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Walking and Walkability: Is Wayfinding a Missing Link? Implications for Public Health Practice

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Abstract

Background—Research on walking and walkability has yet to focus on wayfinding, the interactive, problem-solving process by which people use environmental information to locate themselves and navigate through various settings.

Methods—We reviewed the literature on outdoor pedestrian-oriented wayfinding to examine its relationship to walking and walkability, 2 areas of importance to physical activity promotion.

Results—Our findings document that wayfinding is cognitively demanding and can compete with other functions, including walking itself. Moreover, features of the environment can either facilitate or impede wayfinding, just as environmental features can influence walking.

Conclusions—Although there is still much to be learned about wayfinding and walking behaviors, our review helps frame the issues and lays out the importance of this area of research and practice.

Keywords

physical activity; built environment

Walking is the most fundamental form of physical activity. It is linked to positive health outcomes, including less all-cause mortality, cardiovascular disease, obesity, diabetes, and bone loss.[1–4] For well over 2 decades, public health and other professionals have promoted walking as a means to increase physical activity and therefore enhance health and reduce the burden of chronic disease,[5–7] acknowledging that for many people, walking is a more acceptable form of exercise than vigorous physical activities.[8] The public health benefits of walking have been promoted by the Centers for Disease Control and Prevention,[9] the Office of the Surgeon General,[10] and the American Heart Association,[11] among others.

Despite active promotion, increasing walking in the United States has proven challenging. Although the 2010 National Bicycle and Walking Study reports incremental increases in walking over the past 15 years, original goals have not been met.[12] In a similar fashion, a 2012 *Morbidity and Mortality Weekly Report* documented some increase in walking from 2005 to 2010.[13] However, benchmarking reports and individual studies[14,15] indicate only 10% of all trips are by foot, in marked contrast to most European countries where percentages of pedestrian trips range from 16 to 24%, with figures higher in cities.[15]

Although there are undoubtedly many reasons for limited walking, much attention has focused on neighborhood and community walkability, that is, the qualities of an environment, both objective and perceived, that influence walking. There is a rich research literature exploring how place-based factors are associated with walking, including land use mix, population density, proximity to transit, sidewalk connectivity, safety, and accessibility.[8,16–19] Most studies are cross-sectional and have focused on walking for transportation, with fewer addressing walking for recreation or leisure-time physical activity. A small number of studies, for example those recently reported by Hirsch and colleagues[20] and Gustat and colleagues,[21] demonstrate that improvements in the built environment are associated with positive changes in walking behavior, such as more minutes walking per week. Overall, the strength of the evidence for many community walkability factors varies with the purpose and type of walking, and the age, gender, and functional status of walkers. For example, while higher residential density is generally associated with more walking, there is a point of diminishing returns where walking is inhibited.[22] Also, in recreational walking, aesthetic qualities and access to recreational facilities have particular salience.[22,23]

What is surprising in past research on walking and walkability is the limited attention to wayfinding, which we define as the interactive, problem-solving process by which people use environmental information to locate themselves and navigate from place to place. Visitors to an unfamiliar city searching for a park could use street signs, landmarks, or other kinds of information along a route to find their way there and back. In the absence of understandable information, they might guess a direction, ask a passerby, or consult a mobile application. All people, whether walking, cycling, driving, or using public transit, must engage in wayfinding, and all communities provide wayfinding aids and cues. Despite this, research, practice, and policy to date have emphasized making the built environment attractive, physically safe and accessible, but not necessarily making it coherent, interpretable, memorable, or navigable.

In this article, we explore how wayfinding is linked to walking and walkability, drawing upon research and gray literature across several disciplines. We address what is known about individual and environmental factors integral to wayfinding in general and specifically with respect to walking and walkability. We highlight relevant practice and policy and discuss next steps to advance knowledge of wayfinding and walking and walkability.

Methods

A research team from the Healthy Aging Research Network, a thematic network of the Centers for Disease Control and Prevention's Prevention Research Centers supported by the Healthy Aging Program (www.cdc.gov/aging), along with external partners from fields such as architecture, planning, engineering, and universal design, provided oversight to the project. A literature search was conducted of journal articles in English through PubMed, CINAHL, PsycINFO, Engineering Village, Academic Search Complete, and Web of Science bibliographic databases using the term *wayfinding* and variants (eg, *way-finding*, *way finding*, *wayfinders*), with no date restrictions. In addition, we conducted online computer searches and obtained input from external partners, identifying and reviewing reports, conference proceedings, government documents, and other materials of relevance. Our primary criterion was outdoor urban places. After removing duplicates, 669 of the 1,218 articles identified were deemed potentially eligible and their abstracts were reviewed. During an initial pass, 340 were removed based on our exclusion criteria (primarily relevant to indoor environments, emergency evacuation, computer interface design, basic science (molecular, animal studies, neuroanatomical), clinical, or product development rather than community wayfinding; see Figure 1), leaving 329 articles for potential review. During full review, 125 did not meet eligibility criteria for these same reasons. Ultimately, 204 were included in an initial review. For more detail on our review process, please see the Supplemental Materials online.

We developed and subsequently extracted information from the eligible articles using a comprehensive online abstraction instrument (available upon request). Based on information abstracted, 16 reviewers independently identified key concepts based upon a preliminary conceptual framework that defined areas of interest as person-level factors (eg, visual ability), environment-level factors (eg, presence of landmarks), tools and technology (eg, a map), and person–environment interaction (decision making behavior based on changing environmental conditions).[24] We reviewed topics collectively in teams of at least 3 people, comparing themes with others in the group, and discussing, negotiating, and synthesizing findings into a summary.

From this comprehensive review, we identified a subset of 64 articles of specific relevance to walking and walkability for this paper (54 were research articles and 10 were gray literature articles covering practice and policy.) Selected were articles pertaining to wayfinding while walking, physical and cognitive demands of walking and wayfinding, environmental resources and tools for pedestrian wayfinding, and walking behavior linked to ease of wayfinding. We drew on the full set of articles for context and to develop our background section, while reporting results specifically pertaining to walking and walkability.

Results

Literature in our review represented multiple disciplines (Table 1). Psychology was the dominant field, representing 44% of all research articles found and encompassing a wide range of subdisciplines (eg, environmental psychology, cognitive psychology, developmental psychology, neuropsychology, and social psychology). Other disciplines included design

(12%), spatial science/geography (11%), and computer science (11%). Compared with our overall findings, the pedestrian wayfinding literature was similarly dominated by psychology (43%), but with a greater emphasis than the general literature on disability (19%) and computer science (13%) research.

Demands of Community Wayfinding

From the general wayfinding literature, we identified 3 major cognitive and sensorimotor components that comprise the wayfinding process. First, wayfinding requires *orientation*. Travelers need to know where they are in the environment in relation to reference points such as their origin and destination. Orientation is supported by frames of reference, ranging in complexity from landmarks (distinctive man-made or natural features) to route sequences to mental images or cognitive maps.[25,26] Second, wayfinding requires *decision making* both in advance travel planning, however casual (ie, route choice), and in *en route* decision-making (ie, behavior at decision points). Field-based researchers using subject think-aloud protocols during wayfinding characterized decision making as situated in the environment; travelers have a general idea of where to go and then work out the details on the move, in response to cues in the environment.[27–30] Finally, wayfinding involves *path integration*, a process of movement monitoring to track direction and speed of travel.[31] Cornell and Greidanus,[32] citing Loomis,[33] describe 2 types of path integration: moment to moment updating, based on continuous movement, sensation, and perception, and configural updating, a more conscious periodic linking of body movements such as turns to orienting frames of reference.

The challenge of wayfinding varies by trip type, whether commuting (traveling between familiar places), exploring (moving from a familiar to an unfamiliar place and back), or questing (traveling within or to unfamiliar places).[31] It also varies by degree of support, whether aided by signage, maps or other tools, well-defined paths and degree of environmental complexity.[34]

Much of the literature focuses on environmental knowledge acquisition, generally depicted as progressing from recall of landmarks (reference points such as distinctive buildings or natural features), to routes (sequence of paths to reach destinations), to survey knowledge (larger spatial configurations, such as neighborhoods).[35–38] Survey knowledge is often referred to as a cognitive (or mental) map, and many researchers consider cognitive maps the most flexible form of representation, enabling individuals to reach any destination in their environment.[25,39–41] Such maps allow 1 to encounter an unexpected roadblock and determine an alternative route, or take a shortcut when time or preference dictates. The stages of environmental learning appear to progress developmentally in children to age 12[37] and in adults as they acquire knowledge about unfamiliar places. Some researchers challenge the stage narrative of knowledge acquisition, asserting that route knowledge indicates a visual orientation or preference, while survey knowledge indicates a spatial strategy or preference, either of which can lead to equal levels of wayfinding competence.[42] If not sequential, these 3 forms of knowledge—landmark, route, and survey—remain distinct and important[36] and are addressed throughout the literature, sometimes as competencies, sometimes as preferred approaches.

As sensory, physical, and cognitive capacities differ by person, it is not surprising that research shows large individual differences in wayfinding performance.[43–45] Lack of ability to move through environment, lack of perceptual ability, and memory problems can impair knowledge acquisition and therefore wayfinding ability. Studies have found associations between worse wayfinding performance of various kinds and early childhood,[46–48] old age,[25,49–57] visual impairment,[58,59] cognitive impairment,[60,61] or female sex.[25,62–68] Wayfinding can be further impeded by transient environmental conditions that compromise information gathering such as poor visibility, bad weather, construction, darkness, or sensory overload or even by stressful frames of mind.[26,69–72] In addition, several studies suggested spatial anxiety as a barrier to wayfinding that affects individual performance.[40,51,65,73]

Research on use of directions addresses differences in both ability and preference, without clear conclusions. Some people prefer directions that reference landmarks and turns to the right or left ("route"), whereas others prefer cardinal directions of north/south/ east/west ("survey").[74] Research has frequently associated verbal directions with route-based preferences and maps to survey-based preferences. People with better mental rotation (the ability to turn a map mentally rather than turn it in one's hand) tend to prefer maps, whereas other people prefer landmarks and verbal descriptions.[75]

Gender differences are addressed in a number of articles, with many articles cataloguing differences between men and women on components of wayfinding, often in laboratory-based settings. Others grappled with complex interactions among biological differences, gender-based preferences, gender roles in navigation, and cultural overlays such as gender perceptions of safety.[25,62,64–66,68] Some studies suggest a gender divide, for example, finding that women travel more quickly and accurately with route directions that mention specific objects and actions such as turns, while men perform the same whether the directions are route or survey.[76] However, further research is needed to disentangle these complex issues and address their implications for real-world problem solving and how they relate to walking.

Demands of Wayfinding on Foot

The particular demands of wayfinding on foot start with walking itself. According to information processing theories, people divide their finite thinking capacity across the various tasks at hand, and the easier walking is, the less attention it takes and the more cognitive resources are free for wayfinding.[77] Cognitive resources for wayfinding may be compromised because of the distraction of maintaining posture, balance, and gait under crowded or chaotic conditions, when carrying packages or in the case of functional limitations. In crowded conditions, pedestrians are further challenged by the necessity to adapt their walking speed and direction to other pedestrians.[78] A recent study has called attention to slower and more erratic gait during mobile phone reading and texting.[79]

Because outdoor environments are too large to be seen in their entirety and have no continuous unifying elements such as walls or ceilings, they are especially difficult to navigate at the ground level.[80] As opposed to drivers or transit users, pedestrians are more sensitive to distance and more vulnerable should they exceed their functional limits or become lost. Route selection and *en route* decision-making are accordingly important considerations. According to Dalton,[81] pedestrians typically select the most direct path toward destinations, favoring routes with the least angle between their current position and their goal. Holscher et al[28] found that people were more efficient at finding the shortest route while situated in the environment than in planning it out ahead of time. Route choice may vary by group and walking purpose; for example, older adults in 1 study marked longer routes on neighborhood maps 80% of the time to avoid features such as stairs, blind walls, littered streets, and parks, probably due to perceived safety concerns.[81] In addition, participants said they would walk greater distances to access paved walkways along 1-floor dwellings and shops as well as high traffic areas. In contrast, people with cognitive impairment tend to prefer traffic-free shopping areas.[71] This variation by population groups suggest that pedestrians make wayfinding decisions to balance walking challenges, including difficulty and distraction levels, as well as physical distance.

Pedestrians must keep track of their walking progress to reach their destinations and be able to return to their origins. They are helped in this task by the continuous stream of passing visual information, or “optic flow.”[80,82] However, pedestrians are also exposed to an abundance of other external sensory stimuli including auditory information (eg, sounds of passing traffic) or tactile information (eg, differing pavement qualities), especially important sources of information for those with visual impairment.[26,83,84] In the absence of visual information, as when visibility is limited, for example, by darkness or thick fog, pedestrians rely on path integration to monitor their progress, drawing on kinesthetic information generated by their own body movements. While pedestrians have some success at remembering routes through body turns, they have difficulty perceiving and tracking gradual curves. Path integration is therefore a “process prone to error” especially in large-scale environments, demonstrated by research showing that people lost in poor visibility often walk in circles.[80 (p. 204)] Overall the risk of accumulating errors in monitoring location and progress means that it is important for pedestrians to stay oriented through larger external frames of reference to avoid losing their way. These environmental supports are discussed in the next section.

Environmental Resources and Tools for Wayfinding on Foot

In 1960, urban planner Kevin Lynch first called attention[85] to the contribution environments can make to wayfinding, arguing that environments need to be “legible” so that travelers can “read” them and form “mental maps” of them. Lynch described wayfinding as “… the result of a 2-way process between the observer and the observed” (p. 118). In his seminal research, he asked residents of 3 different cities to sketch particular urban areas and from those maps he enumerated 5 collectively identified place-based features as fundamental to wayfinding: paths, edges, nodes (decision points), districts, and landmarks.[85] These features are part and parcel of built environment design, with the exception of landmarks, which can be natural features. Design, known to influence walking, also affects wayfinding. Garling and colleagues[86] argued that 3 essential wayfinding design elements were (a) visual access (ability to see landmarks and other features), (b) differentiation of environments, and (c) simplicity of layouts. Monotonous nondescript environments or overly complex environments with many alternative paths are not easily understood or remembered. A body of scholarship has tested Garling's model and confirmed that lack of visibility, lack of differentiation, and overly complex layouts lead to traveler disorientation.[72,87–89]

Among specific place-based attributes, visible landmarks are the most clearly identified features that meet pedestrians' need for orienting frames of reference, helping define a route and make it more memorable.[80] People with highly variable levels of environmental knowledge use landmarks as beacons,[90] linking multiple landmarks into networks as they move.[35] Wayfinding is aided when landmarks are visible over short distances[91] and located at decision points, such as intersections.[57,92] Pedestrians may attend to nearby or distant landmarks, depending on personal preference or environmental conditions. In a virtual wayfinding experiment, some pedestrians relied almost entirely on nearby landmarks, indicating a route orientation (eg, turn right at the ferry building), whereas others focused almost entirely on distant landmarks providing survey orientation (eg, go north). In the absence of visibility of one or the other type of landmark, however, all had noticed and could use to some degree the other type of landmark to navigate.[93] Pedestrians with cognitive impairment also made very conscious use of landmarks in navigating.[94] In 1 study, people giving directions to other pedestrians mentioned local landmarks, especially shops, more often than any other feature, while making very little use of distance information.[95] In a Japanese study participants mentioned residential buildings the most, especially those located at intersections where there were changes in route and those that contrasted most with the surrounding environment.[69] People with visual impairment are clearly disadvantaged by lacking access to visual landmarks but make use of soundscapes and tactile information in similar fashion.[26,58,84]

Environmental resources for wayfinding also include signage and information systems, both of which people use for guidance and confirmation that they are on the right track. Signage is what people most often equate with wayfinding; signs, especially at eye level and including images of well-known landmarks[96] and markers indicating that "you are here" have been shown to be useful for orientation and navigation.[97] Other features specifically designed to facilitate wayfinding include point-of-decision cues and aids (eg, street name signs, accessible pedestrian signals, crosswalk treatments, information kiosks). Both researchers and practitioners acknowledge that signage cannot compensate for poor design and as a matter of practice, should be considered in the context of overall design and circulation patterns and integrated with other information resources.[98,99] How information is best presented is a subject of inquiry; 1 study using a kiosk with 7 different types of information displays for a wayfinding task, determined that combinations of photos and text, a map with landmarks, or photos with landmarks produced significantly better wayfinding performances that text, landmark text, and plain map alone.[100]

In unfamiliar places, pedestrians often make use of hand-held navigational tools such as maps and smart phones, as well as directions from other sources. Maps are the most ubiquitous wayfinding tool, but can be challenging to use given that people generally have difficulty with mental rotation and have been observed to rotate hand-held maps to match the orientation of their view.[101] In reading stationary maps in the environment, pedestrians oriented themselves more quickly when maps called attention to landmarks than when they called attention to spatial layout.[102]

Tactile, audio, or visual cues relayed to hand-held devices facilitate navigation,[103] and user interface options allow people to select strategies based on cognitive status and personal preferences.[104] For example, voice-activated systems can significantly enhance wayfinding among adults with sensory and/or cognitive limitations.[103] Navigational applications for smart phones and other devices, including those designed for people with specific needs, may enhance wayfinding performance without necessarily improving knowledge about the environment.[105]

Ease of Wayfinding and Walking Behavior

We found sparse pedestrian wayfinding literature regarding the relationship between wayfinding and elements of walking behavior such as frequency, type of walking, and choice of walking over other means of transportation. In the general wayfinding literature, better spatial ability, as measured by cognitive mapping ability, was associated with greater number of neighborhood services used, total distance of unique trips, and average trip length.[106] Of concern to public health, many people find navigating in unfamiliar or only partially known environments stressful to the point of avoiding making trips.[38,107,108] However, we do not know how spatial anxiety affects walking behavior per se.

Mikami and colleagues[109] note that most pedestrian wayfinding research is focused on destination walking. In contrast, they examine wayfinding as a part of “migratory” or leisure walking identifying a highly interactive process focused on discovery and enjoyment and involving “stopovers” and possible change in destination depending upon experiences along the way. The research of Kubat, Özbil, Özer, and Ekinoğlu[110] in Istanbul points to promising ways to look at walking patterns in urban areas, indicating that such patterns are influenced by street connectivity, directional accessibility, and the quality of information available. Studies have found greater pedestrian traffic in areas that are highly connected visually with more direct and linear street networks.

Among the clearest indicators that wayfinding is a missing link in walking and walkability comes from the gray literature. Legible London (UK) is the most prominent urban wayfinding initiative to date, with an express public health goal of increasing walking.[111] Legible London examined how residents and visitors found their way around the city and what might be done to encourage walking. Uncovering significant barriers to walking, including the presence of 32 distinct, unrelated wayfinding systems within the city, the study found that people lacked information to make decisions about walking vs. transit, for example 55% of trips made by subway would have been quicker to walk. The subsequent citywide Legible London wayfinding system[112] was built around the principles of the seamless journey, human scale (emphasizing solutions that respond to how people think, move, congregate, and remember), naming the parts of a place, progress, stepwise disclosure “don’t make me think” designs (clear and intuitive information requiring minimal effort to understand), and parsimony (providing only as much information as needed).[112,113] Overall, the principles help travelers form mental maps of the city and therefore be able to move about freely.[113] A series of evaluations found that travelers self-reported increased interest in walking, increased speed of walking trips, and fewer getting lost episodes.[114]

Discussion

We began by asking whether wayfinding is a missing component in understanding the behavior of walking and the concept of walkability. We conclude that while there is not a large body of robust and indisputable evidence linking wayfinding to walking behavior, there are compelling reasons to investigate the relationships, and to more systematically access wayfinding as a component of walkability. The research reviewed is clear that wayfinding is a cognitively demanding activity that competes with other functions, including walking itself.[77,78] Moreover, place matters: Features of the community environment can either facilitate or impede wayfinding just as environmental features can influence walking.

In our sample, we discovered a rich wayfinding literature from many disciplines, predominantly representing psychology, the design disciplines, geography, and computer science, in that order. Overall, discussions were psychologically oriented and focused on individual differences and select groups. Many psychological studies took place in virtual environments with small sample sizes, protected from the chaos and unpredictability of real-world settings. Measures of wayfinding differed across studies, making it difficult to synthesize findings for real-world relevance. In addition, studies were primarily focused on destination walking as opposed to other types (eg, recreational walking) and often on performance of least distance traveled as the sole criteria for defining effective wayfind-ing competence. While research on wayfinding is important for public health, especially with regard to growing interest in place and health, specific research from a public health perspective is presently missing.

The literature does provide insight into the process of community wayfinding, and in some instances, lends itself to translation to practice. Findings are convincing that wayfinding capability varies by person, functional status, gender (controversially), psychological state, and perspective, strongly suggesting the need for presentation of pertinent wayfinding information in a variety of ways. Findings demonstrating human difficulty with map rotation underpin the emerging best practice of heads-up street side maps, while knowledge of the importance of landmarks is reflected in newer map and navigation aids. The evidence base is also substantive for differentiated places, visible local and global landmarks, distinct landmarks at choice points, simple and clear organization of paths, and clear and sufficient signage.

Additional study of individual factors, such as the impact of wayfinding anxiety and/or wayfinding self-efficacy on walking, is needed. Note that walking self-efficacy measures are typically focused on belief in physical capabilities and do not address way-finding per se. In particular, indications that perceived safety affects route choice need follow-up to understand the degree to which safety concerns influence walking motivation. Confidence that one can find one's way without exceeding one's limits could prove to be a significant factor in willingness to engage in recreational or destination walking.

Although research confirms the value of mobile navigational supports, such as GPS-enabled phones, for wayfinding performance, it suggests that technology is not a silver bullet that will free us from the demands of wayfinding. Indeed, there are many questions surrounding the use of individual tools and their impact on walking frequency, duration, distance traveled, and safety. The potential negative effect of wayfinding application use on gait and balance may need to be balanced against the potential benefit of clearer environmental design that promotes ease of wayfinding to promote walking in older and sensory-impaired populations, for example.

Questions remain about the impact of tool use on learning and subsequent ability to find ones' way should the tool malfunction. At the same time, environmentally based technologies to facilitate way-finding are becoming more sophisticated and more widely applied with potential for universal benefit. Compared with hand-held devices for the individual, technologies embedded in the environment are consistent with public health's utilitarian mission of having the greatest health impact for the greatest number of people.[115]

Aside from the Legible London study suggesting that well-designed wayfinding systems can increase walking, we found little research directly addressing the relationship between walking and wayfinding or walking and the wayfinding environment. The pivotal question remains as to whether the wayfinding environment and/or modifications to the wayfinding environment can promote walking behavior. Opportunities to address this question abound in study of wayfinding improvement initiatives, now common in communities. Other pedestrian and transportation improvement projects, as well as projects promoting healthy communities, offer similar opportunities if a focus on wayfinding can be integrated in the planning stages.

To assess the impact of environmental features on walking and to evaluate change, we need to be able to adequately characterize places in terms of their wayfinding features. Studies regarding place-based factors affecting walking typically rely on 1 or more complementary assessment methods, for example, Geographic Information Systems,[19] personal interviews,[116] self-report questionnaires,[117] and environmental audits.[118] Few current tools address wayfinding features, or do so comprehensively, with the exception of the CDC-HAN Environmental Audit Tool that includes a wayfinding scale.[119] Integrating wayfinding specific queries into existing tools measuring walkability would greatly facilitate further research and evaluation.

Our review of the gray literature suggests that current wayfinding practice is uneven, with design, implementation and maintenance largely originating at the community level where decisions are typically driven by commercial interests, entertainment, or tourism, and only recently in a few locations by a focus on encouraging walking.[120] Pedestrian wayfinding is just now beginning to receive the attention it deserves, having previously suffered from a lack of guidelines and best practices. Outside the United States, exemplar guidelines are in use in places such as Victoria, Australia,[121] and London.[111] Historically, most US wayfinding practice and policy has been directed to drivers and visually impaired pedestrians, as reflected in the Manual on Uniform Traffic Control Devices for Streets and Highways.[122] The Federal Highway Administration makes available a brief set of recommendations related to pedestrian wayfinding, while the City of New York Mayor's Office provides wayfinding design principles.[123]

Assessment of policy and practices as implemented is highly desirable so that the evidence base can be further strengthened. There are many unanswered questions, especially as communities more systematically embrace increasing walking as part of their goals for their wayfinding systems. For example, the addition of wayfinding support to parks and other recreational areas by the city of Nashville, Tennessee, provides an opportunity to assess impact on leisure walking.[124] Similarly, in New York City, New York, will the addition to street side maps of circles showing walking distances by time encourage more walking?

Study Limitations

This paper draws upon a broad, comprehensive review of the wayfinding literature based on the term wayfinding and its many variants and employing multiple approaches to identify and search the published peer-reviewed and gray literature. Despite our best efforts, we may have missed some studies through our selection of electronic databases, if articles were not published in English, or the authors used terminology distinct from our search terms. Moreover, it is important to note that this paper is based on a subset of articles from the larger review. The searches for that review did not specifically search for "wayfinding and walking" or "wayfinding and walkability," but rather wayfinding only. Had we specifically search on the combined terms it is possible that would have identified other articles of relevance. Accordingly, our review cannot be regarded as all-inclusive; however, our purposes included determining if and how wayfinding research addressed walking and to develop an understanding of the relation between wayfinding and walking and walkability. We believe that this work sets a foundation as well as framework for examining this area of research.

Conclusion

Walking and wayfinding are integrated activities. Walking is an intentional activity, and people's willingness to walk in the community has partly to do with whether their informational wayfinding needs are being met. Walking itself requires attention, and impaired sensory or cognitive function, distraction, or confusing environments can further deplete resources available for wayfinding. Orienting oneself and making *en route* decisions, especially in unfamiliar places, require conscious mental effort to note and remember features in the environment. When those places have limited features to support wayfinding, walking freely can be difficult. The literature hints at ways by which ease of wayfinding and walking are linked (motivation to engage in walking in unfamiliar places; walking frequency, duration, and distance traveled), but research is needed to further confirm and explain the nature and extent of relationship. The significance of this research for public health is clear, with particular relevance to our understanding of walkability and of activity-promoting environments and healthy communities in general.

Today's increased focus on promotion of walking and seamless multimodal travel, as well as the environments to support both, is optimal for integration of wayfinding considerations. Growing numbers of communities envision wayfinding as integral to walking and to walkability. We have much to learn from their work. We encourage the public health community to lead the way in examining wayfinding as a factor in walking behavior and both mental and physical access as factors in community walkability. Wayfinding may indeed prove to be a vital link in walking and walkability, opening the door to a new generation of place-based strategies to enhance health and mobility in our population.

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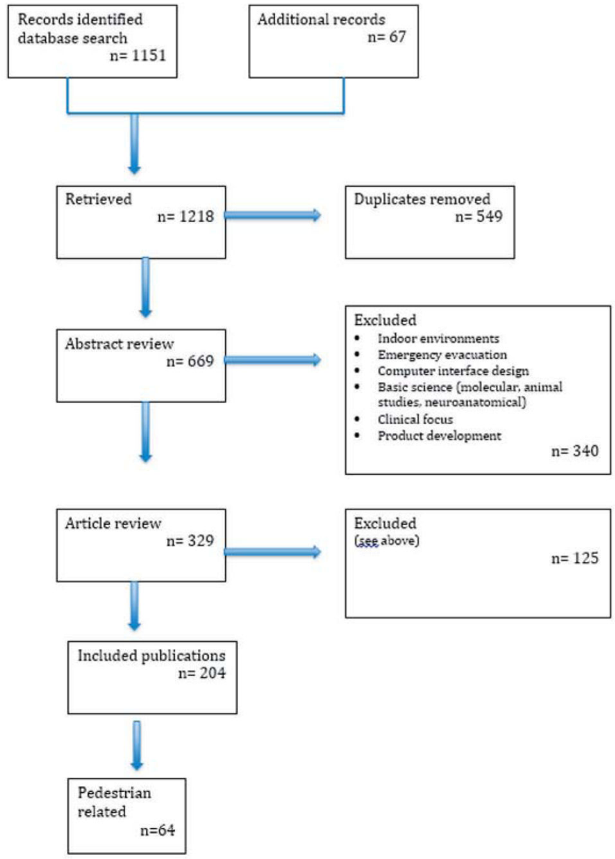

Figure 1.

Wayfinding scoping review process.

Table 1

Disciplines Represented in Wayfinding Literature

	Wayfinding Literature (#/%)		Pedestrian Wayfinding Literature Subset (#/%)	
Disciplines	Research literature	Gray literature	Research literature	Gray literature
Psychology	83 (44)	0 (0)	23 (43)	0 (0)
Disability related/rehabilitation	16 (9)	3 (18)	10 (19)	2 (20)
Computer science	21 (11)	1 (6)	7 (13)	1 (10)
Architecture/urban studies/transportation	23 (12)	10 (59)	3 (6)	5 (50)
Biomedical sciences	10 (5)	0 (0)	3 (6)	0 (0)
Spatial science/geography	21 (11)	0 (0)	4 (7)	0 (0)
Gerontology	7 (4)	0 (0)	2 (4)	0 (0)
Other *	6 (3)	3 (18)	2 (4)	2 (20)
Totals	187 (91.67)	17 (8.33)	54 (84.38)	10 (15.62)
	204		64	

*Business, environmental studies, anthropology, linguistics.