

## Motivational Signs, Artwork, and Stair Use in a University Building

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### Abstract

The purpose of this study was to examine the effects of two interventions, motivational signs and artwork, on stair use in a campus building. **Methods:** A longitudinal intervention study with no control group was designed to evaluate the effects of motivational signs and art murals on stair use in a six-story building. Sensors were installed in stairwells to monitor stair use. After a three week baseline period, two intervention periods (motivational signs and art murals, both three weeks in length) were utilized to encourage stair use. Weekly values for stair trips/day were calculated and expressed relative to estimated campus student enrollment and faculty and staff with offices in the building (means $\pm$ SEM). Values were compared using ANOVA and post-hoc tests ( $p < 0.05$ ). **Results:** Stair use significantly increased relative to baseline after motivational signs were posted ( $0.08 \pm 0.01$  vs.  $0.11 \pm 0.01$  stair trips/day/students, faculty and staff (SFS),  $p < 0.05$ ). Stair use had decreased to levels similar to baseline after creation of art murals ( $0.07 \pm 0.00$  stair trips/day/SFS). **Conclusions:** These results suggest that motivational signs may be an inexpensive and effective way to increase stair use and daily physical activity, while artwork may not affect stair use. Additional studies are needed to determine the most effective intervention to increase stair use in different populations.

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### Introduction

The prevalence of obesity is significantly increasing in the United States. Recent evidence suggests that more than half of the adult population in the U.S. is overweight or obese, with the percentages increasing significantly over the last 15 years (Ogden et al., 2006). Reduced physical activity contributes significantly to the risk of overweight and obesity in adolescents and adults in the U.S. (Kruger & Kohl, 2007). Creating communities and workplaces that encourage and promote physical activity are important ways to reduce the risk of obesity while incorporating healthy lifestyle and behavior changes.

Recent research has focused on community-wide interventions that increase physical activity, including promotion of taking the stairs rather than elevators. Taking the stairs may provide a readily available opportunity for short bouts of moderate intensity physical activity (Anderson,

Franckowiak, Snyder, Bartlett, & Fontaine, 1998; Boutelle, Jeffrey, Murray, & Schmitz, 2001; Brownell, Stunkard, & Albaum, 1980; Coleman & Gonzalez, 2001; Kerr, Eves, & Carroll, 2001; Kerr, Yore, Ham, & Dietz, 2004; Webb & Eves, 2005). An early study by Brownell et al. (1980) observed that signs promoting the health benefits of taking the stairs resulted in a significant increase in stair use in a mall, a train station, and a bus terminal in Philadelphia. Additional studies (Andersen et al., 1998; Blamey, Mutrie, & Aitchison, 1995; Kerr et al., 2001; Webb & Eves, 2005) observed similar results in adult populations, suggesting that low cost signs or messages on stair risers that promote the benefits of taking the stairs may be an effective way to increase stair use and daily physical activity in adults. Motivational signs have also been successful in promoting stair use in a Hispanic-American community (Coleman & Gonzalez, 2001), but have not been effective in promoting stair use in the non-English speaking Hong Kong Chinese (Eves &

Masters, 2001). This suggests that such interventions do not have universal application and may need to be modified for specific population groups. Additionally, few studies have examined the effects of these types of interventions in young adults and college students. Based on the research in different ethnic groups, it is possible that these interventions may need modifications to be effective in a population of young adults.

More recent studies have utilized motivational signs as well as environmental or aesthetic improvements to promote stair use in working adults. Although it is not clear why these aesthetic interventions may increase stair usage, some studies suggest that improvements that make stairs more attractive, safe, and readily accessible increase the “physical activity friendliness” of a building. Boutelle et al. (2001) compared the effects of motivational signs alone and in combination with music and artwork. In this study, motivational signs alone did not significantly increase stair use. When motivational signs were combined with music and artwork, stair use significantly increased and remained higher than baseline for four weeks after removal of the signs, artwork and music. Kerr et al. (2004) compared four different interventions on stair use: 1) new carpet and paint, 2) framed artwork, 3) motivational signs, and 4) music. Although increased stair use was observed during the first three months of each of the interventions, the increase was only significant for the motivational signs. These studies suggest that motivational signs and aesthetic changes may increase stairwell usage, but the magnitude of the increase may be variable and not always significant.

The results of these studies emphasize that depending on the target population, timing and sequence of the interventions, and other factors yet to be determined, the magnitude of the increase in stair usage can be quite variable. Building planners and exercise professionals need to know what might be the optimal combination of aesthetic changes and motivational signs to best encourage stair use. Additional studies are needed to determine what types of interventions may be the most effective

in different target populations, specifically young adults and ethnic minorities. The present study aims to address some of these issues.

The present study examines the effect of two consecutive interventions on stair usage in a campus building, motivational signs and creation of a modern art mural, with the primary target population being young adults. We hypothesized that both motivational signs and the art mural would increase stair usage in this population, thus creating additional opportunities for daily physical activity in the campus community. The results of the study will provide essential information on whether this type of environmental intervention might be effective in increasing physical activity in young adults, a group at risk for obesity and reduced physical activity (Gropper, Simmons, Connell, & Ulrich, 2012; Keating, Guan, Castro Pinero, & Bridges, 2005). Additionally, the results will provide additional information on what sequence of interventions might be the most effective in promoting stair use, particularly in a young adult, college student population.

## **Methods**

### **Study Design**

A longitudinal intervention study with no control group was designed to evaluate the effects of two consecutive interventions, motivational signs created by the CDC to encourage stair use (Kerr et al., 2004) and an aesthetic environmental change (creation of modern art murals), on stair usage in a college campus building. The study was approved by the University Institutional Review Board.

### **Study Location Description**

The study was conducted at a northeast United States college of approximately 12,000 students and 1,300 faculty and staff on three separate campuses (North, South, and East). The building utilized for the intervention is a six-story building which housed the South campus library and faculty and staff offices. Two elevators were located at the center of the building, with two stairway entrances adjacent to the elevators. One of the stairways was randomly chosen for the intervention. The stairway was 44 inches wide,

with 8 to 10 steps, a landing, and 8 to 10 more steps between each of the floors, for a total of 89 steps from the first floor to the sixth floor.

### **Stair Use Assessment**

A pair of infrared sensors (STC-108 traffic counting system; St. Michael Strategies, Chambly, Quebec) was installed at each stairway entrance. These sensors were installed to detect movement between the transmitter and receiver, indicating when a person passed into or out of the stairwell on each floor. Each stair-walking event or trip involved two passages, one to enter the stairwell and one to exit the stairwell. Data was collected from the stair sensors every seven days.

### **Data Collection**

Baseline stair use was monitored for three weeks from February 11<sup>th</sup> to March 3<sup>rd</sup> 2008. After completion of the baseline period, motivational signs encouraging stair use were posted at stairwell door entrances and next to the elevator control buttons on each floor during the week of March 17<sup>th</sup>. Examples of the motivational signs are found on the CDC website ([http://www.cdc.gov/nccdphp/dnpao/hwi/toolkit/s/stairwell/motivational\\_signs.htm#MessageIdeas](http://www.cdc.gov/nccdphp/dnpao/hwi/toolkit/s/stairwell/motivational_signs.htm#MessageIdeas)). The motivational signs were 8.5 X 11 inches in size and displayed messages such as “Walking up stairs burns almost 5 times more calories than riding an elevator”, “Small steps make big differences”, and “Step up to a healthier lifestyle”. For the first intervention phase, stair use was monitored for an additional three weeks from March 24<sup>th</sup> to April 14<sup>th</sup> 2008. Motivational signs were removed at the end of the first intervention phase. For the second intervention phase, modern art murals were created in the stairwells in partnership with a teen art group at a local art museum during the summer months of 2008. The artwork is a series of murals depicting images related to exercise, such as people walking and running, exercise equipment, and motivational messages for people walking up the stairs, such as “You can do it!” and “Almost there!”. The murals extend the length of the stairwell, from the first floor to the sixth floor, with pictures on both sides of the stairwell and the landings. Stair use was monitored after the creation of murals, with

sensor values collected for the first three weeks of the Fall semester, from September 8<sup>th</sup> to September 29<sup>th</sup>, 2008.

### **Stair Use Calculation**

Weekly stair sensor values for each floor were totaled and divided by two to determine the total number of “trips” using the stairs (accounting for stairway entry and exit). The number of trips was divided by the number of days included in the stair sensor reading (stair trips/day). Weekly values for stair trips/day were expressed relative to student enrollment and faculty and staff with offices in the building. Student enrollment for the campus where the building was located was determined from data provided by the Office of the Provost “Facts at a Glance” on the University website. For the Spring and Fall of 2008, there were 4,567 and 5,081 undergraduate, graduate, and continuing education students on campus. Faculty and staff numbers were collected at the beginning of each semester, based on the number of faculty and staff who had offices or worked in the intervention building. For the Spring and Fall of 2008, there were approximately 122 faculty and staff who had offices or worked in the intervention building. Thus, estimates of the number of students, faculty and staff who were exposed to the intervention were 4,689 and 5,203 for the Spring and the Fall of 2008. Weekly values for stair use (trips/day/number of students, faculty and staff) was calculated from number of trips/day detected by stair sensors divided by the total number of students, faculty, and staff who had offices or worked in the intervention building.

### **Statistical Analysis**

Descriptive statistics were calculated for variables of interest, including stair trips/week, stair trips/day, and stair trips/day/students, faculty, and staff (SFS). The three intervention periods (baseline, motivational signs, and art mural) were compared for differences in stair trips/week, stair trips/day, and stair trips/day/SFS, using ANOVA with Fisher’s Partial Least-Squares Difference (PLSD) post-hoc tests performed when appropriate. For both the motivational signs and the art mural interventions, the daily mean number of stair

trips per SFS was compared to the baseline and to each other. The level of significance was set at  $p < 0.05$ .

## Results

Table 1 includes the results in stair trips per week, stair trips per day, as well as stair trips per day per estimated number of students, faculty and staff. Analysis of variance analyses indicate a statistically significant difference in stair use between the three intervention periods (baseline, motivational signs, and art mural) when expressed in trips/week ( $F=7.16$ ,  $p=0.026$ ), trips/day ( $F=7.78$ ,  $p=0.022$ ), and trips/day/SFS ( $F=10.64$ ,  $p=0.011$ ). Fisher's PLSD post-hoc analysis indicated that motivational signs significantly increased stair use compared to baseline when expressed in trips/week, trips/day and trips/day/number of students, faculty and staff (SFS). In addition, stair use returned to values similar to baseline after creation of art murals (Table 1, Figure 1). There was no statistically significant change in weekly stair use values during each of the three phases of the study (baseline, motivational signs, and after creation of the art murals), although there was a large amount of variability in stair use from week to week during the study.

## Discussion

The purpose of this study was to examine the effect of two consecutive interventions, motivational signs and artwork, on stair usage in a campus building, with the primary target population being young college-aged adults. We hypothesized that both motivational signs and artwork would increase stair usage, similar to previous reports in working adults. We observed an increase in stair usage with the first intervention, motivational signs, but no change in stair usage compared to baseline values after completion of art murals. These results suggest that motivational signs are a simple way to increase stair usage, while artwork may only be effective in certain population groups. Additional research is needed to determine the most effective interventions to increase stair usage and daily opportunities for physical activity in different population groups,

particularly young adults and those of diverse ethnic backgrounds. More information is also needed on what might be the optimal combination of aesthetic changes and motivational prompts to best encourage stair use in different population groups.

The results of the present study provide additional information on increasing opportunities for physical activity with environmental changes and community-wide interventions. The present results confirm previous studies suggesting a positive effect of motivational signs on stair usage (Anderson et al., 1998; Boutelle et al., 2001; Coleman & Gonzalez, 2001; Kerr et al., 2001; Kerr et al., 2004; Webb & Eves, 2005). Motivational signs appear to be a simple and inexpensive intervention to increase stair usage and increase opportunities for physical activity in college communities.

In contrast to the study hypothesis, the present study observed no effect of a modern art mural on stair usage. These results suggest that artwork may not always be effective in increasing stair usage. These results were similar to those of Kerr et al. (2004), who observed no change in stair usage following placement of artwork in stairwells, but conflict with the results of Boutelle et al. (2001), who observed a statistically significant increase in stair usage only when artwork was displayed in stairwells. Boutelle et al. (2001) compared the effects of motivational signs alone and in combination with music and artwork. In this study, motivational signs alone did not significantly increase stair use. When motivational signs were combined with music and artwork, stair use significantly increased and remained higher than baseline for four weeks after removal of the signs, artwork and music. The authors explain that they cannot identify whether it is the aesthetic appeal or the novelty that increased stair usage. Additional research, including focus groups or surveys to evaluate the perceptions of building occupants, will be important in addressing these issues.

The explanation as to why the modern art mural was not effective in increasing stair usage is not

**Table 1**

**Stair use at baseline, after the motivational signs were posted, and after completion of the modern art murals**

	Baseline	Motivational Signs	Art Mural
<b>Trips/Week</b>	2,614.7±292.0	3,546.5±175.2*	2,608.0±78.4
<b>Trips/Day</b>	373.5±41.7	509.9±23.3*	372.6±19.5
<b>Trips/Day/Students, faculty, and staff</b>	0.082±0.009	0.112±0.005*	.073±0.002

All values are means±SEM. \*, Significantly different from baseline and art mural, p<0.05

known, but may be related to characteristics of the subject population, such as age, physical fitness level or daily physical activity, the type of artwork, or other factors yet to be determined. The subject population in the present study was younger than the subject population in the studies of Kerr et al. (2004) and Boutelle et al. (2001). This may account for some of the difference in results, since few studies have examined this type of intervention in young adults. In addition, the population in the present study may have been more physically active than those in previous studies and thus, may not have considered stair use as physical activity. It is also possible that the majority of students in the subject population in the present study, similar to the exercise professionals in a previous study (Andersen, Bauman, Franckowiak, Reilley, & Marshall, 2006), were already physically active, thus they did not see the need for additional physical activity. In addition to differences in the subject population compared to previous studies, the type of artwork may also have affected the results of the present study. The art murals may not have appealed to some members of the study population, and may have discouraged rather than encouraged stair use. It is possible that a different type of artwork or a music intervention may be more effective in a young adult, college-aged population. Another issue that may have affected the results is that in spite of the aesthetic improvements to the stairwells with creation of the art mural, the stairwells still had cement floors, were not always clean, and were not well lit. These factors may have discouraged stair use in spite of the art murals. This suggests that artwork alone may not be enough to encourage stair use; other aesthetic factors and

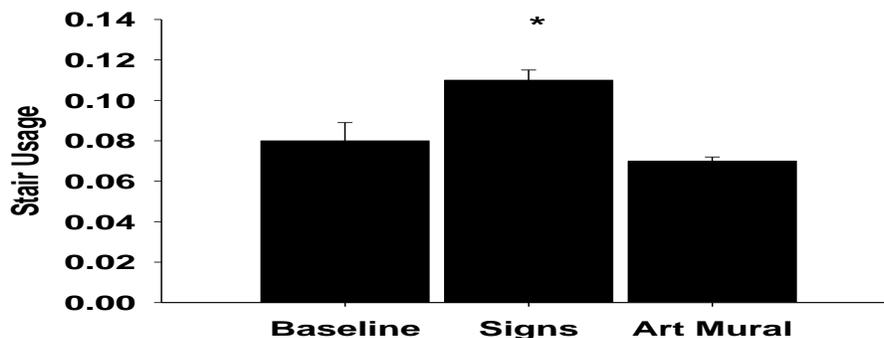
improvements may be important and must be considered in order to effectively increase stair use.

**Study Limitations**

There are a number of confounding factors that may have influenced the results of the present study, including the timing of the baseline and intervention data collections. Baseline stair use was collected during the spring of 2008, while stair use for the two interventions was collected during the spring and fall of 2008. Thus, the data collection spanned two seasons (spring and fall) and two academic years (2007-2008 and 2008-2009). It is possible that seasonal variation in stair use might explain the results of the present study, with increased stair use occurring in the spring compared to the fall. Previous research does not address seasonal variation as influencing stair use. Average temperatures during the spring and fall are relatively mild, so unlikely to influence physical activity patterns. In addition, since the stairs are not exposed to the outside temperature or conditions and the temperature indoors is controlled, it is unlikely that the weather affected stair use. Data collection also spanned two academic years (2007-2008 and 2008-2009). It is possible that the baseline, collected in the 2007-2008 academic year, may not be representative of stair use in the 2008-2009 academic year, due to changes in the student and staff population and use of the building. This appears unlikely, since there were no changes in the number of faculty and staff who had offices or worked in the intervention building and it is unlikely that the characteristics of the student population in the 2008-2009 academic year differed from the student population in the 2007-2008 academic

**Figure 1**

**Stair usage (trips/day/number of students, faculty and staff) at baseline, during the motivational signs intervention, and after completion of the modern art mural in the stairwells. \*, Significantly different from baseline and art mural,  $p < 0.05$ .**



year.

An additional limitation related to data collection timing is that there was no assessment of stair use after completion of the first intervention (motivational signs), prior to completion of the artwork in the stairwells. Thus, it is difficult to determine if stair use remained elevated after motivational signs were removed and decreased as a result of the artwork, or if stair use returned to baseline levels by the time the artwork was completed. This issue is essential in determining the true effect of the artwork on stair use. Based on previously published research, it would be expected that stair use would decrease to baseline levels after the motivational signs were removed (Kerr et al., 2004). Thus, the authors suggest that stair use increased as a result of the motivational signs, then decreased to baseline levels after removal of the motivational signs. In addition, the authors suggest that stair use was not affected by the artwork mural in the stairwells. Additional research with more time points measuring stair use will be necessary to confirm this result.

Another factor that may have affected the stair use measurements and comparisons to previous studies is the methodology used to assess stair use. Many previous studies utilized observational methods to classify individuals by gender, age group, ethnicity, and weight status (not overweight or overweight) and to document

their choice of taking the stairs, elevator, or escalator. In these studies, measurements were taken for a pre-determined period of time, with parts of the day not monitored in terms of stair use. In the present study and one other previous study (Kerr et al., 2004), stair sensors were utilized to monitor people entering and leaving the stairwells. This allowed for a more accurate determination of stair usage for the entire intervention period, rather than just the hours that researchers were stationed to monitor stair usage. Unfortunately, no information on the total number or the characteristics of the individuals who took the stairs compared to those who took the elevators can be collected when using stair sensors. In the present study, we used estimates of the total campus student population and the number of faculty and staff who had offices or worked in the intervention building to correct for the population exposed to the intervention. These estimates, particularly the student population values, are most likely overestimations of the total number of students who entered the library and were exposed to the intervention. This most likely affected the stair usage values, making them lower than values reported by Kerr et al. (2004). In spite of this difference, we believe that the stair usage values in the present study are representative of the changes in stair use as a result of the intervention. Future studies should consider using a combination of stair sensors and

observational monitoring to more effectively determine which interventions might be the most effective to promote stair use in different population groups. This information may help future researchers to determine what types of individuals are most likely to take the stairs and be influenced by certain types of interventions.

### Conclusions and Study Implications

In summary, the current study suggests that motivational signs are a simple and inexpensive way to increase stair use, while artwork may not be effective in a young adult population. The results for motivational signs are similar to what has been observed in other population groups. Additional research is needed to determine the most effective interventions to increase stair

usage and daily opportunities for physical activity in different population groups, particularly young adults and those of diverse ethnic backgrounds. More information is also needed on what might be the optimal combination of aesthetic changes and motivational prompts to best encourage stair use in different population groups. This information can be utilized by health professionals, community officials, and work places to create opportunities for physical activity for the majority of the population at minimal cost.

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