Increasing Walking in the Hartsfield-Jackson Atlanta International Airport: The Walk to Fly Study

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Objectives. To test the effectiveness of a point-of-decision intervention to prompt walking, versus motorized transport, in a large metropolitan airport.

Methods. We installed point-of-decision prompt signage at 4 locations in the airport transportation mall at Hartsfield-Jackson Atlanta International Airport (Atlanta, GA) at the connecting corridor between airport concourses. Six ceiling-mounted infrared sensors counted travelers entering and exiting the study location. We collected traveler counts from June 2013 to May 2016 when construction was present and absent (preintervention period: June 2013–September 2014; postintervention period: September 2014–May 2016). We used a model that incorporated weekly walking variation to estimate the intervention effect on walking.

Results. There was an 11.0% to 16.7% relative increase in walking in the absence of airport construction where 580 to 810 more travelers per day chose to walk. Through May 2016, travelers completed 390 000 additional walking trips.

Conclusions. The Walk to Fly study demonstrated a significant and sustained increase in the number of airport travelers choosing to walk. Providing signage about options to walk in busy locations where reasonable walking options are available may improve population levels of physical activity and therefore improve public health. (*Am J Public Health.* 2017;107: 1143–1149. doi:10.2105/AJPH.2017.303766)

Chronic diseases are among the leading causes of death for US adults,[1] and approximately one half of the US adult population is living with at least 1 chronic disease.[2] Adults can reduce their risk for developing chronic diseases, such as heart disease, type 2 diabetes, and some cancers, by engaging in healthy behaviors such as physical activity.[3] The *2008 Physical Activity Guidelines for Americans* recommends adults engage in the equivalent of 150 minutes per week of moderate-intensity physical activity in periods of at least 10 minutes.[3] Only one half of US adults meet this guideline.[4,5]

Adults report several physical, psychological, or environmental barriers to physical activity. Some of the most commonly reported barriers include inclement weather, perceived lack of safety in their neighborhood environment, and lack of time and transportation to places to be physically active.[6–8] Community venues, such as airports, provide environments that overcome these barriers, and many airports allow travelers to walk between gates, concourses, or terminals. However, motorized forms of transportation (e.g., trains or shuttles) to move travelers to their desired location are often available and may be subtly encouraged. Finding strategies to encourage travelers to actively transport (i.e., walk) instead of using motorized transportation may increase their physical activity.

Point-of-decision prompts to encourage stair use are a recommended strategy to increase physical activity.[9] With this strategy, signs are placed at a decision point to prompt an active (e.g., taking the stairs) over an inactive (e.g., riding an elevator or escalator) choice.[10] In an airport, choosing to walk to the departure gate, instead of ride a train, may provide airport travelers with the opportunity to accumulate small bouts of physical activity while also helping to break up what can be lengthy periods of sitting during and between flights. The point-of-decision prompt strategy, to our knowledge, has not been evaluated in a busy public venue, such as a large hub airport, over a long follow-up period (e.g., > 1 year). In doing so, the evaluation may provide evidence to support this strategy as a way to encourage people to choose an active option. Because many airports have decision points offering a choice between walking or motorized transportation, this strategy is a viable method to encourage airport travelers to include physical activity in their travel experience.

The purpose of The Walk to Fly study was to determine the effectiveness of a point-of-decision prompt intervention to encourage walking, instead of using motorized transport, in a large metropolitan airport (Hartsfield-Jackson Atlanta International Airport, Atlanta, GA). If effective, this relatively low-cost intervention strategy may be used to encourage adults who use airports to choose a physically active option (walking) over a relatively inactive one (motorized transport). The findings from this proof-of-concept intervention study may benefit people who use large hub

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airports or other transportation venues, such as commuter rail stations, where physically active options are available but may not be readily apparent.

METHODS

Walk to Fly is an intervention study conducted at the Hartsfield-Jackson Atlanta International Airport, which is the world's busiest airport—on average, approximately 250 000 travelers pass through the airport daily.[11]

We conducted the study in the domestic terminus of the underground airport transportation mall. This location adjoins the main airport security checkpoint. Once travelers exit the security checkpoint, they proceed directly to the domestic terminus; thus, entry at this point is limited to travelers whose domestic or international flights originate in Atlanta. As travelers enter the domestic terminus, they may choose to ride the train (operational 4 AM to midnight daily), walk, or use a moving walkway to reach their departure concourse.

The airport transportation mall is a 9.1-meter wide, air conditioned connecting corridor between the 7 airport concourses (domestic terminus, A, B, C, D, E, and F), with a central walkway (5.5 m wide) and moving walkways (1.8 m wide) on both sides. A passenger train is located on both sides of the transportation mall, providing transportation to and from all concourses. The distance from the domestic terminus to concourse E is 1 mile, equidistant between concourses. Attractions (e.g., stone sculptures, photography) and wayfinding signage exists throughout the transportation mall. Before we initiated the Walk to Fly intervention, there were no signs providing the time and distance to walk between concourses.

Intervention

We installed 4 point-of-decision prompts (78-in wide × 52-in high signs) in the domestic terminus of the transportation mall (Figure 1). We developed the layout, color scheme, material, and messages for the prompts in coordination with the Hartsfield-Jackson signage and graphics team, and we complied with airport regulations. We developed the message on the sign from surveys conducted with 386 travelers to ascertain barriers to walking and messages to encourage airport walking over riding the train.[12] Our survey findings revealed travelers preferred the direction and the time to walk between concourses as messages to include on the sign. Before installation, we tested sign prototypes with an additional sample of airport travelers (n = 200), which revealed a simple message and image were preferred. Therefore, the message on the prompts read simply, "You Can... Walk to Your Gate" and showed a directional arrow, walking icon, and the time required to walk between adjacent concourses (5 min; Figure 1). We installed the signs on 4 walls (adjacent to the train doors) in the domestic terminus on September 4, 2014. An Airport Walking Guide is available (https://www.cdc.gov/physicalactivity/downloads/CDC-Airport-Walking-Guide.pdf) and describes the process to engage airport stakeholders, create, and post point-of-decision prompt signage to encourage physically active choices. The Walk to Fly study was approved by the Centers for Disease Control and Prevention Institutional Review Board.

Monitoring Walking

We installed 6 ceiling-mounted infrared sensors (Prodco International, Montreal, Quebec, Canada), which were operational on June 15, 2013. We used the sensors to count travelers at the domestic terminus of the airport transportation mall. Three sensors counted travelers entering the transportation mall terminus on the 3 in-bound escalators. Similarly, 3 sensors counted travelers exiting the transportation mall terminus who walked or used the moving walkway to continue to their departure gates. We calculated the count of travelers riding the train as the difference between the number of travelers entering the domestic terminus of the transportation mall on the inbound escalators, and the combined walk and walkway sensor counts. We collected counts of travelers from June 15, 2013, to May 29, 2016 (preintervention period: June 15, 2013–September 3, 2014; postintervention period: September 4, 2014–May 29, 2016).

The sensors were active 24 hours a day, and counts were aggregated and logged in 15-minute time frames. Any count frame with train ridership below 50% of travelers was suggestive of interruption of train service and was dropped from the analysis. We validated the sensors against manual counts at the time of installation, and they were reconfigured until they registered less than 5% miscounts. After reconfiguration, we validated the sensors against manual counts once every 6 months. The sensors registered human heat signatures to generate directional counts, but were not able to detect any individual features (e.g., facial) or demographic characteristics of travelers.

Statistical Analysis

We analyzed the sensor counts to estimate the average number of travelers entering the transportation mall terminus daily by day of the week and to discern daily patterns in traveler volume and mode choice. To detect the impact of the intervention on walking, we used a Bayesian structural time-series model of daily counts that incorporated weekly variation and adjusted for the count of travelers entering the transportation mall to estimate walking counts in the absence of an intervention ($\text{Walkers}_{\text{Intervention absent}}$), which was compared with actual counts with the intervention ($\text{Walkers}_{\text{Intervention present}}$).[13] We estimated percent change in the number of travelers walking before and after the signs were installed as $(\text{Walkers}_{\text{Intervention present}} - \text{Walkers}_{\text{Intervention absent}})/\text{Walkers}_{\text{Intervention absent}}$. We estimated that detecting a 1% change (from 4% to 5%) in the proportion of walkers (travelers choosing to walk vs ride the train) would require monitoring 20 000 travelers—less than one half the average daily number monitored in the study.

Before initiating the study, we did not know that part of the transportation mall (including the moving walkway) was closed for construction for approximately 4.5 months (May 12, 2015, to September 24, 2015). This resulted in the pre- and post-intervention scenarios differing by more than just the Walk to Fly intervention. Therefore, we examined the impact of the intervention on walking over the full duration of the study (June 15, 2013, to May 29,

FIGURE 1—Study Area (a) Without and (b) With Point-of-Decision Prompt Signage: Walk to Fly Study, Atlanta, GA, 2013–2016

2016), and we examined the impact separately when the construction was present and absent. In addition, we performed a sensitivity analysis to examine the change in walking excluding the summer months (June to August) in the pre- and postintervention periods to address any residual confounding attributable to seasonal variation or the moving walkway construction. Analyses were performed using R (version 3.0.2, R Foundation, Vienna, Austria) and the package CausalImpact (R Foundation).

RESULTS

During the baseline (preintervention) period (June 15, 2013–September 3, 2014), we found a large day of the week variation in the number of incoming travelers to the domestic terminus location in the airport transportation mall. The average travelers per day entering this location of the transportation mall ranged from a low of 35 639 travelers on Saturdays to 50 090 travelers on Mondays. Overall, the average travelers per day were 45 356. During this period, 10.4% of travelers walked; 6.2% used the moving walkway, and 4.2% walked on their own. The percentage walking varied from 9.2% on Sundays to 11.6% on Mondays (Figure 2).

Overall, there was a 12.5% relative increase above baseline in the number of travelers choosing to walk on their own or use the moving walkway, with 619 more travelers per day choosing to walk. The relative overall percent increase in walking was similar for those traveling on weekdays (12.5%) and on weekends (12.6%).

When construction was not present (~16 months: September 4, 2014–May 11, 2015; September 25, 2015–May 29, 2016), there was a 16.7% relative increase above baseline in the number of travelers choosing to walk on their own or use the moving walkway (Table 1). During this period, the increase in the number of travelers choosing to walk was 810 travelers per day. To adjust for seasonal variation in walking during the construction period, a sensitivity analysis of change in walking during months common to both pre- and postintervention periods (i.e., excluding counts in June, July, and August) showed a significant effect of the intervention (11.0%; 95% confidence interval = 2.5%, 21.0%) to increase walking that was consistent with the overall findings (Table 1).

Travelers who do not choose to ride the train can choose to use the moving walkway or walk on their own. When the moving walkway was not under construction, of those travelers who walked, 61.3% (pre, 60.2%; post, 62.1%) used the moving walkway. When the moving walkway was not under construction, after the installation of signs, the number of travelers who chose to use the moving walkway increased by 11.9% (–0.5% to 25.0%), and those who chose to walk on their own increased by 23.2% (6.1%–43.1%).

The increase in walking was maintained from the initiation of the intervention on September 4, 2014 ("signs installed") until construction was present (May 12, 2015; Figure 3). The increase in walking was resumed when the moving walkway reopened in September 2015 and was maintained through May 29, 2016 (Figure 3a). On a cumulative basis, the number of additional walking trips after the signs were installed and throughout the intervention period was approximately 390 000 (Figure 3b).

DISCUSSION

The Walk to Fly intervention increased the number of airport travelers choosing to walk to their departure gate by approximately11% to 17%. When construction was not present, approximately 600 to 800 more travelers per day chose to walk rather than ride the airport train to their departure concourse. Using signage such as the point-of-decision prompts used in the Walk to Fly study might help encourage people to choose physically active options. Participation in brief, intermittent periods of physical activity (of at least 10 minutes) provides some health benefits and is a way to help adults meet physical activity guidelines.[3] These findings might be relevant for community venues such as city centers or transportation stations where large numbers of people congregate and where reasonable

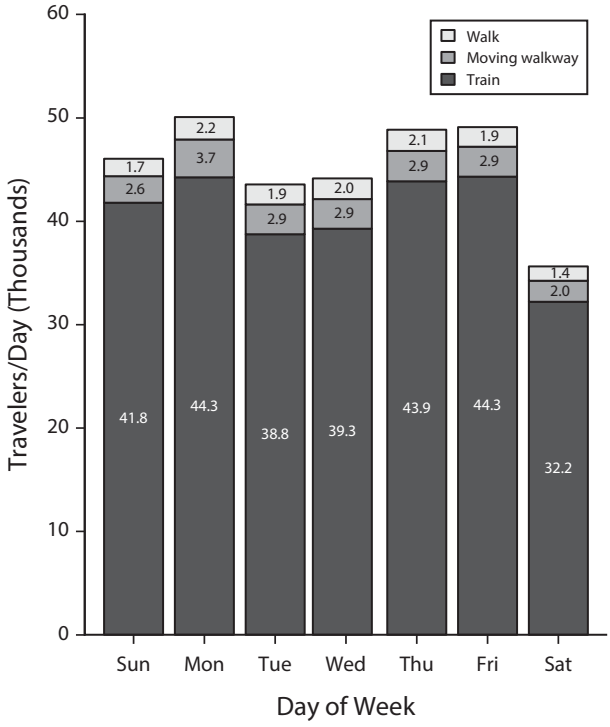


FIGURE 2—Preintervention Airport Walking and Train Riding Patterns by Day of the Week in the Atlanta Airport Transportation Mall: Walk to Fly Study, Atlanta, GA, 2013–2016

options to walk (rather than ride) are available but may not be readily apparent.

Walk to Fly was an effectiveness study conducted in the world's busiest airport. In this uncontrolled setting, unanticipated events occurred. Before initiating the study, we were not aware that midway through the intervention period for approximately 4.5 months (May 12, 2015–September 24, 2015), the transportation mall underwent construction. During this time, the proportion of travelers walking dropped to baseline levels. However, when the construction was completed, walking increased again by approximately 17%. The drop off and subsequent increase in walking upon completion of construction suggested the construction zone posed a significant perceived barrier to walking. Although unanticipated, the construction and subsequent decline in walking illustrated the importance of reducing perceived barriers to physical activity.[14]

TABLE 1—Change in Walking Before and After Point-of-Decision Prompt Signage: Walk to Fly Study, Atlanta, GA, 2013–2016

Variables	Walkers per Day		
	Without Prompts,[a] No. (95% CI)	With Prompts, No.	Percent Change,[b] % (95% CI)
Overall	4952 (4362, 5472)	5571	12.5 (1.8, 27.7)
Day of the week			
Weekday	5309 (4720, 5830)	5971	12.5 (2.4, 26.5)
Weekend	4064 (3475, 4582)	4576	12.6 (−0.1, 31.7)
Construction[c]			
Present	5377 (4795, 5929)	5307	−1.3 (−11.6, 9.5)
Absent[d]	5048 (4569, 5504)	5628	11.0 (2.5, 21.0)
Absent[e]	4844 (4251, 5357)	5654	16.7 (6.1, 29.0)

Note. CI = confidence interval.

[a]Walkers per day without prompts are predicted based on counts before prompts with walkway open, adjusted for the count of incoming travelers and count variations by day of the week.

[b]Percent change from predicted (without prompts) to actual counts (with prompts).

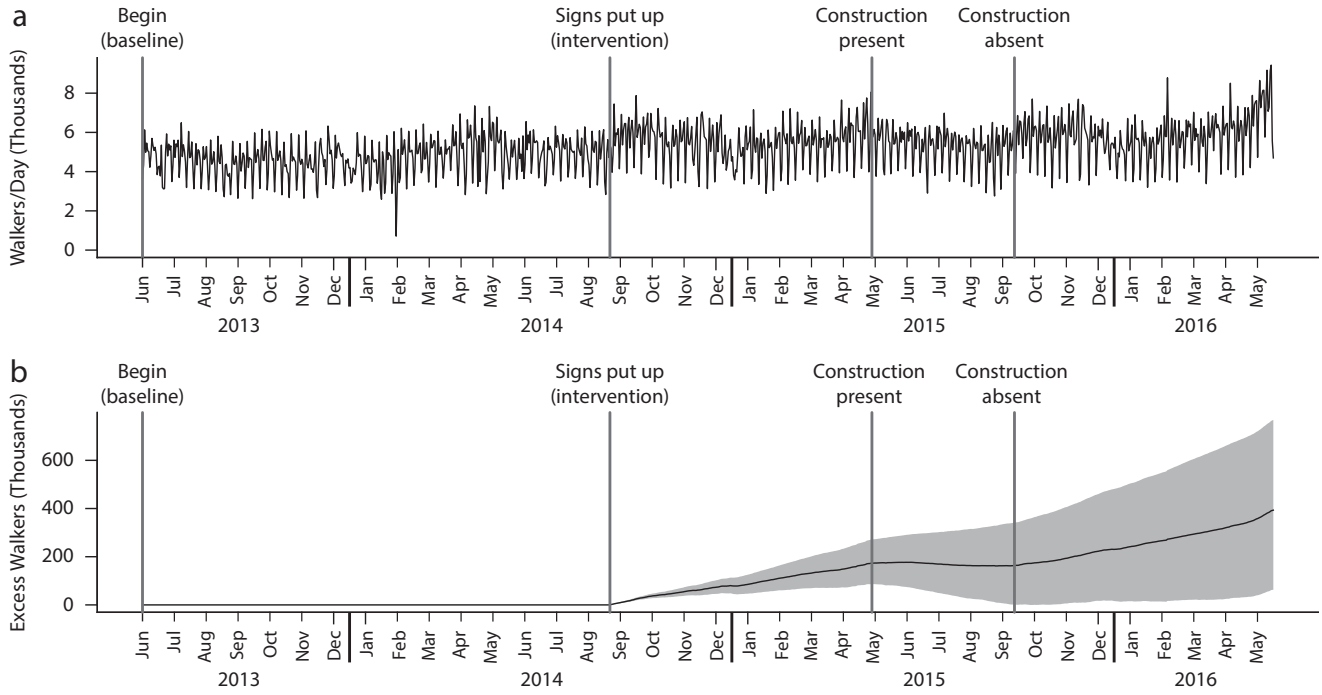
[c]Unknown to investigators before initiating the study, part of the transportation mall (including the moving walkway) was closed for construction for about 4.5 months from May 12, 2015, to September 24, 2015.

[d]Excludes counts collected in June, July, and August in pre- and postintervention periods.

[e]Includes all counts in pre- and postintervention periods.

Our findings were consistent with other studies that used point-of-decision prompts to increase stair use over use of an elevator or escalator.[9] When the moving walkway was open, we observed an absolute increase of 810 walkers per day (walkers/day increased from a predicted 4844 [9.9%] to 5654 [11.6%]) and a relative percent change of 16.7%. In an updated review of 9 point-of-decision prompt studies[9] that used signage to encourage stair or escalator use, the relative percent change in participants choosing the active option ranged from 5% to 81%. Although our findings were consistent with point-of-decision prompt studies, the relative changes we observed in walking were somewhat smaller. However, relatively small shifts in behavior in large populations (e.g., travelers in a large hub airport) could have a large overall population impact.[15] Prompting active choices in airports might have wide reach. In 2014, there were approximately 580 568 021 passenger boardings at the 30 large-hub commercial airports in the United States.[16] In the Walk to Fly study, approximately 390 000 additional traveler walking trips were taken (rather than riding the airport train) during the Walk to Fly intervention period.

Studies attempting to shift the mode of transportation from automobile use to active transportation (walking or cycling) provided relevant examples from which to consider the application of our findings. Providing communities with access to options for public transit is a strategy to increase physical activity because people often walk or bicycle to public transit.[17–19] Adding effective signage to inform travelers about options to incorporate walking (e.g., between transit



Note. Excess walkers indicate the excess of the observed number of walkers per day over the predicted number in the absence of the intervention. The shading in part b indicates the range that includes (based on the variability in the predicted numbers) the number of excess walkers per day with 95% confidence.

FIGURE 3—Walking Patterns During the Baseline and Intervention Periods When Construction Was Present and Absent by (a) Walkers per Day and (b) Cumulative Excess Walkers: Walk to Fly Study, Atlanta, GA, 2013–2016

stops) into their journey might be a viable strategy to not only encourage walking but to further increase physical activity and lessen the burden on public transit systems. This strategy was successfully applied in London, where signage was installed throughout London's boroughs to reduce the burden on the subway system before the Olympic games, with a secondary goal to encourage walking.[20] Cross-sectoral collaborations between transportation, business, community planning, and public health were considered essential for successful program adoption and implementation.[21]

To effectively navigate a physical environment, a key architectural design principle is to simplify wayfinding decisions by placing signs and maps at decision points.[22,23] Wayfinding programs in London, United Kingdom ("Legible London"),[20] and Vancouver, British Columbia, Canada,[24] use signage plus information to present active travel options for commuters. The programs are relatively simple—for example, providing maps showing the distance to walk to popular destinations or providing the walking distance on subway maps.[20] In London, the wayfinding strategy has demonstrated improvements in walking.[20] Adoption and dissemination of similar wayfinding initiatives may be a promising strategy for cities to consider to improve active transportation while also providing community benefits through improvements in traffic congestion, visitor travel experience, and economic development.[18,20]

Creating a culture where walking is an easy and safe option for people of all ages and abilities is a public health priority advanced by the US surgeon general.[18] Creating such a culture will require collaborations between many sectors of society (e.g., transportation and public health).[18,25] These collaborations can be formal, such as the Partnership for Sustainable Communities (https://www.sustainablecommunities.gov) among the Environmental Protection Agency, Department of Housing and Urban Development, and the Department of Transportation, or informal collaborations, such as those between public health and health care to provide patients and families with community resources for physical activity.[18] The Walk to Fly team fostered collaborations by engaging multiple stakeholders in the development and implementation of the intervention to include the city of Atlanta (Atlanta Hartsfield-Jackson International Airport), nongovernmental organizations (The Kresge and Centers for Disease Control and Prevention Foundations), and leaders from key sectors at the Atlanta airport who represented facilities management, information technology, security, customer service, communication, marketing, engineering, and signage and graphics. Collaboration among transportation, business, and health sectors may be particularly beneficial to implement the Walk to Fly intervention strategy in other contexts, such as transportation stations or city centers.

Limitations

At least 4 limitations of the study are important to note. First, the sensors detected the number and direction of airport traveler

walking, but were unable to detect traveler characteristics (e.g., age or gender), whether the traveler was walking or standing on the moving walkway, or their walking speed. Therefore, it was not possible to examine how the point-of-decision prompts differentially affected some population groups or examine how the intervention affected the volume or intensity of walking. For public health professionals, gaining a better understanding of the correlates of those who respond to walking prompts by validating walking counts with observational data (e.g., from film) might provide useful information. This information might also enhance the generalizability and application of the Walk to Fly intervention strategy to similar contexts around the world. Second, the number of travelers entering the transportation mall was different before and after the signs were installed; however, our analysis adjusted for this difference. Third, the Walk to Fly intervention might not be appropriate for some airport travelers. Our previous findings suggested walking might be difficult or inconvenient for approximately one quarter of airport travelers.[12] Fourth, as mentioned, the moving walkway construction during the intervention period was unanticipated; however, when the walkway reopened, walking increased to preconstruction levels, which suggested that removing a perceived barrier was an effective strategy to improve physical activity.[18] In addition, the moving walkway construction occurred during the summer when the number of travelers walking might be lower than during other times of the year based on the patterns observed in this study (Figure 3). To adjust for this potential bias, we excluded the summer months from the analysis, and we observed an 11% increase in walking. This result was somewhat lower but consistent with the 17% increase we observed when there was no construction. Continued follow-up of the Walk to Fly intervention over time will allow examination of the sustained effect of the point-of-decision prompts on walking.

Intervention saturation resulting in a diminished effect over time was not observed in this study. Because an airport traveler population changes daily, saturation was less likely than if the same people consistently viewed the signs. Findings from the Walk to Fly study might not be generalizable to locations where the same people consistently view signage over time. For example, point-of-decision prompt interventions conducted in locations such as universities or workplaces where people routinely go might experience saturation, although this phenomenon is difficult to study because most studies do not collect postintervention data for more than 6 months.[9]

The Walk to Fly study had several unique strengths. First, the messages on the point-of-decision prompt signage were developed from surveys of several hundred airport travelers.[12] Most point-of-decision prompt studies do not report a scientific method from which messages are developed.[9] Second, baseline and follow-up data were collected for more than 1-year periods, which allowed adjustment for potential differences in walking by time of year. Detection of walking by ceiling-mounted, infrared sensors was an unobtrusive method that provided reliable and accurate data by remote download. Finally, although traveler movement patterns could be difficult to monitor in a busy public venue such as the Atlanta airport, the domestic terminus location chosen for this study made for easier monitoring because of a simple pattern with few entrances and exits.

Conclusions

The Walk to Fly study demonstrated a significant and sustained increase in the number of airport travelers choosing to walk to their departure gate. This point-of-decision prompt intervention increased the number of airport travelers choosing to walk by approximately 11% to 17%, where approximately 600 to 800 more airport travelers per day (approximately 390 000 traveler walking trips to date) made the decision to walk (rather than ride) to their departure gate. In effect, the Walk to Fly study demonstrated that small changes in behavior could result in large population impact. Extending the Walk to Fly strategy to other large hub airports or in the planning of new airports or airport upgrades might help encourage physically active choices on a wide scale. Providing signage about options to walk in other busy locations such as city centers or transportation venues where reasonable walking options are available[20] hold the potential to improve population levels of physical activity and therefore improve the public health.[18] Providing effective wayfinding options to prompt walking offers a simple, feasible solution to improve public health.[26] AJPH

CONTRIBUTORS

J. E. Fulton and P. Paul contributed to the conceptualization, design, analysis, and interpretation of data. G. M. Frederick, S. A. Carlson, and J. M. Dorn contributed to conceptualization, design, and interpretation of data. J. D. Omura contributed to interpretation of data. All authors contributed to the drafting and revision of the article and approved the final version to be published.

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Note. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

HUMAN PARTICIPANT PROTECTION

The Walk to Fly Study was approved by the Centers for Disease Control and Prevention institutional review board.

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