Can Inexpensive Signs Encourage the Use of Stairs? Results from a Community Intervention

Ross E. Andersen, PhD; Shawn C. Franckowiak, BS; Julia Snyder, BS; Susan J. Bartlett, PhD; and Kevin R. Fontaine, PhD

Background: The U.S. Surgeon General advocates the accumulation of moderate-intensity activity throughout the day to improve health.

Objective: To test the effectiveness of signs to encourage use of stairs instead of escalators.

Design: Community intervention.

Setting: Shopping center.

Participants: 17 901 shoppers.

Intervention: Signs promoting the health and weight-control benefits of stair use were placed beside escalators with adjacent stairs.

Measurements: The sex, age, race, weight classification, and use of stairs were observed.

Results: Overall, stair use increased from 4.8% to 6.9% and 7.2% with the health and weight-control signs, respectively. Younger persons increased their stair use from 4.6% to 6.0% with the health sign and 6.1% with the weight-control sign. Older persons almost doubled their stair use from 5.1% to 8.1% with the health sign and increased use to 8.7% with the weight-control sign. Differential use of stairs was observed between ethnic groups. Among white persons, stair use increased from 5.1% to 7.5% and 7.8% with the health and weight-control signs, respectively. Among black persons, stair use decreased from 4.1% to 3.4% with the health sign and increased to 5.0% with the weight-control sign. Differential use of stairs was observed between ethnic groups. Among white persons, stair use increased from 5.1% to 7.5% and 7.8% with the health and weight-control signs, respectively. Among black persons, stair use decreased from 4.1% to 3.4% with the health sign and increased to 5.0% with the weight-control sign. At baseline, lean persons used the stairs more often than overweight persons (5.4% and 3.8%, respectively). The health sign increased stair use to 7.2% among normal-weight persons and 6.3% among overweight persons; the weight-control sign prompted stair use to increase to 6.9% among persons of normal weight and to 7.8% among overweight persons.

Conclusions: Simple, inexpensive interventions can increase physical activity. Research is needed to identify effective motivators to promote activity among black persons.

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The American Heart Association recently added a sedentary lifestyle to its list of modifiable risk factors (1). Reports suggest that only 22% of the U.S. adult population are active enough to derive health benefits from their physical activity and that one in four Americans are completely sedentary (2). This finding may parallel the sharp increase in the prevalence of overweight persons over the past 12 years, from 25% in the National Health and Nutrition Examination Survey (NHANES II) in 1976–1980 to 33% in phase I of NHANES III in 1988–1991 (3). The Centers for Disease Control and Prevention and the American College of Sports Medicine recently revised their recommendation regarding exercise to suggest that all Americans should accumulate 30 minutes or more of moderate-intensity physical activity on most or all days of the week (4). Inactive people who increase their levels of physical activity are less likely to die of all causes and of cardiovascular disease than those who remain sedentary (5, 6).

Walking and taking the stairs instead of escalators or elevators may be two easy ways for seemingly healthy sedentary adults to become more moderately active (7-10). In 1980, Brownell and associates (11) examined the effects of placing a sign that encouraged stair use for health benefits at the base of an escalator that was adjacent to a flight of stairs in a mall, train station, and bus terminal in Philadelphia. They reported that the sign resulted in statistically significant increases in stair use among 45 694 commuters. They also noted that overweight persons did not use the stairs as often as leaner persons before or after the sign was erected. Blamey and colleagues (12) recently examined the effects of encouraging stair use for health benefits in a Scottish train station and also found that a low-cost sign could result in statistically significantly increases in stair use by adults.

We examined the trends among shoppers of different ages, ethnicities, sexes, and body weights in a shopping mall in which escalators and stairs were adjacent. We also observed the differential effects of adding signs at the base of the escalator that promoted stair use for health benefits or weight control.
Table 1. Stair Use before and during Placement of Two Different Motivational Signs

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Baseline</th>
<th>Health Benefits Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observations</td>
<td>Persons Who Took the Stairs</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Age</td>
<td>2562</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>2188</td>
<td>5.1</td>
</tr>
<tr>
<td>Sex</td>
<td>1927</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>2822</td>
<td>4.9</td>
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<td>Weight class</td>
<td>3074</td>
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</tr>
<tr>
<td></td>
<td>1676</td>
<td>3.8</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>3882</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>597</td>
<td>4.1</td>
</tr>
</tbody>
</table>

* Differences between persons who used the stairs and those who used the escalator

Methods

Participants

We observed 17,901 adult patrons of a mall located in a Baltimore suburb while they used the stairs or escalators. Because of the potential for artificial influence on the decision process, persons carrying items larger than a briefcase were excluded. We also excluded persons carrying a baby or child and those judged to be younger than 18 years of age. Participants were unaware that they were part of a study investigating physical activity patterns.

Design

This observational study involved an initial baseline phase and two subsequent intervention phases that incorporated motivational signs displayed at the base of the escalator and stairs. Each of the three phases lasted 1 month. During the baseline phase, the frequency of stair use compared with use of the adjacent escalator was recorded. During the first interventional phase (health benefits), a 22" x 28" sign was placed on an easel beside the escalator and stairs. The sign featured a caricature of a heart at the top of a flight of stairs and the statement, “Your heart needs exercise, use the stairs.” During the second interventional phase (weight control), a similar-sized sign was placed on an easel. The sign featured a caricature of a woman at the top of a flight of stairs; she had a thin waistline and was wearing pants with a waist that was too large. The caption on the sign read, “Improve your waistline, use the stairs.”

Setting

In this suburban Baltimore mall, participants could use the escalator or the stairs to get to the second floor. A stairway was adjacent to ascending and descending escalators. The stairway consisted of 10 stairs, a 6-foot landing, and 10 more stairs. Observations were made during June, July, and August between 10:30 a.m. and 9:00 p.m. on all days of the week.

Procedures

Observations were made by one of the authors. A previous physical activity study (11) used many observers to ensure valid observation of all persons. However, the volume of mall traffic was never so heavy that more than one observer was needed to code the characteristics and choice of each person. Before the study began, the observer and the senior author spent one full day in the mall classifying shoppers by age and weight status to be sure that observations were as accurate as possible. The observer sat in an inconspicuous spot at the foot of the steps that allowed for clear observation.

Frequency of stair use was recorded in the same way during each of the three phases. Each person’s sex and ethnicity (black, white, or other) was recorded. In addition, persons were judged to be 40 years of age or older or younger than 40 years of age. Finally, the observer noted whether the person appeared overweight.

Statistical Analysis

The change in proportions of persons using the stairs from the baseline to the intervention phases of the study was analyzed by using the chi-square test and by computing 95% CIs around the differences in proportions between the comparison groups. The same procedure was used to examine intergroup differences (normal weight or overweight) within a given phase of the study. We also computed the number needed to treat (NNT), the
number of shoppers who needed to be exposed to the sign to get one shopper to use the stairs, as \(1/RD\), where \(RD\) is expressed as the difference in proportions between the two comparison groups. Results are presented as the proportion of persons who opted to use the stairs rather than the escalator; 95% CIs are presented with associated \(P\) values and the NNT. Data were analyzed by using the SPSS for Windows (version 8.0) statistical package (13).

## Results

A total of 17,901 observations were made. Overall, the use of stairs at baseline was 4.8%. During the intervention period when the health benefits sign was displayed, stair use increased significantly to 7.2% (difference, 2.4 percentage points [CI, 1.5 to 3.2 percentage points]; NNT, 42). Stair use did not differ between the health benefits (6.9%) and the weight-control (7.2%) signs (difference, 0.3 percentage points [CI, 0.5 to 1.2 percentage points]; NNT, 333).

### Sex

Table 1 shows the percentage of persons who used the stairs during the study's three phases as a function of age, sex, race, and body weight. Table 2 shows the change in stair use with the two signs and the change from the health benefits sign to the weight-control sign. A similar pattern emerged among men and women: Compared with baseline levels of stair use, both the health benefits sign and the weight-control sign increased stair use from 4.9% to 7.2% and 7.4%, respectively, among women and from 4.8% to 6.4% and 7.0%, respectively, among men). No sex-related differences were found when no sign or either type of sign was present.

### Age

At baseline, 4.6% of persons judged to be younger than 40 years of age used the stairs. Six percent took the stairs with the display of the health benefits sign (difference, 1.4 percentage points [CI, 0.3 to 2.4 percentage points]; NNT, 71), and 6.1% took the stairs in response to the weight-control sign (difference, 1.5 percentage points [CI, 0.3 to 2.7 percentage points]; NNT, 66), significantly increasing stair use relative to the baseline value (\(P = 0.015\)). No statistically significant difference in stair use was found between the health benefits sign and weight-control sign (difference, 0.1 percentage points [CI, −0.3 to 3.6 percentage points]).

## Table 2. Changes in Stair Use among Groups of Shoppers in Response to Signs Promoting Stair Use

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Change in Stair Use</th>
<th>Percentage Point Difference between Groups (95% CI)</th>
<th>Change in Stair Use</th>
<th>Percentage Point Difference between Groups (95% CI)</th>
<th>Change in Stair Use</th>
<th>Percentage Point Difference between Groups (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Age &lt;40 years</td>
<td>1.4</td>
<td>1.6 (0.7 to 2.7)</td>
<td>1.5</td>
<td>2.1 (1.2 to 3.0)</td>
<td>0.1</td>
<td>0.5 (0.1 to 0.8)</td>
</tr>
<tr>
<td>Age ≥40 years</td>
<td>3.0</td>
<td>3.6</td>
<td>2.3</td>
<td>2.5</td>
<td>0.6</td>
<td>0.0 (0.0 to 0.0)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.6</td>
<td>0.7 (−0.06 to 1.5)</td>
<td>2.2</td>
<td>0.3 (−0.06 to 1.0)</td>
<td>0.06</td>
<td>0.04 (0.0 to 0.01)</td>
</tr>
<tr>
<td>Female</td>
<td>2.3</td>
<td>2.5</td>
<td>1.8</td>
<td>2.15 (1.1 to 3.1)</td>
<td>0.3</td>
<td>1.7 (1.3 to 2.7)</td>
</tr>
<tr>
<td>Weight class</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not overweight</td>
<td>2.1</td>
<td>0.4 (−0.4 to 1.2)</td>
<td>3.9</td>
<td>3.9</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Overweight</td>
<td>2.5</td>
<td>3.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>2.4</td>
<td>3.1 (2.6 to 3.6)</td>
<td>2.7</td>
<td>1.7 (0.8 to 2.6)</td>
<td>0.3</td>
<td>1.4 (0.3 to 2.4)</td>
</tr>
<tr>
<td>Black</td>
<td>−0.7</td>
<td>−1.0</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
A similar pattern emerged among persons judged to be 40 years of age or older. At baseline, 5.1% of persons took the stairs; when the health benefits sign was erected, 8.1% chose to climb the stairs (difference, 3.0 percentage points [CI, 1.7 to 4.3 percentage points]; NNT, 33), and the weight-control sign increased stair use to 8.7% (difference, 3.6 percentage points [CI, 2.1 to 5.1 percentage points]; NNT, 28). Stair use did not significantly differ between the two signs (difference, 0.6 percentage points [CI, −0.8 to 2.1 percentage points]). Older shoppers were more likely than younger shoppers to take the stairs in response to both the health benefits sign (difference, 2.1 percentage points [CI, 0.9 to 3.2 percentage points]) and the weight-control sign (difference, 2.6 percentage points [CI, 1.1 to 4.1 percentage points]) (Figure 1).

**Body Weight**

Persons were stratified by body weight (not overweight or overweight). At baseline, 5.4% of shoppers judged to be not overweight used the stairs. The health benefits sign increased stair use to 7.2% (difference, 1.8 percentage points [CI, 1.2 to 4.7 percentage points]; NNT, 55), and the weight-control sign increased stair use to 6.9% (difference, 1.5 percentage points [CI, 0.3 to 2.6 percentage points]; NNT, 66). The same pattern emerged among persons judged to be overweight: The health benefits sign significantly increased stair use from 3.8% to 6.3% (difference, 2.5 percentage points [CI, 1.2 to 3.7 percentage points]; NNT, 40), and the weight-control sign increased stair use from 3.8% to 7.7% (difference, 3.9 percentage points [CI, 1.2 to 7.0 percentage points]; NNT, 40). In persons judged not to be overweight, stair use did not differ significantly between the health benefits sign (7.2%) and the weight-control sign (6.9%) (difference, 0.3 percentage points [CI, −2.6 to 3.2 percentage points]). However, among overweight persons, stair use was greater with the weight-control sign than with the health benefits sign (7.7% compared with 6.3%; difference, 1.4 percentage points [CI, 0.3 to 2.8 percentage points]; NNT, 71). At baseline, persons judged not to be overweight used the stairs significantly more than those judged to be overweight (5.4% and 3.8%; difference, 1.6 percentage points [CI, 0.4 to 2.8 percentage points]; NNT, 72). However, no statistically significant differences were found for stair use as a function of body weight when either the health benefits sign (7.2% of nonoverweight persons compared with 6.3% of overweight persons; difference, 0.9 percentage points [CI, −1.9 to 8.8 percentage points]) or the weight-control sign (6.9% of nonoverweight persons compared with 7.7% of overweight persons; difference, 0.8 percentage points [CI, −0.6 to 2.3 percentage points]) was displayed (Figure 2).

**Ethnicity**

When participants were stratified by ethnic group (white or black), we found that among white persons, the health benefits sign (7.5% compared with 5.1%; difference, 2.4 percentage points [CI, 1.5 to 3.3 percentage points]; NNT, 42) and the weight-control sign (7.8% compared with 5.1%; difference, 2.7 percentage points [CI, 1.6 to 3.8 percentage points]; NNT, 37) significantly increased stair use from baseline values. Conversely, black shoppers did not substantially change stair-climbing patterns in response to either the health benefits sign (3.4%) or the weight-control sign (5.0%) relative to baseline (4.1%). White persons and black persons did not differ for stair use at baseline (5.1% and 4.1%, respectively). However, stair use was significantly higher among white persons than among black persons when either the health benefits sign (7.5% and 3.4%; difference, 4.1 percentage points [CI, 2.7 to 5.4 percentage points]; NNT, 24) or the weight-control sign (7.8% and 5.0%; difference, 2.8 percentage points [CI, 0.9 to 4.7 percentage points]; NNT, 36) was used (Figure 3).

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**Figure 1.** Patterns of stair use among shoppers judged to be younger than 40 years of age (white bars) or 40 years of age or older (striped bars). Values at the top of each bar are sample percentages.

**Figure 2.** Patterns of stair use among shoppers judged to be overweight (white bars) or not overweight (striped bars). Values at the top of each bar are sample percentages.
Discussion

Despite focused media attention and substantial public health efforts to encourage more physical activity in the U.S. population, we found that the proportion of Americans who opt to walk up stairs rather than use an adjacent escalator is similar to the proportion found almost 20 years ago (11). We were able to increase physical activity among a large number of persons by using visual cues that promoted both the health and weight-control benefits of stair use. An additional finding was that visual cues that emphasized the weight-control benefits of stair use were as effective as or more effective than cues that highlighted health benefits.

The increases in stair use in our study were similar to those reported by Brownell and coworkers in 1980 (11) and by Blamey and colleagues (12). These earlier investigations examined the short-term and long-term effects of signs that encouraged stair use to improve health among persons at a commuter train station. Both studies noted that stair use remained elevated for 1 month after the signs were removed, suggesting that increases in physical activity changes were maintained in the short term. However, stair use returned to baseline levels 3 months after the signs were removed.

We were not able to determine the long-term benefits of signs in our setting because, presumably, the same people do not return to a shopping mall each day as they would in a commuter train station. A related limitation of our study is that mall employees or frequent shoppers may have been coded more than once; we could not collect these data because the mall management did not want us to disturb shoppers. Although it seems unlikely, our findings may reflect a substantial increase in physical activity among only a small percentage of persons who changed their behavior consistently. In addition, because no "cool-off" time was provided between use of the health benefits and weight-control signs, there may have been some carryover effects.

Among black persons, a 17% decrease (which was not statistically significant) in stair use after placement of the health benefits sign and the lack of a statistically significant increase after placement of the weight-control sign were both surprising and cause for concern. This tendency was especially troubling given that almost one in two black women is now overweight (3). Moreover, the prevalence of hypertension and cardiovascular disease among black persons remains a serious health problem (14). We recently reported that 43% of black children watch 4 or more hours of television each day compared with 26% of all U.S. children (15). Thus, intervention strategies that reduce sedentary leisure-time activities and increase moderate-intensity physical activity in the black community represent a major public health challenge. We observed 2146 black persons; replicating this study in a setting where more observations of black persons could be made would result in greater statistical power. Conducting focus groups within the black community to develop tailored signs or other interventions to encourage stair use is an important next step.

This study took place in an urban mall located between Baltimore and Washington, D.C. Results of this intervention are particularly encouraging given the high rates of physical inactivity among adults in this area. The most recent Behavioral Risk Factor Surveillance System (16) reported that 30.5% of adults in Maryland and 48.6% of adults in Washington, D.C., report performing no physical activity. Adults in Maryland are less active than Americans at large, whereas adults residing in the Washington, D.C., area are the least active of persons in all U.S. states.

The trends among persons older than 40 years of age are encouraging. Older persons increased their stair use in response to both the health benefits and weight-control signs more than their younger counterparts. Furthermore, we found no differences in stair use between younger and older shoppers when no sign was present. These findings are in contrast to those of Brownell and colleagues (11), who found that younger commuters chose to use the stairs significantly less often than older persons. Because older persons are more likely to be overweight and have health problems (3, 17), older shoppers may be more health- and weight-conscious than their younger counterparts and, hence, more likely to believe that they will benefit from walking up the stairs.

The trends that we saw among the older shoppers are particularly promising given that the greatest health benefits are achieved in moving from the completely sedentary state to a moderate level of fitness (18). Recently, it has been suggested that
accumulating short bouts of moderate-intensity activity throughout the day may offer health benefits similar to those gained with uninterrupted vigorous activity (5, 9, 10). Likewise, modest weight losses yield most of the health benefits among obese persons (19). It seems that among adults 40 years of age or older, low-cost signs prompting stair use for both health and weight-control purposes may substantially increase physical activity.

This is the first investigation that we know of to compare the effectiveness of a health message with that of a weight-control message in promoting moderate-intensity activity. In all subgroups studied, both signs significantly increased the proportion of people who chose to use the stairs to a similar degree. Overweight adults tended to take the stairs more often when the weight-control sign was up than when the health benefits sign was displayed. This trend was encouraging because we recently reported that accumulating moderate-intensity physical activity throughout the day may offer overweight adults a suitable alternative to a more vigorous traditional exercise program (9). Moreover, it has been suggested that adopting even small amounts of lifestyle physical activity at a time may lead to the accumulation of significant amounts of activity in the course of a day (8). Prompting physical activity may serve as a gateway to more traditional exercise programs, especially among sedentary persons who were formerly physically active (20).

At baseline, we found that overweight persons used the stairs significantly less often than their leaner counterparts. This is consistent with the findings of Brownell and colleagues almost 20 years ago (11). However, those investigators reported that when a health benefits sign was used, obese persons chose to use the stairs less often than their leaner peers. Of interest, we found no difference in stair use between overweight and normal-weight persons in the presence of either sign. This may be a function of increasing awareness among Americans of the importance of maintaining a healthy weight and remaining physically active (21). Mutrie and colleagues (22) recently reported that among Scottish commuters interviewed after using the stairs, 43% mentioned that they did so because they were prompted by the sign. Thus, it seems that when prompted, overweight persons may be more likely to adopt more active lifestyles (12).

Our investigation has potential public health implications. Currently, only 22% of U.S. adults are active enough to derive health benefits from their physical activity, and one in four adults is completely sedentary (2, 4). The management of the mall in which this study was conducted informed us that 8 000 000 shoppers come to the center each year. Therefore, even if only 4% more shoppers opted to take the stairs, 320 000 adults would use the stairs in 1 year in this mall alone.

The International Council of Shopping Centers reports that there are 1850 regional and super-regional malls in the United States (23, 24). We conservatively estimate that the cost of producing a sign and purchasing an easel is approximately $60. Thus, for $11 000, signs could be placed in each regional mall in America. If only 4% more shoppers used the stairs in each of these major malls, more than 1.6 million Americans would take the stairs each day instead of using an escalator or elevator. Brownell and colleagues (11) noted that the caloric cost of walking up and down two flights of stairs each day instead of using the escalator would amount to a weight loss of 2.7 kg for an average (80-kg) man in the course of 1 year. The Elevator and Escalator Safety Foundation (25) recently reported that elevators, escalators, and moving walks move twice the entire Canadian and U.S. populations each day in these countries. Our optimism about the effectiveness of signs to increase stair use is tempered, however, by awareness that methods to sustain changes in physical activity are sorely needed and by the knowledge that it is unclear whether hypothesized changes in activity (such as more frequent stair use) prompt persons to significantly increase their overall level of physical activity.

Clinicians have always believed in the value of prevention (26). This investigation highlights the potential synergy that may take place when health care providers and members of the community work together to increase the physical activity of our population. Behavioral risk-reduction trials that have involved health care providers and community-based interventions suggest that these trials are effective in both the short term and the long term. For example, the proportion of patients who began to always use their seat belts was significantly higher in an intervention group who received brief physician counseling at 1 year of follow-up. In a follow-up questionnaire survey, patients reported wearing seat belts more often in response to a brief statement by their physician during an office visit (27, 28). Furthermore, antitobacco messages included in school-based programs have been shown to delay the initiation of tobacco use (29). Physicians should be aware of programs promoting physical activity that may already be in place in their communities. When possible, physicians should support such programs, thereby reinforcing the importance of an active lifestyle.

In conclusion, we have shown that low-cost signs can significantly increase the proportion of shoppers who take the stairs rather than an adjacent escalator in a suburban shopping mall. We also found that trends in stair use are similar to those found in
previous studies (11, 12). Our results suggest that intervention studies designed to increase levels of moderate activity among black adults represent a major public health challenge.

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References


