compared between men and women using a chi-square analysis. The statistical analyses were conducted using the IBM SPSS Statistics for Windows version 19.0 (IBM Corporation, Armonk, NY, USA) software package, and statistical significance was defined as $p<0.05$.

_results_

A total of 16,583 observations of the choice of the workers between the elevators and stairs were made during the observation period. There were 5,433 women and 11,150 men, and the mean number of stair users was 281.0 ± 66.0 per day. Stair use increased significantly from 31.5 to 58.1% [odds ratio (OR) 4.25, 95% confidence interval (CI) 3.20–5.64] among women and from 26.3 to 62.4% [OR 4.65 95% CI 3.72–5.83] among men during months 1–3 of the campaign (Table 3). The rate of stair use was highest during months 4–6 of the campaign in both women and men. The rate of stair use was significantly decreased during months 7–9 of the campaign compared with that observed during months 4–6 of the campaign in women only (Fig. 3). The rate of stairs use was maintained above 51% among women and 60% among men during the campaign period. These values were significantly above the baseline levels. After months 7–9 of the campaign, the rate of stair use was significantly higher among men than women.

Among the 250 people who received the questionnaire survey, valid responses were obtained from 81 respondents. We found no significant differences between men and women with respect to the questionnaire items. The details of the questionnaire results are presented in Table 4.

_discussion_

The level of physical activity and exercise is insufficient among young/middle age workers in Japan. Stairs are frequently accessible to most population groups, and taking the stairs is one way to be more physically active. Office workers are often presented with a choice between taking the stairs and taking the elevator or escalator at work. Choosing the stairs
instead of the elevator or escalator is a quick way for people to add physical activity to their everyday lives. Stair use has been previously evaluated using campaigns with point-of-choice prompts at worksites; however, these surveys were conducted over short-term periods. We surveyed the effects of a stair climbing campaign over a long-term period at a worksite.

In the present study, the rate of stair use increased significantly from 31.5 to 58.1% among women and from 26.3 to 62.4% among men during months 1−3 of the campaign. The rate of stair use was maintained above 51% among women and 60% among men during the entire campaign period; these values were significantly above the baseline levels. Maintaining exercise habits is difficult in diabetes patients who require exercise therapy. As to the main reasons why Japanese patients do not engage in exercise, 70% of physicians state that patients “have no time to exercise”\(^\text{17}\). Using the stairs requires little additional time and does not require major changes in behavior. Worksites provide a worker with opportunities to use the stairs throughout the day in a public place. The use of stairs may be easily accepted among Japanese office workers. In the present study, it was noteworthy that the increased rate of stair use was maintained over a long-term period. The stair climbing campaign in the Kochi Prefectural Office was one of the main components of the action plan of the prefecture staff, who took the lead in improving their lifestyle habits in order to encourage changes in behavior among citizens to prevent metabolic syndrome. Office workers may have a desire to exhibit exemplary behavior as an example for other citizens in compliance with the policy of the prefecture. In addition, the workers may have felt they were required to take the stairs, as the rate of stair climbing was being observed and the results, including the total and mean data, were to be released to the public. On the other hand, there was no penalty for not taking the stairs, although instructions were provided by section chief to use the stairs. These factors may have increased the rate of stair use. However, the direction of causation between these factors and the increased rate of stair use is unclear.

Point-of-choice prompts, such as posters or stairwell messages, have been used in interventional studies aimed at increasing the frequency of stair use. Interventions with point-of-choice prompts at worksites increase stair use by only +0.1% on average\(^\text{10}\). However, in the present study, the average rate of stair use during the long-term campaign period was maintained above 51% in women and 60% in men. Therefore, our results are superior to those observed in previous studies. We used message banners as point-of-choice prompts in our study. Such messages convince workers to change their behavior and can alter attitudes\(^\text{10}\). Point-of-choice prompts help translate positive intentions into behavior. Furthermore, the effects of the stair use campaign were augmented by the use of multicomponent interventions (i.e., stairwell messages + posters). Stair use campaigns using point-of-choice prompts are more cost-effective than other interventions used to increase physical activity\(^\text{18}\). In the follow-up questionnaire survey, 96% of the respondents reported that they “noticed the message banners every day”, while 10% of the respondents reported that their “use of the stairs increased due to the message banners”. The message banners may have been effective in encouraging stair use among some of the office workers. However, we were unable to establish a control group in this study; thus, the direction of causation between the increase in stair

<table>
<thead>
<tr>
<th>Questions</th>
<th>Results</th>
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<tbody>
<tr>
<td><strong>Sex</strong></td>
<td>Women, 30%; men, 70%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>40 years of age or older, 54%; 20 to 39 years of age, 46%</td>
</tr>
<tr>
<td><strong>Floor on which the employee worked</strong></td>
<td>First, second, or the third floors, 49%; fourth floor or above, 51%</td>
</tr>
<tr>
<td><strong>Frequency of stair use per day</strong></td>
<td>I use the stairs more than five or six times a day, 38%; I use the stairs three to four times a day, 27%; I use the stairs once or twice a day, 26%; I do not use stairs, 9%</td>
</tr>
<tr>
<td><strong>Did you see the message banners placed on the stair risers every day?</strong></td>
<td>I noticed the message banners every day, 96%; I did not notice the message banners, 4%</td>
</tr>
<tr>
<td><strong>How do you feel about the message banners?</strong></td>
<td>The message banners were effective in making people use the stairs, 76%; I do not think that the message banners influenced the stair use for any individuals, 21%; I think that the message banners disturbed the ability to use the stairs, 3%</td>
</tr>
<tr>
<td><strong>Did your stair use increase due to the message banners?</strong></td>
<td>The message banners did not influence my use of the stairs, 70%; I did not understand the message banners, 20%; My use of the stairs increased due to the message banners, 10%</td>
</tr>
</tbody>
</table>
use and the campaign with message banners encouraging stair use is unclear.

In previous studies, the baseline rates of stair use ranged from 1.7 to 39.7%, with the rates of stair use during the intervention period ranging from 4.0 to 41.9%[19]. The subjects of our study included 31.5% women and 26.3% men at baseline. The rate of stair use at baseline was similar to that observed in previous studies. The rate of stair use in men and women did not show any gender differences at baseline or during months 1–3 or 4–6 of the campaign. However, after months 7–9 of the campaign, the rate of stair use among women was significantly lower than that of men. Kerr et al. reported that, in a study conducted in a shopping mall comparing women under 60 years of age with men and women over 60 years of age, the women showed a strong initial response to the message banners[4]. We found similar results in a previous study carried out in a department store[15]. Therefore, message banners may be effective among women of both young and middle-age groups. The rate of stair use remained high after removing the message banners in these previous reports. In contrast, we did not recognize a similar trend in our previous study conducted at a local station in which there were stairs with a total of 37 steps[46]. Furthermore, the rate of stair use returned to baseline when we removed the message banners. In the present study, the message banners were placed for five months and then removed, with the exception of those between the first and second floors. The rate of stair use among women decreased, perhaps because we removed the banners. With respect to general physical function, the muscle strength of the limbs in women is lower than that in men[20]. There were 56 steps between the first and fourth floors in this field study. Stair climbing may be relatively more punishing and less rewarding for women.

In the present study, the use of stairs increased during a specific window in the morning. According to the follow-up questionnaire survey, the proportions of respondents who reported that they “use the stairs more than five or six times a day” and “use the stairs three to four times a day” were 38% and 27%, respectively. We did not measure the same questionnaire items at baseline and therefore cannot interpret the change in frequency of stair use. We asked 250 passing office workers for their cooperation in completing the questionnaire survey, 81 of whom agreed. The response rate was very low, and the data may not be representative. Therefore, caution is necessary when interpreting the questionnaire results. The above are limitations of the present study.

Conclusion

Using stairs at work is a simple and easy method of increasing physical activity among office workers. In this study, a stair climbing campaign was found to effectively increase stair use, and the observed increased stair use was maintained over a long-term period. It is noteworthy that the rate of stair use was maintained over a long-term period. The factors associated with the increase in and maintenance of the rate of stair use may have included the instructions provided by the section chiefs and a desire to improve one’s own health and/or exhibit exemplary behavior as an example for other citizens. The use of message banners as prompts is simple, easy and does not require high costs or man power. However, because most office workers thought that their increased stair use was not due to the message banners, the reason for the increased stair use thus remains unclear.

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References


