RESEARCH ARTICLE

Universal design for the rural walks of life: Operationalizing walkability in Bonnyville, Alberta, Canada

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Funding Acknowledgement: This work was supported by the Canadian Institutes of Health Research (BEO85861, 2007-2012), the Heart and Stroke Foundation of Canada (PG-07-0353, 2007-2010), and the University of Alberta Killam Research Fund (KRFcgCG 08/09, 2008-2009). CN received support as an Applied Public Health Chair from the Canadian Institutes of Health Research in partnership with the Public Health Agency of Canada and Alberta Innovates - Health Solutions (2014–2019; CPP 137909).

Disclosure Statement: The authors have no financial interest or benefit arising from the direct application of their research.

Universal Design for rural walks of life

Abstract

Many Canadians have low levels of physical activity, including walking. One public health response is to improve opportunities for walking, or walkability, by changing community built environments. While urban walkability research is expanding, it does not readily apply to smaller, rural communities, leaving a significant knowledge gap. This participatory research project operationalized rural walkability using Universal Design principles to promote walking in a vibrant rural community. A literature review examining rural walkability supplemented local data from a related study. Simultaneously, local partners were engaged to operationalize walkability and iteratively develop a walking map responsive to community priorities of inclusivity and community engagement. The walkability literature was severely limited in evidence and theory for rural settings; conventional urban walkability constructs did not fit the geography, degree of rural-ness, nor primary purposes of walking by residents. This challenged the cogency of current rationales for walkability as a socio-structural response to the obesity epidemic, which may undervalue the individual benefits and public good inherent to walking and equitable supports for walkability. The Bonnyville Community Walking Map was developed using Universal Design principles, providing a tool for all residents, including seniors and others with limited mobility. Consideration of Universal Design can enhance equity and transferability of walkability research across settings, and prompt reconsideration of walkability as access to pedestrian spaces for embodied and vulnerable pedestrians. This research is among the earliest in Canada to investigate theoretical and empirical bases for operationalizing walkability in rural settings in broader efforts to foster health-promoting community environments.

Keywords: rural health; community-based participatory research; Universal Design; built environment; walkability

Introduction

Societal factors that contribute to low levels of physical activity are recognized as critical risk factors for many chronic diseases, which are exacerbated among rural populations (Canadian Institute for Health Information & Public Health Agency of Canada, 2011), increasing the health inequities already experienced by Canadians living in rural communities. One public health response has been to promote daily walking, either for active transportation or fitness, as a physical activity that is generally accessible across all socio-demographic groups (Saelens & Handy, 2008). Interventions can occur at multiple levels, focused on individuals (e.g., pedometer use), groups (e.g., workplace walking meet-ups), or the environment (e.g., community infrastructure), and are expected to positively impact physical activity and health outcomes. Environment-level interventions often implicate *walkability*, i.e., features that make an area *pedestrian-friendly* or inviting for walking (via the presence and quality of sidewalks, curb-cuts, cross-walks, traffic density, etc.). This characterization of walking – and walkability – for the purpose of promoting physical activity is prominent in the literature, with intrinsic public health appeal as it implicates the behavioural risk factors and socio-environmental conditions linked with many chronic diseases. Yet, this positioning does not adequately reflect the priorities or values of communities related to their own well-being (Parry, Mathers, Laburn-Peart, Orford, & Dalton, 2007), which should be of eminent concern to public health.

The concept of walkability adopts a socio-ecological perspective to examine ways of producing environments supportive of walking, and linking health to built form (McCormack & Shiell, 2011). Measures of walkability commonly involve level of density, degree of diversity (land-use mix), scale of design, extent of street connectivity, and volume of destinations; factors thought to uniformly impact pedestrian friendliness (Sallis, 2009). Destination or trip-specific

factors, including retail opportunity/floor area, distances to destinations, proximity to recreational opportunities, and green spaces, are other environmental correlates of walking. There is no consensus on a single, standard measure of walkability; high quality, comparable, and replicable definitions and measurements are only in the 'first generation' of research (Brownson, Hoehner, Day, Forsyth, & Sallis, 2009).

Walkability research comprises a predominantly urban and metropolitan evidence base (Brownson et al., 2009; Frost et al., 2010), limited in transferability to rural, small urban, or semi-urban communities, which do not have the same kinds of pedestrian spaces found in major cities (Hart, Larson, & Lishner, 2005). The geographic attributes and scales of rural areas diverge from urban ones, making rural walkability resistant to operationalization at the neighbourhood-level geography usually employed in research. Barriers to walkability in rural communities are indicative of the often-limited municipal infrastructure resources available to them, typically due to a smaller municipal tax base and reliance on provincial/state level funding. Consideration of walkability for rural communities, as a construct, is thus constrained: its conceptual and empirical foundations are untested in this context and current knowledge cannot be equitably applied to either public health practice or research in rural settings (Lewis, 2012). Nevertheless, even in urban settings, operationalization of the walkability construct remains indistinct and imprecise, with little confirmation that assessments consistently align with the same underlying factors reliably (Schopflocher, VanSpronsen, & Nykiforuk, 2014). Operational inconsistency leaves practitioners and researchers in the difficult position of redefining the concept for themselves, and renders meta-analyses, generalization, and application of findings challenging (Frost et al., 2010). The walkability construct is also under-developed theoretically and yet to fully engage sociological and critical social justice perspectives to interrogate the values and

definitions that underpin current measures; for instance, as described by Lewis (2012) who posits that [pedestrian] access must reflect an individual's ability to use available resources as constrained by the attributes of the individual, their social circumstances, and their perceptions of both.

A critical public health lens should then question the characterization of walkability as merely an attribute of built environments, as well as the prioritization of active transportation above other forms of walking, instead turning to focus on pedestrians and their nuanced interactions with pedestrian space (Lewis, 2012; Lo, 2009). In much of the public health literature, pedestrians are understood only in superficial terms of objective walking variables versus subjective walking experiences, neglecting their multiple social, temporal, and spatial perspectives (Middleton, 2009; Middleton, 2010). In contrast, planning and design perspectives portray walking as an embodied and vulnerable practice, implicating pedestrian movement between more- or less-privileged places as a socio-ecological determinant of health (Fletcher, 2016; Sheller & Urry, 2006). Operationalizing walkability thus requires a critical understanding of the pedestrian as politically, economically, and socially positioned within pedestrian spaces in ways that can variably support or undermine their common experiences of embodiment and vulnerability (Lid, 2013), and ultimately their perceptions of well-being in their community beyond their physical activity aims.

The idea of walkability, as whether and how neighborhood environments encourage walking, is also quickly moving from academic discourse to policy and practice realms (e.g., Walk Score®), despite its limited conceptual robustness. Formalization of walkability interventions in healthy public policies and planning guidelines implemented outside of urban areas, however, must reflect issues relevant to rural communities, and carefully define

walkability in the context of their needs and realities. Yet, current public health interventions employ walkability predominantly to address the clustering of overweight/obesity in rural populations, despite having little empirical evidence or theoretical development (Kegler et al., 2013). In addition to hindering decision-making in rural areas where it is arguably most needed, the theoretical imprecision of walkability further muddies public health discourse, conflating the societal values associated with physical activity and socio-ecological supports for individual behaviour with those related to the embodied experiences of community participation through walking.

Adopting a more situated understanding of walking can expand the consideration of equity concerns for rural walkability research and practice. Our research is among the earliest in Canada to investigate the theoretical and empirical basis for operationalizing rural walkability, as part of a broader community-based participatory research project on built environment and health.

Research Setting

The Town of Bonnyville, Alberta, Canada (population: 6,216) is the primary service centre for approximately 10,000 people including surrounding areas (Statistics Canada, 2011). The economy revolves around oil field industries and agriculture, with a growing outdoor tourism sector (http://town.bonnyville.ab.ca). Geographically, this low-density residential community extends from a vibrant main street where the majority of businesses and services are concentrated. This main street is connected to the provincial highway and is flanked by service and residential roads. Most of the length of the main street (and some of the newer residential streets) has limited street lighting and narrow sidewalks, with a few traffic lights for pedestrian crossings at busy intersections. Light industrial manufacturing and farm equipment sale lots

bound the town on three sides. Bonnyville's southern boundary runs along a lakeshore and wetland circled by 8 kilometres of paved walking trails.

Bonnyville was identified as 'rural' based on Statistics Canada's definition, which characterizes rural populations simply as those living outside of large settlement regions, or census metropolitan areas (population 100,000+) and census agglomerations (population 10,000+) (Statistics Canada, 2011). This definition is consistent with the National Center for Health Statistics' Urban-Rural Classification Scheme for Counties' cut-off of 49,999 to distinguish between levels of lesser or greater urbanization for non-metropolitan county equivalents (Ingram & Franco, 2012). In public health research and policy, rural geographies are commonly distinguished from urban ones by three features: population size, population density, and travel distance from essential services (Hart et al., 2005). Further, a number of built environment features relevant to walking have been identified as distinguishing urban from rural areas (Supplemental Table 1), emphasizing the absence of rural design, transportation, and land-use mix considerations. Rural communities differ in socio-demographics, social norms, institutions, economic structures, and access to resources, yet walkability research tends to almost exclusively identify features associated with walking that are only reproducible at urban political, economic, and social scales (Frost et al., 2010).

Study Design

Bonnyville was involved in a larger, two-phase community-based participatory study relating built environment to physical inactivity and unhealthy eating (Nykiforuk et al., 2013). Phase one, community observation, included objective and subjective measurements of the built environment. Objective assessment was conducted along street segments (block faces) by observers who used a validated audit tool to document and assess micro-scale features

potentially related to accessibility, pleasantness, human needs, comfort, and safety. Subjective assessment employed photovoice with residents to document their impression of community opportunities and barriers to physical activity and healthy eating. Phase two, knowledge translation and sharing of data with community stakeholders (from the municipalities, health regions, local health and social service providers, and general public), helped solidify the design and implementation of specific community-driven initiatives. Supplemental Figure 1 and Supplemental Figure 2, respectively, provide examples of the observation and photovoice data discussed with the community.

After seeing their data, Bonnyville community partners prioritized the development of a local, evidence-informed 'pedestrian-friendly' walking map. The map would be developed from the Bonnyville observation data to demarcate accessible routes to key destinations in the main street area. During a community townhall meeting, it became clear that prevailing concepts of walkability in the literature were 'too urban' to fit Bonnyville's rural setting. The community viewed walkability in entirely different terms, defining pedestrian-friendliness primarily as equitable access to services by walking, as experienced by all members of the community, regardless of age, station, or mobility. Partners were most concerned about seniors in the community (many with limited mobility) due to the proximal location of seniors' retirement residences relative to the downtown core where many essential services are offered. While conceivably within walking distance from downtown, it was unclear if the walking route(s) available were 'walkable' by seniors, and if the existing evidence on walkability was appropriate for informing the development of a walking map in this rural community. These community-identified priorities revealed that facilitating walking in Bonnyville was not about promoting

physical activity (or obesity intervention), but about ensuring equitable access to community services and fostering inclusion and social engagement of potentially isolated residents.

Thus, prior to co-designing the Bonnyville walking map with community stakeholders, we conducted a narrative literature review to identify: (i) which tools, measures, or factors have been used to operationally or effectively measure or define walkability in urban and rural settings; and, (ii) which features make neighborhoods accessible for walking to seniors (or those with mobility challenges). The following sections outline the results of that review, the arrival at Universal Design principles to inform the project, and the process of community consultation for the resulting Bonnyville Community Walking Map.

Conceptualizing Rural Walkability Rural

The majority of walkability research has focused on urban and metropolitan regions; only a few studies have specifically addressed walking (i) in rural communities and (ii) among seniors. Table 1demonstrates important distinctions in these two bodies of literature.

<Insert Table 1>

Walking in rural settings does not have demonstrated associations with many of the characteristics that typify walkability in urban settings (abundant retail floor area, highly connected street networks, diversity of land uses, and density) for all of which there is limited, and sometimes contradictory, evidence relative to health outcomes. Many features negatively associated with walking in urban contexts (longer distances to destinations, absence of sidewalks or crosswalks, more difficult terrain, poor street lighting, fewer recreational facilities, and less retail floor area) are typical of rural geographies (Table 1 and Supplemental Table 1) and may not be easily amenable to conventional interventions targeting built form (Nykiforuk, McGetrick, Crick, & Johnson, 2016). Built environment features that support walking among seniors

(controlled domestic dogs, curb cut sidewalks, bench and table seating, few stairs and gradients, and even pavement) are not instrumental in either urban or rural conceptualizations of walkability, despite providing a baseline or threshold level of support for pedestrians with limited mobility (Fletcher, 2016). From a physical activity promotion standpoint, seniors, with high prevalence of multi-morbid chronic conditions limiting functional mobility, and rural populations, with higher rates of overweight/obesity, have the most to gain from interventions that improve health outcomes through increased daily walking (Kokkinos, 2012). This perspective, while clinically relevant, inadvertently contracts the public health perspective of walkability to a focus on physical activity, largely irrespective of social context. It is problematic that the extant definitions and measures underpinning walkability research may only narrowly correspond to rural realities (Barnidge et al., 2013; Lewis, 2012) and have restricted application to seniors and other populations with limited mobility (Gray et al., 2012; Lid, 2013).

Universal Design

Given the community's emphasis on equitable access and the narrative literature review findings, Universal Design principles were selected to operationalize walkability in Bonnyville. Use of these principles in map development would ensure deliberate consideration of access by all community members, including those with the greatest mobility concerns (Gray et al., 2012). The seven principles of Universal Design are: 'equitable use'; 'flexibility in use'; 'simple and intuitive use'; 'perceptible information'; 'tolerance for error'; 'low physical effort'; and, 'size and space for approach and use' (National Disability Authority, 2016).

Universal Design principles, developed in 1997, broadened inclusion of all potential users (pedestrians, in the present research) within the scope of what is normal for design (pedestrian spaces) (Fletcher, 2016). Within the set of principles, 'equitable use' incorporates all users across

diverse abilities; ‘flexibility in use’ seeks diversity in how designs can be used; ‘simple and intuitive use’ presents understandable design; ‘perceptible information’ communicates to diverse users; ‘tolerance for error’ reduces consequences of accidental misuse; ‘low physical effort’ aims for comfort and minimal fatigue in use; and ‘size and space for approach and use’ accommodates a range of abilities (National Disability Authority, 2016). For walkability, Universal Design supports the reinterpretation of pedestrians and pedestrian spaces as both embodied and deterministic by acknowledging that the degree to which mobility constraints are experienced as a disability depends on the built environments in which people are moving (Lid, 2013). For example, pedestrians are less likely to perceive themselves as disabled by limitations in the built environment if they can travel along routes that support their embodied and vulnerable experiences of walking (Macpherson, 2010). The World Health Organization endorsed the adoption of Universal Design as a means of celebrating human diversity, identifying facilitators and the limits of fixed standards for functional independence, and supporting the lifelong contributions to society of all people (World Health Organization, 2011).

Universal Design was confirmed as appropriate for the current project after examining two other relevant frameworks, the Rural Active Living Assessment (RALA) (Yousefian et al., 2010) and the Senior Walking Environment Assessment (SWEAT) (Cunningham, Michael, Farquhar, & Lapidus, 2005). RALA was the first walkability audit designed specifically for rural settings (albeit primarily for use only in highly resourced areas such as town centres and developed strips) and emphasizes variables concerning broad-level physical environments, community programs and policies, and street segments (Yousefian et al., 2010). Conversely, the SWEAT tool operates from four scales of walkability (functionality, safety, aesthetics, and destinations) to document features specific to the needs of seniors (Cunningham et al., 2005). Neither were

deemed appropriate for developing the Bonnyville Community Walking Map given their epistemic grounding in physical activity; i.e., the emphasis on the 'walking as transit perspective' and exclusion of walking for leisure or social connection, regardless of mobility. The Bonnyville research-community partnership wanted to work from a more critical perspective on walkability: one centered on equity, cognizant of ongoing interaction between pedestrians and pedestrian spaces, and recognizing the shifting conceptions of walking as a universal act, which is nevertheless invested with individual meanings (Solnit, 2001).

Use of a Universal Design framework can help bring neglected equity concerns to the attention of researchers and policy makers (Lid, 2013), by helping to connect what walkability researchers have conceptualized as materiality (practical contact with the day-to-day), the built environment (physical form of human settlements), and embodied experiences (knowledge of the self and its capacities) (Middleton, 2010). For the Bonnyville Community Walking Map project, Universal Design offered a new lens for: recognizing commonalities and differences between urban and rural geographies; incorporating walkability literature into our operationalization; giving local pedestrians a holistic overview of pedestrian spaces in their community; and, enabling selection of appropriate supports for walking. This experiential perspective on mobility (Sheller & Urry, 2006) was especially important for seniors, who may not travel solely as pedestrians, but who instead combine walking with other modes and equipment (driving, public transportation, scooters, wheelchairs, and walkers) as part of a trip-chain. The limited research on how mobility is embodied shows that those with constrained mobility often confront a hostile built environment on many scales (Middleton, 2009). The Bonnyville Community Walking Map was designed to be used in a variety of ways by all residents, providing an easily understood walkability rating system across a diversity of map users, and allowing those users to determine

pedestrian routes that minimized negative experiences of limited mobility through the selection of usable, error-tolerant spaces. This lens promotes social inclusion and community access in the walking experience, but is also consistent with the tenets of physical activity promotion, offering a more balanced inclusion of the myriad of values inherent to community walkability.

The Bonnyville Community Walking Map

The narrative review on walkability revealed that, rather than imposing a 'first generation' walkability index (Brownson et al., 2009), an operational definition should come directly from the community, particularly since rural residents have been shown to have different conceptions of walkability than their urban counterparts (Schasberger, et al., 2009). Consistent with the project's participatory approach, community stakeholders were directly engaged in defining walkability. Employing an iterative process of continual refinement, the discussion of walkability began as loosely describing barriers to access and perceptions of safety of a street segment when walking. The concepts identified were then organized by the group according to the phase one built environment observation data collected in the larger project, including: curb cuts at beginning and end of street segments; convenience to cross the street; sidewalk condition as fair or good; pretty safe or very safe traffic-wise to cross the street; no barriers or path obstructions on the segment; complete sidewalks; ease of walking; presence of street lights; and aesthetic attractiveness. However, preliminary data analysis revealed insufficient variation between street segments to distinguish between low, moderate, and highly walkable street segments using these criteria. Moreover, despite a variety of analyses combining the segment level data according to the micro-level factors associated with rural and seniors' walking identified in the literature, our partners still preferred a highly simplified version of the walkability construct for use in programming and municipal decision-making. For example, they

indicated that it would be most helpful to have an inventory of which streets had sidewalks and curb cuts, as this – in and of itself – was important for them in identifying walkable, in their context (i.e., due to limited capacity to capture that information with community resources).

In designing the map, our team developed an equitable, simple, and perceptible representation of the walkability construct, applying Universal Design principles accordingly. A color categorization scheme for street segments was devised following traffic light standards to make the walkability rating intuitive for users. Street segments were given a 'green' rating if there was a sidewalk and curb cuts at both ends; 'yellow' if it had a sidewalk, but no curb cuts; and 'red' if there was no sidewalk or considered inaccessible. The map also presented the location of paved walking trails along the lakeshore, in light of photovoice data indicating their importance for social connection and physical activity (Supplemental Figure 2). Drawing on the walkability literature (Table 1), the location of municipal parks were numbered on green coloured areas of the map, and traffic lights and marked crosswalks were highlighted as yellow circles identifying safer routes to cross the main street/provincial highway. All local recreation facilities (indoor and outdoor) and schools were marked on the walking map with unique symbols, due to their identified significance as destinations. To foster greater accessibility to pedestrian 'resting' spaces for those on longer walking trips, bench and table-seating locations were marked on the map in orange and pink circles. To promote wayfinding, the map included all street names, provided estimates of walking distance and time along key routes, and indicated roads entering and leaving the community (Figure 1).

<Insert Figure 1>

Strengths and Limitations

Our research provides one example of how Universal Design can support the operationalization of rural walkability, prioritizing equity and social inclusion values over physical activity alone. While Universal Design can enhance considerations of walkability across community types, it may not adequately represent the unique needs, aspirations, and resources of every community or the experiences of every pedestrian. A key feature of Universal Design practice is the necessity of consulting with users (Fletcher, 2016; Lid, 2013) to ensure their needs can be met; it is this integrative practice that is transferable across populations and geographies. The Bonnyville Community Walking Map project directly engaged stakeholders to define walkability and collaborated with them to use local priorities and research data to create the map. Although built environment modification was outside the scope of the mapping project, subsequently community stakeholders used the walking map to identify critical locations where bench seating was needed (and then installed) (Nykiforuk et al., 2013). Because of the collaboration, the data supporting the map was used in further municipal decision making and programming. This approach was consistent with other calls for public health research to employ the 'ordinary' health expertise of citizens to balance and, arguably enhance, the sometimes one-dimensional expert-driven perspective of public health (c.f., MacDougall, 2003).

A potential limitation of this research was the bounded consideration of barriers faced by Bonnyville residents as revealed through the photovoice data from the overarching study. While rich and varied, the photovoice data offered insights primarily in the context of physical activity (Belon, Nieuwendyk, Vallaniatos, & Nykiforuk, 2016) and participants did not reveal extensive insights related to sociological factors or the social determinants of health. Poverty, for example, is associated with higher rates of obesity and disability (Fletcher, 2016); researchers are beginning to question whether structural issues like income inequality can be suitably addressed

through health promotion interventions to increase community-level physical activity (Chaufan, Yeh, Ross, & Fox, 2015). Further research exploring ways to explicitly include social and structural considerations into the definition and measurement of walkability would undoubtedly increase the robustness of the construct.

Nuanced, mixed-methods walkability research is also needed to better understand how pedestrian interactions with pedestrian spaces are structurally determined and socially perpetuated, and how this interaction shapes lived experiences of residents, e.g., community engagement, disability, parenthood, or aging in built environments. The mechanisms by which these experiences impact health over the lifecourse must also be investigated, for example, by considering health and well-being outcomes produced outside of norms and behaviours couched in physical activity (Degeling, Rock, Rogers, & Riley, 2016). By advancing Universal Design as a unifying construct in walkability research, we aim to support and sustain efforts to address physical, social, and structural aspects of walkability, and to inspire theoretical introspection so that more knowledge and resources to address health inequities across populations and geographies become available to researchers and practitioners as the field matures.

Conclusions

Despite efforts to systematically define walkability across geographies, disagreement persists about the generalizability of constructs and the utility of defining and measuring walkability everywhere in the same terms and resting on a limited set of normative values. An assortment of criteria can be employed to classify and conceptually define factors related to walkability, but no universally applicable construct exists, nor does a theoretically robust rationale for perpetuating varied definitions of walkability across varied geographies. Designing effective public health interventions beyond the urban contexts that currently predominate the

walkability literature requires innovation on the issues of transferability, purpose, and relevance for rural populations and careful consideration of health and social outcomes beyond those pertaining to physical activity. Development of the Bonnyville Community Walking Map reflected one such innovation: it combined research and community knowledge within a Universal Design framework to promote social inclusion in the accessibility of pedestrian spaces for all pedestrians, regardless of mobility constraints. Situating the project within Universal Design facilitated greater inclusion of transferability, embodiment, and equity considerations into the project, and thus contributes to the literature on walkability in a rural context.

Many Canadians live in rural, small urban, or semi-urban locales; the geography, degree of rural-ness, and primary purposes of walking in these communities render much of the extant walkability research irrelevant to them. Some features of the built environment that are considered instrumental to walkability in urban areas (high density, high diversity, high connectivity, and high retail volume) are atypical of more rural areas. Other elements in walkability research (e.g., attractive streetscapes, walking distance destinations, light traffic, green spaces and trails, etc.) have urban and rural geographies in common, but de-emphasize the importance of social inclusion, well-being, and embodied experiences of community for pedestrians and neglect structural influences on health. By employing Universal Design, it is possible to bridge urban and rural walkability literatures, focusing on pedestrian accessibility in pedestrian spaces to develop more holistic theoretical and empirical insights.

Still, there persists an immediate and pressing call for meaningful evidence to support effective public health interventions focused on walkability in rural settings to promote an array of social and physical health outcomes. The need for action is clear: effective changes to a community's built environment can alter the environmental and social factors that foster

isolation, poor access to services, and physical inactivity. Using Universal Design to reframe walking as an issue of access to pedestrian spaces permits renewed examination of the walkability evidence using a health equity lens. This approach can reveal inconsistencies across populations and built environments, and provide insights to guide appropriate research and intervention tailored to varied rural needs and realities. In this light, and as the field matures, the extant literature on walkability may be thought of as indicating the degree of successful inclusion of pedestrian accessibility in policy, planning, and design in order to provide supportive infrastructure that facilitates walking – for any purpose – across individual capacities and geographic contexts. Those interested in walkability, irrespective of setting, must interrogate the legitimacy and disproportionate weighting of current rationales for walkability (and walking) interventions as a response primarily to physical inactivity and prevalence of related chronic diseases. This rhetoric undervalues the myriad of other individual benefits and public good inherent to people being able to walk their community and to the equitable supports necessary for enhancing walkability.

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Table 1. *Built environment features associated with walking among seniors, and with walking in urban versus rural settlements (Superscripts designate citations below table)*

	Seniors	Urban	Rural
Positively Associated		More Retail Floor Area[9]	
	Gridded Street Networks[8]	Gridded Street Networks[5,9]	
	Diverse Land Use[8,10]	Diverse Land Use[3,5,6,9]	
	High Density Residential[8,10]	High Density Residential[3,5,6,9]	
			Residential Road Shoulders[4]
	Attractive Streetscapes[1,10]	Attractive Streetscapes[3,7,9]	Attractive Streetscapes[7,9,11]
	Walking Distance Destinations[8,10]	Walking Distance Destinations[6,7,9]	Walking Distance Destinations[2,4,7,9]
	Clean & Unlittered Streets[1,8]	Clean & Unlittered Streets[7]	Clean & Unlittered Streets[7]
	Friendly Neighborhoods[1,8]	Friendly Neighborhoods[3,7,9]	Friendly Neighborhoods[7,9]
	Light Traffic[1,8,10]	Light Traffic[5,7,9]	Light Traffic[4,7,9,11]
	Green Spaces & Trails[1,8,10]	Green Spaces & Trails[3,5,7,9]	Green Spaces & Trails[2,4,7,9]
	Personal Safety[1,10]	Personal Safety[7,9]	Personal Safety[4,7,9,11]
	Sidewalks & Crosswalks[1,8]	Sidewalks & Crosswalks[6,7,9]	Sidewalks & Crosswalks[2,4,7,9,11]
	More Street Lighting[1]	More Street Lighting[9]	More Street Lighting[4,9]
	Recreational Facilities[1,8,10]	Recreational Facilities[7,5,9]	Recreational Facilities[4,7,9,11]
	No Sidewalk Barriers[1]		No Sidewalk Barriers[11]
	Controlled Domestic Dogs[1]		
	Curb Cut Sidewalks[1]		
	Bench & Table Seating[1]		
	Few Stairs & Gradients[1]		
	Even Pavement[1]		
Negatively Associated		Less Retail Floor Area[9]	
	Curvilinear Street Networks	Curvilinear Street Networks[5,9]	
	Homogenous Land Use[8,10]	Homogenous Land Use[3,5,6,9]	
	Low Density Residential[8,10]	Low Density Residential[3,5,6,9]	
			No Residential Road Shoulders
	Unattractive Streetscapes[1,10]	Unattractive Streetscapes3[,7,9]	Unattractive Streetscapes[4,7,9,11]
	Driving Distance Destinations[8,10]	Driving Distance Destinations[6,7,9]	Driving Distance Destinations[2,4,7,9]
	Dirty & Littered Streets[1,8]	Dirty & Littered Streets[7]	Dirty & Littered Streets[7]
	Social Disorder[1,8]	Social Disorder [3,7,9]	Social Disorder[7,9]
	Heavy Traffic[1,8,10]	Heavy Traffic[5,7,9]	Heavy Traffic[4,7,9,11]
	Lack Green Spaces & Trails[1,8,10]	Lack Green Spaces & Trails[5,7,9]	Lack Green Spaces & Trails[2,4,7,9]
	Personal Danger[1,10]	Personal Danger[7,9]	Personal Danger[4,7,9,11]
	No Sidewalks & Crosswalks[1,8]	No Sidewalks & Crosswalks[6,7,9]	No Sidewalks & Crosswalks[2,4,7,9,11]
	Less Street Lighting[1]	Less Street Lighting[9]	Less Street Lighting[4,9]
	Few Recreational Facilities[1,8,10]	Few Recreational Facilities[7,5,9]	Few Recreational Facilities[4,7,9,11]
	Sidewalk Barriers[1]		Sidewalk Barriers[11]
	Unleashed Dogs[1]		
	Lack of Curb Cut Sidewalks[1]		
	No Bench & Table Seating[1]		
	Many Stairs & Gradients[1]		
	Uneven Pavement[1]		

1. Cunningham & Michael, 2004; 2. Doescher et al., 2014; 3. Durand, Andalib, Dunton, Wolch, & Pentz, 2011; 4. Frost et al., 2010; 5. McCormack & Shiell, 2011; 6. Moudon et al., 2006; 7. Owen, Humpel, Leslie, Bauman, & Sallis, 2004; 8. Rosso, Auchincloss, & Michael, 2011; 9. Saelens & Handy, 2008; 10. Van Cauwenberg et al., 2011; 11. Yousefian et al., 2010.

Figure 1. *Town of Bonnyville, Alberta, Canada, Community Walking Map, reflecting the principles of Universal Design*