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Abstract

Experts have advocated exercise with little success, and have turned to encouraging physical activity by incorporating it into daily activities such as taking the stairs over elevators. Much literature exists suggesting that environmental prompts can encourage the use of stairs and literature has established that some messages may be more effective than others. This study aimed to assess the effects of selected signage prompts on stair usage. Methods: Stair and elevator use were monitored in three, two-story buildings. One building served as a control, while a fitness message was placed in another building, and the final building received a weight control message. Observations took place twice per week for the seven weeks of the study. Results Predictors of stair usage included age ($p<0.001$), gender ($p<0.001$), and direction of stair usage ($p<0.001$). Stair rate usage in the three buildings was compared across three time points. Conclusions Though stair usage did not show significant change with the introduction of signs, a trend of increased use suggests that signs may influence stair usage. It was unexpected to find that the introduction of the signs didn't impact use. Two explanations for this finding are a ceiling effect, and physical differences in building floor plans.

Keywords: Physical activity, stair usage, health promotion

INTRODUCTION

Obesity in the United States has been on the rise, and is at an historic high. In 1991, the four states with the leanest residents reported having obesity rates between 15% and 19%. By 2008, only one state reported obesity rates between 15% and 19%, while 17 states reported obesity rates between 20% and 24%, 26 had rates between 25% and 29%, and in six states over 30% of residents were obese (Centers for Disease Control and Prevention [CDC], 2009). These statistics are concerning because of the negative health effects of obesity including hypertension, type 2 diabetes, heart disease, stroke, and some cancers (CDC, 2011).Exercise has been proposed as a way to counter weight gain and curb the obesity epidemic. Exercise, defined as planned physical activity, is done with the purpose of improving physical fitness and has been promoted for decades with little improvement (Haskell et al., 2007). Experts have now turned to encouraging physical activity by incorporating it into people's daily lives, by recommending such things as the taking of stairs instead of elevators or escalators (CDC, 2007).

Abundant research has explored ways to increase stair usage. Several studies suggest that adding an environmental prompt, such as a sign at the point-of-decision between stairs and elevators, or escalators can increase stair usage (Andersen, Franckowiak, Snyder, Bartlett, & Fontaine, 2005; Bungum, Meacham, & Truax, 2007; Eves, Webb, & Mutrie, 2006; Ford & Torok, 2008; Grimstvedt et al., 2010; Howie & Young, 2011; Kerr, Eves, & Carroll, 2000; Kerr, Eves, & Carroll, 2001a; Kerr, Eves, & Carroll, 2001b; Kerr, Eves, & Carroll, 2001c; Russell, Dzewaltowksi, & Ryan, 1999; Russell & Hutchinson, 2000; Soler et al., 2010; Webb & Eves, 2005; Webb & Eves, 2007). Point-of-decision prompts have been described by Soler et al. (2010) as motivational messages, placed near stairs and elevators to encourage stair usage. Many messages have been used during stair climbing research. Point-of-decision prompt messaging has addressed fitness, the cost of exercise, lifestyle, the limited time needed to stair climb, ease of exercise, weight control, and improvement of heart function and blood pressure, as well as deterrent prompts that encourage people to leave the elevators for those incapable of using stairs. Webb and Eves (2007) recommend specificity in poster prompts. These authors compared general description messages to specific messages on poster prompts. They found that participants rated poster prompts with specific consequences as more likely to succeed at encouraging stair usage. Accordingly, the aim of this study was to add to the knowledge base about the effects of specific messaging that promotes stair usage. Two messages were used in this study to gain insight into the effects of relatively inexpensive environmental prompts on stair usage on a college campus.

METHODS

In this quasi-experimental study, stair and elevator use were monitored in three buildings. One building served as a control, and the other two buildings received environmental prompts. A generic sign was placed in one intervention building, “Get Fit, Take the Stairs,” while the other building received a sign with the specific weight control/loss phrase, “Burn One Calorie for Every Six Stairs” (Teh & Aziz, 2002). Buildings receiving intervention signs were not randomized to avoid introducing the intervention in the building with the highest stair usage.

Buildings were selected based on the number of floors. The three buildings were each two stories tall. All buildings had a point where the stairs and elevator could be simultaneously observed. Stair height on all staircases was between six and eight inches, which is standard building code (Nicoll, 2007). Participants were users of the stairs or elevators in the three buildings. Exclusion criteria included people using wheelchairs or crutches, those carrying large equipment, children, and people with children. IRB approval was received from the University of Nevada, Las Vegas.

Observations took place twice per week for each of the seven weeks of the study in each building. Each observation lasted for one hour. Baseline observations were collected for two weeks. After baseline data collection, signs were placed in the two intervention buildings, and remained posted for three weeks. Observations took place at the same time each day in each building.

Signs were placed at point-of-decision sites, such as building doors and wall space near the elevators. Signs were also placed at the bottom of stairs, near the first and second floor elevators. Each building received one 11 x 17 inch poster and the remaining posters displayed were standard 8 1/2 x 11. The signs were removed after having been posted for three weeks. A final data collection occurred during the two weeks following removal of the signs

Data were collected using direct observation by one of the researchers. The researcher was positioned in an inconspicuous location where the stairs and elevator could both be observed. The observer recorded whether the participant came up or down the stairs, used the elevator going up or down, gender, approximate age group (young: 18-30, middle: 31-50, or older: 51 or above) and presence of heavy bags or backpacks. All data collected was categorical in nature.

The control building’s elevator was located outside the main building on the north side. Stairs were located immediately inside the building. This stairwell has 12 steps, a landing, and then 11 more steps to the second floor. The stair area is semi-enclosed. The width of the staircase is approximately 56 inches (1.42 m).

The building receiving the general health message (“Get Fit Take the Stairs”) has an elevator located in the center area of the building; staircases are located immediately upon entrance into the building at both the north and the east entrances. The north stairwell had 17 steps, a landing, and then 17 more steps to the second floor. The stair area is open and spacious in an atrium type setting. This staircase has a width of 64 inches (1.63 m). The east staircase has 5 steps, a landing, 11 more steps, another landing, 11 more steps, another landing, and 5 more steps. This staircase is dimly lit, enclosed, and has a width of 49 inches (1.24 m).

The third building received the specific weight control/loss sign (“Burn 1 Calorie for Every 6 Stairs Climbed). The stairs and elevator are in close proximity. This building’s stairs were also in an atrium type setting. Those using the stairs could see the lobby below and the landing at the top of the stairs while ascending or descending. This stairway has 19 steps, a landing, and then 19 more steps to the second floor. The stair area is open and spacious and the staircase width is 105 inches (2.67 m).

Statistical Analysis

Descriptive statistics were calculated which was followed by the Loglinear model to test for all main effects (sign status, age, group, use of bag or backpack, gender, direction, and phase) and adjusted for all potential interaction effects with stair usage as the outcome variable. Here, the likelihood of taking the stairs versus the elevator was also modeled. A Chi-Square test for trend was used to compare individual buildings at multiple time points (pre-intervention, intervention, and post-intervention) and Chi-Square distribution was used to compare buildings across phases. Chi-Square contingency tables and risk ratios were also used to determine directionality and magnitude of differences. Individual-level data was modeled during analyses. The SPSS version 18 statistical package was used for analyses.

RESULTS

Over the three-phase intervention, 2707 observations were recorded. Eleven observations were deleted because of missing data. Of the 2696 remaining observations, 80% (n= 2155) were males and 20% (n= 544) were females. Overall, 86.5% (n= 2342) of observations were of people taking the stairs versus 13.4% (n= 362) using elevators. Other demographic information is presented below in Table 1.

The frequency and percentage of those using the stairs is presented in Table 2. As can be seen in this table, stair usage rates were at least 50% in all buildings at all stages of the study.

Age was a statistically significant predictor of stair usage ($p< 0.001$). Young participants were more likely to use the stairs as compared to the other two age groups. Younger and middle aged participants were more likely to use the stairs as compared to the older age category ($p<0.001$ for both groups, $z= 4.981$ for younger age group, $z= 4.368$ for middle age group). Age was a significant predictor in all buildings.

Gender was also a statistically significant predictor of stair usage ($p < 0.001$, $z= 4.270$). Greater than 87% of males were stair users (n= 1886), whereas 83% of females were stair users (n= 453), suggesting that males were slightly more likely to take the stairs over females.

Direction of stair use was also statistically significant ($p < 0.001$). Participants were more likely to go down the stairs than up. Among stair users (n= 2342), 60% (n= 1406) of the participants went down via the stairs, while 40% (n= 936) went up using the stairs.

Table 1

Demographics of Total Participant Population

Variable	N	Percent
Gender		
Male	2155	79.6%
Female	544	20.1%
Missing	8	0.3%
Estimated Age Group		
Younger (18-30)	1910	70.6%
Middle (31-50)	723	26.7%
Older (51+)	71	2.6%
Missing	3	0.3%

The Chi Square test for trend was used to compare each building across multiple time points (pre-intervention, intervention, and post-intervention) as seen as Table 2. After analysis, none of the buildings showed significance (Building 1: $x^2= 0.005$, $p= 0.946$; Building 2: $x^2= 0.167$, $p= 0.683$; Building 3: $x^2= 0.014$, $p= 0.906$). But stair use trends shown in Table 2 appears to slightly increase with the introduction of the two signs suggesting environmental prompts may positively influence stair usage. Nevertheless, because statistical analysis does not indicate significant achievement, authors cannot conclude these time trends are due to the environmental prompt intervention.

Table 2
Stair Use Rates by Building

	Frequency (% of stair usage)			
Observation Time	Building 1 Control	Building 2 Specific Message	Building 3 General Message	Total
Pre-intervention	44 (100)	442 (93.4)	197 (72.4)	683 (86.6)
Intervention	73 (97.3)	629 (93.6)	322 (76.1)	1024 (87.5)
Post-intervention	50 (100)	369 (89.6)	219 (73)	608 (84.7)
Total	167 (98.8)	1440 (93.3)	738 (74.2)	2354 (86.7)

DISCUSSION

It was unexpected to find that the introduction of the signs made no significant impact on stair usage. Previous literature (Bungum, Truax, & Meacham, 2008; Ford & Torok, 2008; Soler et al., 2010; Webb & Eves, 2007) indicates that environmental prompts can positively influence stair usage rates. Yet, this study's findings were not consistent with previously published literature suggesting that two-story buildings may not benefit from these types of interventions. There are two major plausible explanations for this: 1) a ceiling effect, and 2) the influence of the built environment.

Our stair usage rates across all buildings and intervention phases indicate drastically higher stair usage rates than the other literature (Andersen, Franckowiak, Snyder, Bartlett and Fontaine, 1998; Bungum, Meacham, & Truax, 2007; Kerr, Eves, & Carroll, 2001c; Russell & Hutchison, 2000; Webb & Eves, 2007). Because there were already high rates of stair usage during pre-intervention observations, the rates of stair use would be difficult to increase. For example, Webb and Eves (2007) had baseline stair usage rates of 7% and intervention stair usage rates at 14.2% and Kerr, Eves, & Carroll (2001c) had baseline rates at 8.1% and improved these to 18.4%. As seen in Table 3, the stair usage rates were much higher in this study than in comparative research. Again, because these rates were already high, it was difficult to show change.

A second possible reason for a lack of change in stair usage is the built environment, which may have trumped our intervention efforts (Sallis, Bauman & Pratt, 1998). Soler et al. (2010) described that stair usage may vary depending on environmental characteristics, such as the accessibility and the cleanliness of stairs. For example, the location of the elevators and the staircase width may have affected our results. Nicoll (2007) described spatial measures including stair width as a strong predictor of stair usage. Nicoll (2007) also explained that wide stair width appeals to those travelling in groups because they can continue group conversation. For example, the staircase in the specific sign building ("Burn one calorie for every six stairs") is quite wide, at 105 inches, and accommodated people traveling in groups.

Although more research is needed, our findings suggest that stair use interventions in two story buildings may not be effective. One might argue that in two-story buildings using the elevator as opposed to using the stairs is inconvenient. The characteristics of the control building provide an even stronger argument for the influence of the built environment. Its elevator is located outside the main building in a separate attachment. It appears as if the elevator was an addition to the building in order to accommodate updated building code requirements. Few people used this elevator, likely because of its inconvenient location. On the other hand, the general sign building's environment may discourage stair usage. The east staircase is unappealing (dark and narrow, and only 49 inches in width) and the north staircase is relatively narrow (64 inches) as well. Although both staircases are located upon entrance into the building, the elevator is conveniently located near offices, classrooms, and labs.

Previous research has shown that younger women were more likely to use the stairs, followed by younger men, then older women, and lastly older men (Russell & Hutchinson, 2000). Our study found that males were more likely to use the stairs. This suggests that men and women are potentially motivated by different messages, and future research should examine potential messages that target the sexes. Because women are more aware of their weight status than are men (Carrol, 2005), we believed that women would respond more strongly to the specific message that mentions burning calories. Qualitative studies may be effective in determining why females use or do not use stairs. It is possible that safety, footwear, or even unwanted sweating may influence female responses to point-of-decision prompts.

Age was also a predictor of stair usage. Younger- and middle-aged populations were more likely to take the stairs as compared to older populations. While younger people appear to be more apt to respond to some healthy messages, researchers should continue efforts to discover strategies that could increase stair use rates among the elderly.

There were limitations to this study. These buildings are not replicas of one another and we understand that it would have been ideal to utilize three identical buildings. Therefore, factors other than signage such as structural design of each building may influence stair usage. Our data support the notion that when stairwells are spacious and located in open-air, atrium type settings, people are more likely to use the stairs. Because of the unique implications of the high stair usage rates, further research needs to be conducted.

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