Applied Research Brief: Health Promoting Community Design; From Evidence-Based Practice to Practice-Based Evidence

Assessing the Walkability of the Workplace: A New Audit Tool

Andrew L. Dannenberg, MD, MPH; Todd W. Cramer, MPH; Christopher J. Gibson

Abstract

Purpose. *Walking can be incorporated into most people's daily routines if the process is made convenient by a well-designed built environment. Walkability rarely is assessed in the workplace, where adults spend much of their time.*

Methods. *From existing tools, we developed an instrument to audit walkability at a single government agency's facilities, which were located in multiple states. We used a five-point scale to evaluate nine elements of walkability: pedestrian facilities, pedestrian-vehicle conflicts, crosswalks, route maintenance, walkway width, roadway buffer, universal accessibility, aesthetics, and shade. Weighted scores ranged from 20 to 39 (poor), to 40 to 69 (fair), to 70 to 100 (good).*

Results. *Of 79 walking route segments surveyed on 10 agency campuses, 34% were rated poor, 32% fair, and 34% good. Repeat assessment of 20 walking route segments by three independent observers yielded similar scores.*

Conclusion. *Facility planners may find this walkability instrument useful in identifying and eliminating barriers to convenient walking opportunities in workplaces such as office parks and university campuses. (Am J Health Promot 2005;20[1]:39–44.)*

Key Words: Walking, Prevention Research, Audit Tool, Environment

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INTRODUCTION

Despite the numerous health benefits, most Americans fail to achieve the Surgeon General's recommended level of at least 30 minutes of moderate physical activity on most—preferably all—days of the week.[1,2] Walking is a physical activity in which most people can participate because it requires no special skills or equipment and easily can be made routine, particularly if used for transportation. The creation or enhancement of access to places for physical activity can increase the percentage of people engaging in such activity.[3] Because most adults spend much of their time in workplace settings, workplace designs that encourage walking for transportation and recreation may help more Americans achieve recommended physical activity levels.

Walkability audit tools are used to assess pedestrian facilities and to identify specific improvements that would make routes more attractive to pedestrians. After finding that existing audit tools are not well suited to workplace settings, we developed a new audit tool to assess those characteristics of physical facilities that affect walking for transportation and recreation in workplace settings, such as office parks, university campuses, and light industrial facilities. Such audits can be used to help make workplace facility planners and managers more aware of how their decisions affect the health and safety of employees.

METHODS

Design

While serving on the Healthier Worksite Committee at a U.S. Federal agency, we developed and used a walkability audit tool (Appendix) to help identify potential improvements in workplace design that would encourage agency staff to walk more often, for transportation and recreation, during the workday. We designed our audit tool after reviewing the literature on existing walkability audit tools and pedestrian ''level of service'' guidelines.[4–12] While none of these tools met our needs well, we adapted audit elements from several of these existing tools. Compared to existing neighborhood audit tools, our audit tool examines the suitabili-

Table 1

Workplace Walkability Audit Elements and Priorities and Reliability Substudy Score Ranges and Measures of Agreement

Walkability Audit Elements		Reliability Substudy		
Name	Priority	Score Range ≤2*	Mean Weighted κ Coefficients (range SE κ)†	Kendall Coefficient of Concordance
A. Pedestrian facilities	High	19/20	0.54 (0.09–0.12)	0.86
B. Pedestrian conflicts	High	18/20	0.67 (0.07–0.11)	0.87
C. Crosswalks	High	15/20	0.60 (0.09–0.16)	0.80
D. Maintenance	Medium	15/20	0.23 (0.10–0.20)	0.50
E. Path size	Medium	14/20	0.33 (0.11–0.14)	0.54
F. Buffer	Medium	17/20	0.64 (0.08–0.14)	0.81
G. Universal accessibility	Medium	16/20	0.48 (0.10–0.16)	0.68
H. Aesthetics	Medium	18/20	0.44 (0.12–0.14)	0.72
I. Shade	Low	13/20	0.26 (0.08–0.17)	0.53

* As described in the text, each element for each of 20 segments on one campus was evaluated by the original auditor and three subsequent independent auditors. The score range is the proportion of these four evaluations that are within two points on a five-point scale for a given element. For example, for Pedestrian facilities, the four evaluators gave scores within two points (such as scores of 1, 2, 2, and 3) for 19 segments and scores ranging more than two points (such as 1, 3, 4, and 5) for one segment.

† As a measure of interrater agreement, weighted κ coefficients were calculated for each of the six possible pairs of the four observers. Results in this table represent the mean of these six weighted κ coefficients and the range of their standard errors (SE).

ty of workplace routes for recreational walking and the presence of features needed for persons with mobility impairments and minimizes attention to child-related concerns (such as playgrounds) and to traffic speed and volume (usually low in campus settings).

Sample

We evaluated walkability on seven agency campuses with office and laboratory facilities in the headquarter city of the Federal agency. In addition, collaborators used the audit tool to evaluate three agency campuses elsewhere in the United States. These 10 campuses constitute all agency facilities that have multiple buildings at one site, except for two distant campuses for which only limited information could be obtained.

Measures

The audit tool is designed for use with individual pathway segments. First we mapped pedestrian routes between all reasonable destinations on or near each of the 10 campuses. These routes were then divided into discrete segments bounded by intersections with other routes and/or common destinations. Segment lengths ranged from dozens to hundreds of yards. In aggregate, these segments form a pedestrian ''grid'' for walking between any two destinations on or near each campus. Facility planners and other colleagues reviewed each campus map to ensure that all useful segments were included.

The tool independently assesses nine critical elements of the pedestrian-level physical environment that are thought to constitute ''walkability'' (Table 1). We assigned a relative priority (high, medium, or low) to each element by reviewing the literature[4,6–8,12] and consulting with colleagues. For example, safety-related elements are considered to be of high priority, and shade is considered a low priority for walkers. Assessment of each element is based on a one-to-five–point scale, where a score of one represents the least favorable environment for walking. Individual element scores are weighted and summed according to their priority. Scores for elements with high priority are multiplied by 3, medium by 2, and low by 1, yielding a final overall score of 20 to 100 points.

The audit tool also contains five open-ended questions to identify the most dangerous and unpleasant elements of a route, to describe potential improvements in its directness and the quality of pedestrian facilities, and to assess the suitability of the route for recreational use.

Analysis

Each segment was examined using the audit tool, generally by a pair of observers who discussed and recorded a single score on each element for each segment. Segments scoring a weighted total of 70 or more points, 40 to 69 points, and below 40 points were classified as ''good,'' ''fair,'' and ''poor,'' respectively.

To measure interrater reliability, three people not otherwise involved in the study were given brief instructions and then independently used the tool to reassess each of the nine elements for each of 20 segments on one large agency campus that was selected for convenience. For each element, the proportion of the 20 segments for which the original evaluation and the three subsequent reevaluations differed by two or fewer points on the five-point scale was calculated (Table 1). Using SAS (version 9.0) software, weighted κ coefficients and standard errors were calculated for each of the six possible pairs of the four observers.[13] In addition, the Kendall coefficient of concordance among the four evaluations was calculated for each audit element by using SAS software to run the Magree macro version 1.0.[14] Kendall coefficients can range from 0 to 1, in which case 1 would indicate complete agreement on one element

Table 2

Ratings of 79 Walking Segments From Audits on 10 Campuses of a Federal Agency, Fall 2003

Campus	Number of Acres*	Number of Employees†	Number of Buildings	Segment Ratings (%)			Total Number of Segments
				Good	Fair	Poor	
1	Large	Medium	20	8 (40)	8 (40)	4 (20)	20
2	Large	Small	3	1 (100)	0 (0)	0 (0)	1
3	Large	Large	11	2 (20)	3 (30)	5 (50)	10
4	Small	Small	3	1 (100)	0 (0)	0 (0)	1
5	Small	Medium	2	6 (67)	1 (11)	2 (22)	9
6	Medium	Large	5	1 (20)	3 (60)	1 (20)	5
7	Large	Large	11	2 (18)	4 (36)	5 (45)	11
8	Large	Large	8	0 (0)	1 (11)	8 (89)	9
9	Medium	Small	9	0 (0)	2 (67)	1 (33)	3
10	Medium	Medium	2	6 (60)	3 (30)	1 (10)	10
Total	—	—	—	27 (34)	25 (32)	27 (34)	79 (100)

* Acres: <10 = small; 10–40 = medium; >40 = large.
† Employees: <200 = small; 200–1000 = medium; >1000 = large.

among the four evaluations for each of the 20 segments assessed.[15]

RESULTS

Campuses ranged in size from less than 2 to over 80 acres, and in employee population they ranged from less than 25 to over 2500 individuals. In total, 79 walking segments were mapped and analyzed on the 10 campuses; the number of segments identified on each campus ranged from 1 to 20. Overall, 27 segments were scored ''good,'' 25 ''fair,'' and 27 ''poor'' (Table 2). ''Good'' segments typically included direct routes across pleasantly landscaped areas or along slow-speed roadways. ''Fair'' segments usually included routes that directly crossed active parking lots and driveways or required close proximity to heavy traffic. ''Poor'' segments commonly included routes that lacked crosswalks across busy intersections or consisted of unpaved pathways adjacent to busy roadways.

Responses to the five open-ended questions varied. Almost all of the dangerous pathway locations involved unsafe and unpleasant proximity to vehicular traffic. Similarly, unpleasant elements of walking segments were most commonly smells and noises generated by traffic. Common suggestions to make segments more appropriate for pedestrian use included provision of sidewalks and marked crosswalks. Five routes were identified that could be replaced with a more direct path, often made obvious by dirt paths that had been worn into the landscape. Finally, the observers subjectively identified 28 of 79 (35%) segments as attractive for recreational use when such routes were isolated from vehicular traffic and could be incorporated into a pleasant walking loop.

When three observers used the audit tool to independently reevaluate 20 segments on one campus, the highest reliability was noted for pedestrian facilities, where 19 of 20 segments received all four scores within two points of each other on the five-point scale (Table 1). The lowest reliability was observed for shade, in which case only 13 of 20 segments received all four scores within two points of each other. Based on weighted κ coefficients, the highest agreements were measured for pedestrian conflicts (.67) and buffer (.64), while the lowest agreements were for maintenance (.23) and shade (.26) (Table 1). Based on Kendall coefficients, the highest concordances were measured for pedestrian conflicts (.87) and pedestrian facilities (.86), while the lowest concordances were measured for maintenance (.50) and shade (.53) (Table 1).

DISCUSSION

Summary

This tool is designed to audit the walkability of office parks and other nonresidential campuses. It differs from neighborhood walkability audit tools in its decreased emphasis on children and on traffic speed and volume and its increased attention to potential recreational walking routes for workers, to the needs of persons with disabilities, and to shade, which may be an important factor as it pertains to walking comfort.

Segment scores generated by this audit tool were similar to those intuitively expected at most locations. Although agency-wide scores were well distributed between ''good,'' ''fair,'' and ''poor'' categories, scores at individual campuses ranged from mostly good to mostly poor. This likely reflects varying degrees of attention to pedestrian needs among agency campuses. In general, higher scores were observed on government-owned properties than on government-leased properties within commercial office parks. About one-third of the audited segments were considered attractive for recreational use, indicating that opportunities for physical activity already exist on many agency campuses.

The audit tool includes sufficiently detailed scoring information so that

the tool can be used by interested persons with minimal instructions. Audits were successfully conducted on distant campuses by agency employees without a need for formal training. Based on the measured interobserver variation, some elements were easier than others to assess consistently.

The conduct of this walkability audit led to several accomplishments. First, it helped raise the awareness of the agency's facility planners and managers to the importance of walkability in designing, renovating, and maintaining the agency campuses. Second, based on the audit results, the Healthier Worksite Committee submitted to the agency a list of desirable campus improvements, along with cost estimates, that focus on improving specific locations for walking for transportation and for exercise. On one campus, improvements completed to date include construction of a new sidewalk from a bus stop to the entry gate, new signage to highlight a complex pedestrian route around a construction site, and construction of a short wooded trail specifically for employee recreational use. In addition, a marked perimeter walking trail has been added to the master plan for another campus, and discussions are underway to improve pedestrian safety at a complex road intersection on a third campus. Implementation of additional recommendations from the audit may be expected over time.

Limitations

Although arbitrary, the ''good,'' ''fair,'' and ''poor'' categories used in the tool were based on a review of previously published audit tools and generally were consistent with observations. The tool is primarily qualitative rather than quantitative in design, so some interrater variation in observations was expected. In addition, we may have underestimated the tool's reliability, because the repeat observations were made during ongoing campus construction.

For assessing instrument validity, there is no gold standard against which a walkability audit tool can be compared, and few, if any, existing audit tools have been validated.[9] For two walking routes in close proximity, one would expect more frequent recreational use on the one with the higher walkability score, although we were not able to examine this possibility. Because workplace walking routes are primarily used for transportation, one would expect the frequency of people using such routes to be determined more by the need to travel between two points than by a route's walkability.

Significance

This walkability audit tool is designed to provide planners and stakeholders with an instrument with which to identify and eliminate barriers to convenient walking opportunities in the workplace. The reliability of the tool appears to be sufficient for nontechnical assessment of pedestrian facilities. A copy of the audit tool and instructions for its use have been posted on the Centers for Disease Control and Prevention website to encourage its use.[16] Future studies might attempt to examine the connection between walkability improvements and increases in levels of use by pedestrians for transportation or recreation.

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Workplace Walkability Audit Tool

Appendix

Location: _____

Date: _____

A. Pedestrian Facilities (High importance): presence of a suitable walking surface, such as a sidewalk.

1	2	3	4	5
No permanent facilities, pedestrians walk in roadway or on dirt path		Paved walkway on one side of road, minor discontinuities that present no real obstacle to passage		Continuous paved walkway on both sides of road, or completely away from roads

B. Pedestrian Conflicts (High importance): potential for conflict with motor vehicle traffic because of driveway and loading dock crossings, speed and volume of traffic, large intersections, and low pedestrian visibility.

1	2	3	4	5
High conflict potential				Low conflict potential

C. Crosswalks (High importance): presence and visibility of crosswalks on intersecting roads. Traffic signals have functional 'walk' lights that provide sufficient crossing time.

1	2	3	4	5
Crosswalks not present despite major intersections				No intersections, or crosswalks clearly marked

D. Maintenance (Medium importance): buckling pavement, overgrown vegetation, standing water, etc. on or near the path. Does not include temporary problems (e.g. tall grass).

1	2	3	4	5
Major or frequent problems				No problems

E. Path Size (Medium importance): useful path width, accounting for barriers to passage such as utility poles and signs mounted in the walkway.

1	2	3	4	5
No permanent facilities	< 3 feet wide, significant barriers			> 5 feet wide, no barriers

F. Buffer (Medium importance): space separating path from adjacent roadway.

1	2	3	4	5
No buffer from roadway, or pedestrians walk in roadway			> 4 feet from roadway	Not adjacent to roadway

G. Universal Accessibility (Medium importance): ease of access for the mobility impaired. Includes handrails accompanying steps, ramps to accommodate wheelchairs, etc.

1	2	3	4	5
Completely impassible or no permanent facilities	Very difficult or dangerous (e.g. no wheelchair ramps)		Universally - accessible route available but inconvenient	Designed to facilitate universal access

H. Aesthetics (Medium importance): includes proximity of fences and buildings, noise, landscaping quality, and presence of pedestrian-oriented features, such as benches and water fountains.

1	2	3	4	5
Uninviting				Pleasant

I. Shade (Low importance): amount of shade, accounting for different times of day.

1	2	3	4	5
No shade				Full shade

Sum of High importance (A-C):	_____	x	**3**	=	_____
Sum of Medium importance (D-H):	_____	x	**2**	=	_____
Sum of Low importance (I):	_____	x	**1**	=	_____
Total Score:					_____ / 100

Observations

1. What is the most dangerous location along this segment?

2. What is the most unpleasant element of this segment?

3. What improvements would make this segment more appropriate for pedestrian use?

4. Would it be possible to design a more direct route to connect the ends of this segment?

5. Are the conditions of this segment appropriate and attractive for exercise or recreational use?

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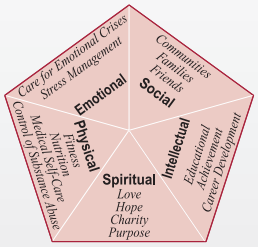

DIMENSIONS OF OPTIMAL HEALTH

Definition of Health Promotion

"Health Promotion is the science and art of helping people change their lifestyle to move toward a state of optimal health. Optimal health is defined as a balance of physical, emotional, social, spiritual and intellectual health. Lifestyle change can be facilitated through a combination of efforts to enhance awareness, change behavior and create environments that support good health practices. Of the three, supportive environments will probably have the greatest impact in producing lasting change."

(O'Donnell, *American Journal of Health Promotion,* 1989, 3(3):5.)

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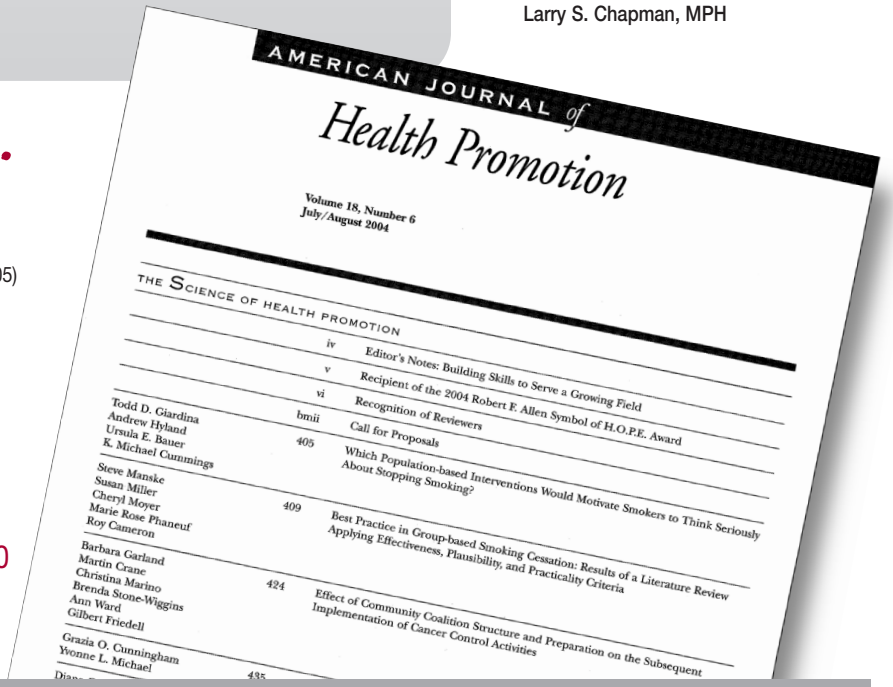
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