

**Designing Outdoor Spaces to Support Older Adult Dog Walkers:  
A Multi-Method Approach to Identify and Prioritize Features in the  
Built Environment**

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**ABSTRACT**

Associations between the built environment and walking are well understood among the general population, but far less is known about how features of the built environment influence walking in older adults. As compared to other age groups, older adults, defined as those 65 years of age and older, are more likely to experience declines in physical activity, social interaction, and loss of community connectivity. Animal companionship can provide older adults the motivation to stay physically active and help them mitigate the feelings of isolation. Built environments that align with the needs and abilities of older adults and their animal companions, like dogs, can encourage and help sustain walking habits. The aim of this study was to identify and prioritize features within the built environment pertinent to older adult dog walkers. Existing literature served as the basis for identifying neighborhood design features associated with general walking and dog walking. Through the use of a three round Delphi study, 25 experts from urban planning and design, management of outdoor spaces, public health, gerontology, and human-animal relationships modified and rated the importance of the identified features as it pertains to older adult dog walkers. Following the Delphi study, 12 older adult dog owners from the Warm Hearth Village participated in a guided walk and interview using the Photovoice technique. The goal was to gather their perceptions of the outdoor walking environment. Among expert panelists, safety from motorized traffic, crime, unleashed dogs, and personal injury was paramount (*mean (M) = 93.20, standard deviation (SD) = 11.54*). Experts also saw the value and agreed upon the importance of dog supportive features within the built environment, like dog waste stations *dog waste stations (desirable; M = 87.95, SD = 11.37)*, and dog policy signage (*desirable; M =*

79.91,  $SD = 11.22$ ). Older adults also believed safety was important. They saw their dog as a protective safety factor against walking deterrents like aggressive or unleashed dogs. However, the feature that resonated most with older adult dog walkers in this study was their interaction with nature. They described the pleasure of observing seasons change and the connection with nature that came from the tree canopy cocooning the walking path. Path design is also a necessary consideration. Older adults emphasized the importance of having options between paved and unpaved walking paths. The panelists stressed the need for creating lines of sight (*desirable*;  $M = 66.46$ ,  $SD = 20.71$ ) and lighting (*desirable*;  $M = 77.92$ ,  $SD = 19.77$ ). Those who plan, develop, and maintain spaces that support older adults can prioritize the features I identified in my research. Incorporating these features into the design of spaces for older adults has the potential to translate into increased walking and opportunities to socialize, contributing to mental and physical health.

Designing Outdoor Spaces to Support Older Adult Dog Walkers:  
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**GENERAL AUDIENCE ABSTRACT**

Associations between the built environment and walking are well understood among the general population, but less is known about how features in the built environment influence older adults. As compared to other age groups, older adults are more likely to experience declines in physical activity and social interaction. Animal companionship can provide motivation to stay physically active and help them mitigate feelings of isolation. Built environments that align with the needs of older adults and their animal companions, like dogs, can encourage and help sustain walking habits. My research identified and prioritized features within the built environment pertinent to older adult dog walkers. I implemented an iterative three round study to gain consensus among expert panelists and guided walks and interviews with older adult dog walkers. Among expert panelists, safety from motorized traffic, crime, unleashed dogs, and personal injury was paramount. Experts also saw the value of dog supportive features within the built environment, like dog waste stations. Older adults also believed safety was important. They saw their dog as a protective safety factor against walking deterrents like aggressive dogs. The feature that resonated most with older adult in this study was nature. They described the pleasure of observing seasons change and the connection with nature that came from the tree canopy cocooning the walking path. Path design is also a necessary consideration. Older adults emphasized the importance of having options between paved and unpaved walking paths. Those who plan, develop, and maintain spaces that support older adults can prioritize the features I identified in my research. Incorporating these features into outdoor spaces has the potential to translate into increased walking and opportunities to socialize, contributing to mental and physical health.



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## **Chapter One – Introduction**

## BACKGROUND

Overall, the proportion of the U.S. population subject to chronic disease is growing. By 2060, the number of Americans aged 65 or older is expected to reach 98 million, a nearly two-fold increase from 2014 estimates (Colby & Ortman, 2015). Older adults are among the most inactive demographic in our population (King & King, 2010). With increasing age, older adults experience progressively more physical inactivity, contributing to the high prevalence of obesity, cardiovascular disease and cancer in the United States (Green & Klein, 2011; Watson et al., 2016). The cost of physical inactivity is seen in economic expenditures, declines in quality of life, and global mortality (King & King, 2010). To further complicate the issue of inactivity, 40% of adults over 65 report having a disability (Kerr et al., 2012).

In older adults, chronic diseases have the opportunity to be delayed, prevented, and managed more successfully while improving overall quality of life through maintained physical activity. Little is linked to healthful aging as strongly as physical activity (Michael et al., 2006). While an association between health and place is established through research evidence, the design of built environments to promote active aging of older adults is still lacking (Kerr et al., 2012). Active aging refers to the ability and desire of older adults to incorporate physical activity, such as walking for exercise and pleasure, into their daily life, while also remaining socially engaged (Michael et al., 2006). With one in five Americans projected to be 65 or older by 2030, there is a need to understand the role of neighborhood design in addressing the unique needs faced by this growing population (Kerr et al., 2012).

Historical design practices have led to largely car dependent communities with little consideration for the promotion of wellness and walkability (Kerr et al., 2012). Older adults, especially those with disabilities, are vulnerable to community environments that hinder activity associated with healthy aging (Kochtitzky et al., 2011). Older adults' perceptions of their built environment as well as access to amenities influence both their ability to stay active and car dependence (Michael et al., 2006). Mounting evidence suggests that neighborhood design with high residential density, mixed land use, short block lengths, and grid streets patterns are associated with more walking than sprawling neighborhoods lacking these features (Michael et al., 2006; Saelens et al., 2003). Additional benefits of walkable neighborhoods include higher levels of community cohesion and sense of community (Toohey et al., 2013). Given the association between the built environment and physical activity (Clark & Scott, 2016) and the influential role of neighborhoods on healthy aging (Toohey et al., 2013), neighborhoods and parks designed with supportive features for active aging may pose a solution to the growing number of inactive older adults.

Correlates of active aging not only include physical and social environmental factors, but may also dynamically include human-animal relationships, specifically relationships with dogs (Toohey & Rock, 2011). Dogs have the opportunity to serve as a conduit for physical activity through the motivation, companionship, and social support they provide to owners, given supportive infrastructure is available and accessible (Cutt et al., 2008). Additionally, dogs are bonding animals and may serve as an effective social bridge for older adults. Dog-ownership and dog-walking are linked to social engagement and physical activity with neighborhood level determinants influencing these activity



patterns (Toohey et al., 2013). There is a complexity between neighborhood environment, dog ownership, physical activity, and social interaction (Toohey et al., 2013). The intersection of these multiple features may lead to better health promotion for older adults, but the evidence is not comprehensive. The cumulative goals of the studies presented within this dissertation are to identify and prioritize environmental design features pertinent to older adult dog walkers so they can be integrated into design practices that promote active aging.

## LITERATURE REVIEW

Existing literature provides evidence of established relationships between the built environment and active aging, the built environment and animal companionship, and active aging and animal companionship. But there is little evidence for the intersection of all three, which my research helps fill this gap. To articulate this gap, the following literature review consists of four sections, 2.1-2.4. Additionally, an annotated bibliography of notable references is provided in Appendix A. The first three sections provide current evidence about the relationships depicted by the arrows in Figure 1.1. The intersection of all three is then further explained in section 2.4.

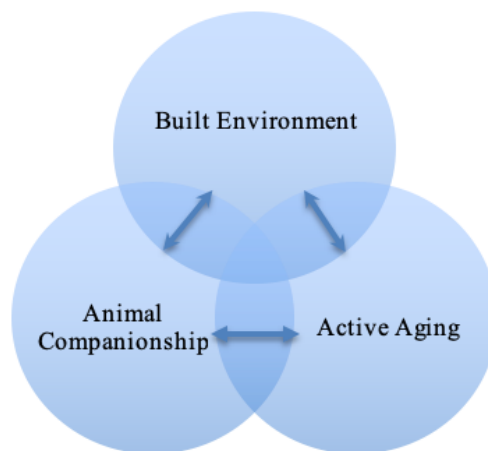


Figure 1.1. Venn diagram of intersecting topics

## **Built Environments and Active Aging**

The most common form of physical activity to promote through design is walking (Clark & Scott, 2016; Saelens & Handy, 2008). In the literature, features of the built environment that promote walking are often more narrowly described as features within neighborhood design. Common features include path surface, traffic, streetscape, and greenery. These features are typically described by the function they provide, the degree of safety or perceived aesthetics to the community, and destinations they serve (Brownson et al., 2009; Green & Klein, 2011; Pikora et al., 2003). For instance, potted tree streetscapes function as a physical barrier between automobiles and walkers, are effective in reducing automobile speeds, and are a useful tool of urban planners in connecting corridors between neighborhoods.

However, the effect of features that support walking, like streetscapes, are not necessarily all that straightforward, particularly when measuring their effect across different age groups. Thielman et al. (2015) assessed neighborhood walkability in relation to physical activity across varying age groups and population sizes. Communities with less than 30,000 residents and a high Walk Score (i.e. based on the proximity to nine destination types) was associated with increased leisure physical activity; however, an inverse relationship was found in young adults in communities with more than 100,000 people. The study highlights the complexity between walkability and design features and that tailored approaches to adapting the built environment may be necessary in order to effectively reach the intended audience. Therefore, the following sections discuss the complexity of design features influencing walkability for older adults and the challenges in designing age friendly walkable cities.

### *Walkability for Older Adults*

The way older adults are influenced by features of the built environment is not necessarily the same as other groups (Ahrentzen, 2010). In a study by Clark & Scott (2016), senior citizens and those with a higher body mass index were among a demographic who identified more barriers to walking than other groups. In addition, seniors were concerned with crime and pedestrian safety, which could be a potential barrier to walking. Congruent with these findings, Michael et al. (2006) utilized focus groups to identify prominent neighborhood design features important to older adults and found older adults prioritize pedestrian safe pathways, for example, traffic calming and crosswalks. This group also cared more about the attractiveness of the streetscape and were less concerned about distance to destinations. Implications of findings by Michael et al. (2006) include the need for policy and design in both new and retrofit construction that better align with older adult preferences. Additionally, understanding design preferences of older adults and those with changing physical abilities may provide benefits to those with disability and create spaces that serve intergenerational activities.

Even among older adults, preferences for walkability are not all the same. Evidence by Ahrentzen (2010) contradicts Clark & Scott (2016) and Michael et al. (2006). In a survey of 700 seniors, only 2% reported perceived safety as a barrier (Ahrentzen 2010). The strong sense of community cohesion and belonging to the neighborhood was thought to explain the low priority of safety (Ahrentzen, 2010). Eight of the neighborhoods surveyed were characterized with close to 60% of respondents living in their community for more than 20 years (Ahrentzen, 2010). These neighborhood residents also reported walking mainly for their health or exercise and motivation

included getting outdoors, pleasure, and to view the landscape. Similarly, Michael et al. (2006), suggested distance to destination is not a critical variable for walkability in older adults. However, Michael et al. (2006) and Ahrentzen (2010) conflict with Winters et al. (2015) that found the presence of a high community Walk Score, was associated with 17% higher odds of meeting activity guidelines through walking among 1,300 Canadian residents aged 65 and older. The residents living in Canadian neighborhoods characterized as a “Walking Paradise” were three times more likely to meet activity guidelines than car dependent neighborhoods. Thus, neighborhood design features that influence walkability in older adults present some conflicting findings and may vary based on community, contextual, and personal factors.

One explanation for these conflicting findings is that the literature does not adequately address or control for individual personal characteristics that may not align with one’s environment. When competence of functional ability misaligns with features of the built environment it can lead to poor behavioral outcomes. This is the theory behind the Environment Press model, which is further explained in section 2.5. Additional factors that could lead to variability in the prior findings include urban vs. rural settings and residential density. Not controlling for these potential confounding features could lead to drastically different design features that are perceived to influence walkability.

### *Age Friendly Design*

The need and desire for older adults to remain active and aging in place is at odds with current urban planning and design practices. Urban planners, transportation experts, and public health officials acknowledge the value of walkable communities; however,

they are often not focused on older adults (Giles-Corti & King, 2009; King & King, 2010). There are a number of reasons why built environments are not conducive to active aging. These include the promotion of car dependent lifestyles in low density segregated developments (Barton & Grant, 2013), organizational silos (Barton & Grant, 2013), lack of engagement of older adults in community-based decisions (Barton & Grant, 2013; Moazedi, 2014), and policies for city regeneration focused on the labor market (Phillipson, 2012).

Older adults are looking for reasons to walk, such as going to the grocery store and post office, as well as places to socialize (Michael et al., 2006). However, these institutional barriers make the creation of walkable environments more challenging. The shift to age-friendly design is still taking shape in the United States (Barton & Grant, 2013; Phillipson, 2012) and while complex challenges exist, it is a growing priority. Future solutions will likely involve targeting practical needs first and learning from European countries who have already implemented age friendly practices (Barton & Grant, 2013; Phillipson, 2012).

### **Built Environments and Animal Companionship**

While features of the built environment can promote or deter walking among older adults, pet ownership, in particular dog ownership, is also known to have an effect on physical activity. Dogs are not the only companion animals, but they are most associated with walking and helping create new social connections. The United States is home to 78.2 million dogs with around 39% of households owning one or more dogs (Gaunet et al., 2014). Environmental amenities for dogs include dog parks and green spaces (Gaunet et al., 2014; Weston et al., 2014). While dog parks create an outlet for

“more than human families,” the need for “more than human public spaces” is just one facet to where dog activities occur (Gaunet et al., 2014). The following literature discusses both design features and social environments that support human-animal activities, specifically dog ownership and walking.

### *Design Features That Promote Dog Walking*

Animals are often overlooked during the urban planning and landscaping design process (Tarsitano, 2006). One reason may be because features, like function, safety, and aesthetics that support general walking also support dog walking (Cutt et al., 2007). However, more specific design features, like dog exercise areas, should also be important considerations for local planning because of their association with walking and human physical activity (Gaunet et al., 2014). The physical environmental factors that most influence dog walking include linear design for continued walking, constructed or natural barriers, off-leash areas, being within a certain walking distance from home, and providing signage to users about clean up and leash policies (Cutt et al., 2007). Dog related facilities including water and exercise areas are also highly associated with increased likelihood of walking (Sugiyama et al., 2015). Of these design features, the most critical feature associated with dog walking is access to public open space (Cutt et al., 2007, Sugiyama et al., 2015). Although the presence of dogs in public open spaces can pose a nuisance (Weston et al., 2014), whether this negativity is real or perceived has not been well determined (Gaunet et al., 2014).

Another place that dogs are present is called built-up outdoor areas (Gaunet et al., 2014). Built-up outdoor areas are those between home and the park and are often not taken into account by urban planners (Gaunet et al., 2014). In this context built-up

outdoor areas refer to general spaces outside. In a unique case study by Gaunet et al. (2014), dogs and owners were observed in Lyon, France in three types of built-up outdoor spaces including a residential/ shopping area, enclosed park, and town square. Patterns of use, use of leashes, activities, and social interaction were dictated by the different urban spaces being observed. Although boundaries to where and how the dogs used the spaces were often followed, owners would push legislative boundaries to enhance access and activities (Gaunet et al., 2014). Although the desire for dog owners to have greater access is countered with that of non-dog owners who wish for greater regulations on dog activity (Weston et al., 2014). The conflict observed by Gaunet et al. (2014) is real. How to resolve this issue between dog owners and non-dog owners may come through more defined spaces within the physical environment built specifically for dogs. This appears to be an area for future research as none of the research reviewed provided adequate resolutions for this conflict.

#### *Social Environment and Dog Ownership*

Differences in pet culture such as dog friendly spaces in parks and permissibility of pets in and around businesses appear to be contextual factors affecting social interaction (Wood et al., 2015). In a study of four international cities, residents who owned pets were significantly more likely to meet and get to know people in their neighborhood than non-pet owners (Wood et al., 2015). Dog ownership, and the presence of dogs seem to also positively affect perceived safety (Wood et al., 2007). The visual presence of neighbors walking their dogs increased feelings of neighborhood safety, and thus a stronger sense of community (Wood et al., 2007). An added benefit, as mentioned earlier, perceiving one's environment as safe is also associated with increased walking.

## **Active Aging and Animal Companionship**

Animal companionship can positively impact older adults through higher emotional well-being, increased physical activity (Anderson et al., 2015), lower blood pressure, lower cholesterol, lower mental stress and depression, and higher self-esteem (Cutt et al., 2007). Older adults are the most sedentary age group with high levels of disability and healthcare usage (Feng et al., 2014). Promotion of physical activity for this age group remains a significant public health issue (Feng et al., 2014). The relationship between active aging and animal companionship is clustered into three sections: dogs and walking, dogs as a social catalyst, and alternative options to dog ownership.

### **Dogs and Walking**

In a study of 547 adults over the age of 65, walking was 27% higher among dog owners than non-dog owners (Feng et al., 2014). General health and physical function mediated the effects of dog ownership, highlighting the role of varying age groups and ability. In a cross-sectional study of over 1000 adults age 65-95, dog owners who walked their dog engaged in 50% more total walking and had higher functional ability than non-dog owners and owners/non walkers (Gretebeck et al., 2013). Across a wider age group of 20-65 year old adults, dog owners who walked their dogs had the lowest levels of obesity and highest walking levels compared to non-owners and owners/non-walkers (Coleman et al., 2008). Evidence supports the association between dog ownership and recommended and or increased walking levels (Coleman et al., 2008; Feng et al., 2014); however, whether dog ownership encourages walking or those who like to walk acquire a dog is not well understood (Thorpe et al., 2006). Either way, companionship from dogs has the opportunity to not only motivate activity in older adults, but also sustain it.



## **Dog as a Social Catalyst**

Active aging encompasses not only physical activity, but also active social engagement. Dogs in particular can be a form of social support where the social support acts as a predictor of physical activity, more specifically walking (Cutt et al., 2007). Dog walking is associated with social conversations and interactions and thus may facilitate social capital and sense of community (Cutt et al., 2007). Older adults are at an increased risk for isolation and declining independence (Kerr et al., 2012) and activities such as dog walking that bring about interactions may be a prescriptive solution.

In a qualitative assessment of adults, focus groups revealed that dogs provided owners with motivation, companionship, and social support for dog walking (Cutt et al., 2008). The social aspect to dog walking is associated with a strong sense of community and can serve as a protective factor in an aging population (Toohey et al., 2013).

In a study by Wood et al. (2005), dog owners were more likely to get to know other local people and felt a stronger sense of community than non-dog owners. What is more, the benefits of pets extend beyond the individual level of ownership and can also have collective benefits to the community as a whole (Wood et al., 2005). Implications for dog ownership, and more broadly animal companionship, and associated walking activity have benefits that span both physical health and social connections in one's community.

### *Alternative Options to Dog Ownership*

Human-animal companionship commonly takes the form of dog ownership, but can also include communal dogs (Anderson et al., 2015). To help accommodate ownership challenges faced by barriers in facilities, non-conventional companionship

may be an acceptable avenue to enjoying the health benefits of dogs. Johnson & Meadows (2010) studied the impact of loaner dogs on adherence to a walking program. Among participants in the 50-week walking group, walking certified therapy dogs was associated with a 72% adherence to intended walking regimen and a significant weight loss of 14.4 pounds per person. Like dog owners, commitment to a dog in other facets may provide the needed motivation to stay active, especially later in life when inactivity is more common.

### **Intersection of the Built Environment, Active Aging and Animal Companionship**

Figure 1.2 demonstrates the relational pathway to achieving the ultimate outcome of improved active aging. Although few studies exist about the dynamic interrelationship of the built environment, active aging, and animal companionship, nine studies are discussed below that consider some aspect of all three. The challenge is that each study presents the relationship through a different lens. There is a lack of consistency in features and measurement across studies.

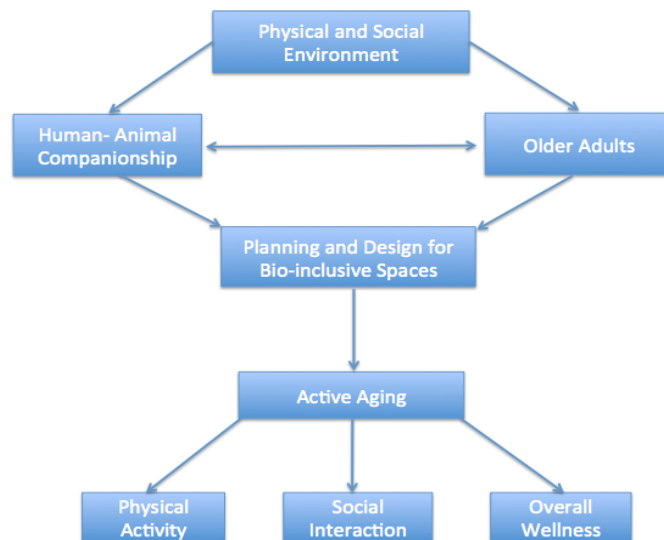


Figure 1.2. Conceptual relationship between independent and dependent variables

The following discussion explores literature on the intersection of the built environment, older adults, and animal companionship with dogs, along with whether results are congruent or differing from other studies. McCormack et al. (2016) investigated perceptions of design features in the built environment between dog owners and non-owners in both young and older adults, although a distinction between younger and older adults was not made in their results.

The perceived features McCormack et al. (2016) find are complex. For example, the built environment may not encourage initiation of dog walking, but may support existing dog walkers. In addition, non-dog owners reported more positive perceptions of their neighborhood than dog walkers. The study does not mention a sense of community, which could be a confounding variable, based on Toohey et al. (2013). The primary finding from Toohey et al. (2013) was older adult dog walkers may benefit by having a heightened sense of community and increased physical activity. Thorpe et al. (2006) assessed walking behavior between dog owners and non-owners among adults aged 71-82. While dog owners were more likely to meet walking recommendations, only 36% actually walked their dog. Neighborhood design features were mentioned as a potential factor in the relationship but were not measured (Thorpe et al., 2006).

Two literature reviews were identified looking at the built environment, dogs, and older adults. Westgarth et al. (2014), assessed correlates of dog walking and included potential differences between age groups. Results of the study support other literature in that dog ownership is associated with increased walking and supportive environmental features may further encourage these activities. The other review by Toohey & Rock (2011), focused on how dogs impacted physical activity for dog owners and non-owners

via their influence on the social and physical environment. The study concluded that dogs may impact activity for owners and non-owners and dogs' influence on the environment will not have a standard effect. Findings between the reviews do not contradict each other; however, they do not suggest the same path of influence.

Studies by Giehl et al. (2016), Solomon et al. (2013) and Jansen et al. (2016) provide congruent findings in that dogs along with certain design features positively correlate to walking in older adults. Although the results lack consistent measurement and identification of key design features associated with walking and animal integration. In addition, contradictions within the literature around neighborhood design features important to older adults make the development of design guidelines challenging. For example, both personal and pedestrian safety were shown to be important in a study by Clark & Scott (2016); however, Ahrentzen (2010) did not find safety to be a concern for walking in older adults. An existing framework developed by Pikora et al. (2003) found personal safety to influence walking more than other design elements among a general population. The priorities for older adults and their relationship with animals may not necessarily align with that of other age groups, warranting further investigation.

While existing frameworks on built environment features related to walking are established, they do not focus on older adults and nor do they consider features for animals. With evidence to support the association between built environments and walking, and dog ownership and walking, emergent benefits may be achieved by considering the interaction of all three. By creating walkable neighborhoods conducive to the needs of older adults while also allowing ease of animal integration and dog related activities, aspects of active aging may be more successfully achieved.

## Theory

Given the unique nature of intersecting disciplines, and nuanced differences across the literature, a relevant theory called The Environmental Press Model provides a basis for identifying features that create an optimal environment for older adults. The Environmental Press Model asserts that capacity, demands, and opportunities interact to create either an optimal fit or a misfit with the person and setting (Lecovich, 2014; Yang & Sanford, 2012). The Environmental Press Model considers the need for adaptation of older adults and alignment of abilities and environmental accommodations. Additionally, the model explains what should be expected when a person is exposed to poorly matched conditions. Figure 1.3 (adapted from the Environmental Press Model) illustrates the balance between environmental demand (challenges) and personal ability (competence) with in the outdoor walking environment (Moore, 2005).

When considering the ability to age in place, environmental barriers or demand alone do not necessarily dictate outcome. Supportive features likely also play a significant role in determining fit (Glass & Balfour, 2003; Greenfield, 2016). Support may be from social support or resources and are referred to as environmental “buoying” (Glass & Balfour, 2003; Greenfield, 2016). The result is a feedback loop between environmental press, buoying, and personal competence, and all influence adaptive ability (Glass & Balfour 2003; Greenfield, 2016).

Optimal built environments or changing them are not always realistic; therefore, it is important to understand how individuals may respond to and control for the experiences within less optimal environments. The locus of control theory accounts for the role of personal responsibility (Reich & Infurna, 2016). Understanding internal and

external locus of control could help predict how individuals respond to perceptions of their environment. For example, a person with an internal locus of control may feel they can change themselves to overcome negative perceptions and barriers within the built environment, whereas a person with an external locus of control may feel anxiety and powerless to make personal changes.

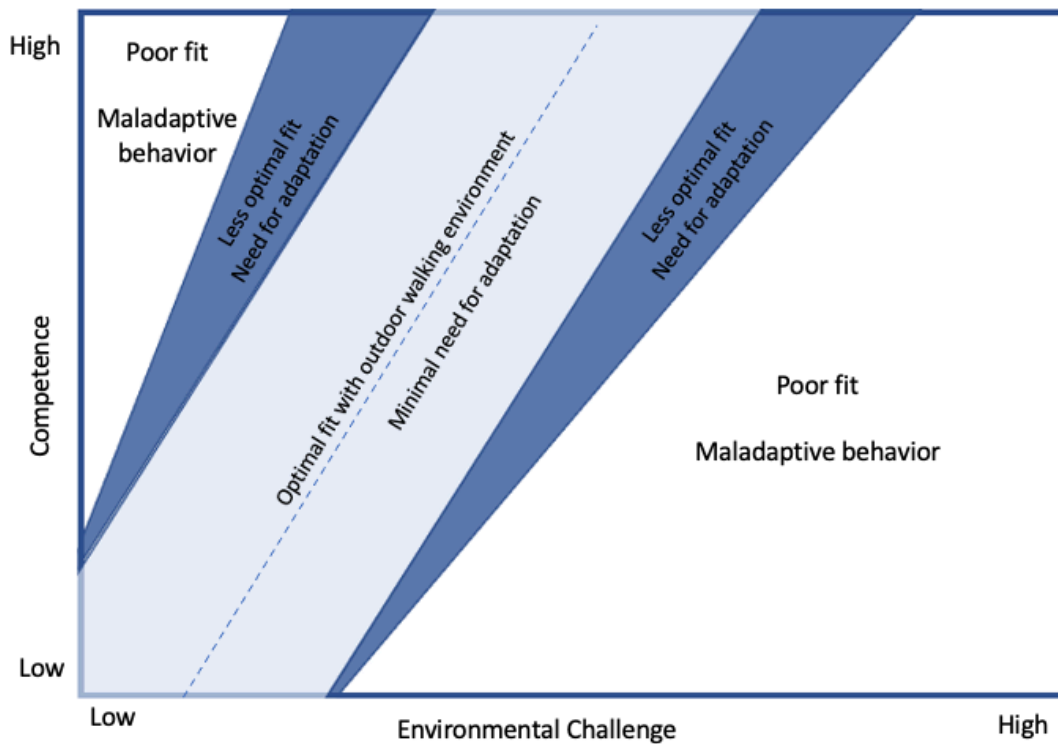


Figure 1.3. Balance between environmental challenge and personal competence

Adapted from Environmental Press Model (Moore, 2005)

## RESEARCH GOALS AND OBJECTIVE

The *purpose* of this research is to identify and prioritize neighborhood design features that are most influential to walking and animal companionship in older adults through the utilization of expert opinion. Animal companionship refers to the human-animal unit whereas animal integration refers to the place of activities and includes the animal, owners and other people impacted by their presence. Animal companionship and integration will be limited to dogs for this research because they are the most commonly associated with walking and socializing with humans. For this research, older adults are defined as those 65 years of age and older, which is consistent with the literature. Understanding the needs and desires of walkability and animal friendliness for a wide range of with a range of physical ability among older adults may create new opportunities to be active and serve as a preventive measure against future health challenges. Additionally, with age come declines in function and social network, leading to greater reliance on the surrounding neighborhood, which makes the focus on neighborhood scale particularly relevant for older adults (Yu et al., 2017).

Identification of design priorities for older adult dog owners will inform a comprehensive and hierarchical organization of built environment features with associated rating of importance. The final deliverable will be an ontology of design features and useful for urban planners to facilitate the development of outdoor spaces conducive and mutually beneficial to older adults and dog owners. An ontology provides a formal description of a particular domain (Noy & McGuinness, 2001), in this case, built environments for older adult dog walkers. The ontology will be accomplished through iterative organizations of features. Ultimately, identifying, grouping, and prioritizing

features relevant for those responsible for neighborhood design, may serve to promote active aging and encouraging physical activity among a less active portion of the population.

In order to pursue this goal, the *research objectives* are:

- 1) To identify, compare, and organize neighborhood design features that influence general walking, and design features that support dog walking.
- 2) To determine which neighborhood design features are agreed upon as important by a panel of experts.
- 3) To understand how neighborhood design features are perceived as either supportive or non-supportive by older adult dog walkers.

## **RESEARCH DESIGN**

The following section describes the original research design to show how each of the three studies evolved in their execution. Each study design was further refined in the papers that follow. The research design included a three-step process where data from each step helped inform the subsequent study and the prioritization of features. The implementation plan is provided in Appendix B. To address the three research objectives, the research design addressed the following questions.

### **Research Questions**

1. What neighborhood design features promote general physical activity walking as well as dog walking?
2. What is the relative importance of identified neighborhood design features as it relates to dog walking and which achieve consensus by a panel of experts?



3. What neighborhood design features are perceived as most appealing to older adult dog walkers? Additionally, how do perceived deterrents impact walking the dog?

### *Research Proposition*

My proposition is older adults who perceive their built environment as appealing, approachable, and appropriately challenging will be more likely to identify high levels of personal competence. Additionally, older adults who perceive their built environment as unappealing and too challenging will be more likely identify low levels of personal competence.

### **Research Approach**

The research design for this study is a mixed methods approach, drawing on both qualitative data through content analysis, expert opinion, and interviews and quantitative data through descriptive statistical analysis of built environment features.

The content analysis will be conducted via a systematic review of existing literature. Identifying and organizing existing features in the literature is a viable method to interpret textual data, bridge qualitative and quantitative data, and provides preliminary content for the Delphi study (Olawumi et al., 2018; Pikora et al., 2003).

As part of the mixed method approach, the Delphi technique will be employed following the content analysis, which aims to gather consensus from participants within their area of expertise (Hsu and Sandford, 2007). While other methods exist to gain consensus, such as the nominal group process, the face to face sessions during the nominal group process do not allow for anonymity and can be dominated by one person's opinion (McMillan et al., 2016). The Delphi technique provides advantages such as the ability to participate when in different locations, allows input without direct pressure

from peers, and iterations of questioning. With each iteration, participants can see group averages, change their weighting, and justify their answer.

As a way to gain greater insight into user perspectives, older adults will be asked to participate in photography and interviews, known as Photovoice. Photovoice is a qualitative method that allows visualization of individual perceptions (Nykiforuk et al., 2011) and story development through photographs (Ronzi et al., 2016). Photovoice will allow direct input from those potentially impacted by future built environment modifications as a result of this study. This research approach of gaining input from stakeholders allows for organic and less biased feedback, whereas a survey approach may limit the feedback and richness of responses. Similar methods include photo elicitation, where interviews are guided by photos, however the photos are often provided by the researcher and are used merely as a guide (Harper, 2002). The results from Photovoice will be compared to the Delphi study results. I expect to find similarities in the Delphi results and insights from the interviews. However, the purpose of the interviews is not to confirm the Delphi study but rather to capture, interpret, and present the perception of older adults along with the experts in the Delphi study.

### **Process Diagram**

Figure 1.4 illustrates the study process. The diagram shows how the objectives inform subsequent steps in the research as well as triangulation of features.

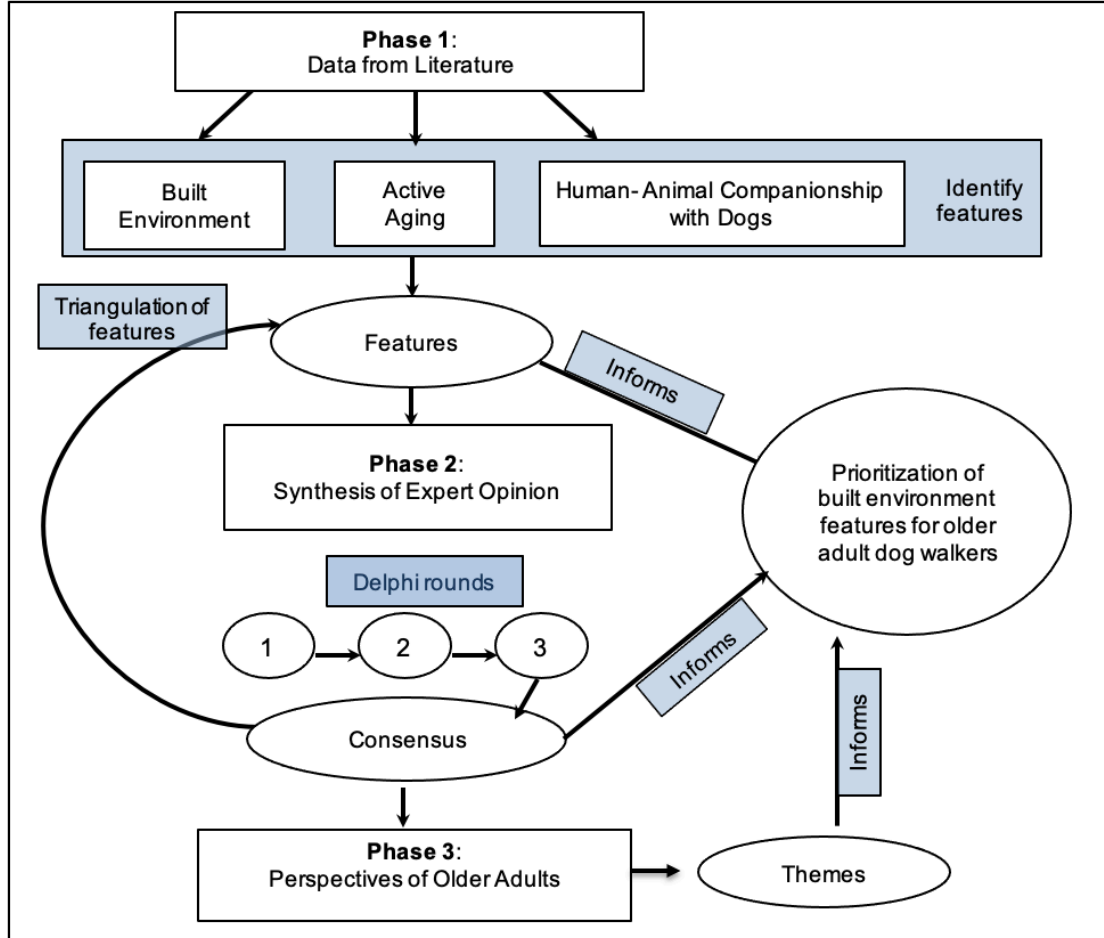


Figure 1.4. Process diagram of key steps in the research process

### Phase One: Content Analysis Through Systematic Review

*Sampling Approach: Systematic Review*

Built environment features documented in the literature, representative of the needs and desires of general walkers, older adult walkers, and dog owners as it relates to walking will serve as a repository of criteria and will address objective one. In addition to built environment features pulled from the literature, an existing framework by Pikora et al. (2003) will be referenced in the development of an initial organization of features.

Neighborhood design features will refer to an all-encompassing term about the built environment and includes domains (e.g., safety, aesthetics, function, and destination), elements (e.g., streetscape) and characteristics (e.g., trees and benches). The inclusion of domains, elements, and characteristics will allow for a broad organization of features from the literature moving into the second phase of research. However, these domains are not necessarily exhaustive given the additional elements and characteristics related to dog walking. The identification of relevant built environment features will inform the questions and flow of the Delphi study.

The systematic review will follow PRISMA guidelines (Liberati et al., 2009). As part of the PRISMA guidelines, the search strategy includes standardized Boolean searches. The following search terms will be used to assess built environment correlates to dog walking and other dog-related activities in the neighborhood or park setting. These terms will be searched in abstracts.

(built environment\* OR “physical attributes” OR neighbourhood OR neighborhood OR “park” OR “parks” OR “open space”) AND ("human-animal companionship" OR "human-animal relationship" OR "dog ownership" OR "dog-ownership" or "dog walking" OR dog\*) AND (walk\* or activity)

The following Boolean search will be used to capture systematic reviews on correlates of walking and physical activity of adults and older adults in the neighborhood or park setting. These terms will be searched within titles.

("built" or "built environment" OR “physical attributes” OR neighbourhood OR neighborhood OR “park” OR “parks” OR “open space”) AND (walk\* or activity) AND (systematic or review)

Based on the current breadth of literature about the influence of the built environment on older adults and dog walking, a combination of original research and systematic reviews will be used. While the focus is older adults, reviews on adults are also beneficial. Prioritization of features for older adults will be determined in the Delphi study. Completing a new review would be redundant. However, there is less literature about built environment features influential to dog walkers. Original studies must be synthesized to understand and summarize relevant features.

Inclusion criteria of articles:

- Published in English from peer reviewed journals
- Published in last 15 years
- (Dog specific) Original research on dog owners/walkers and the built environment
- (Dog specific) Address features and function of the built environment as it relates to the use of the space by dog owners/walkers
- (Adult specific) Systematic reviews on the intersection of adults and older adults, physical activity and the built environment
- (Adult specific) Addresses features and function of the built environment as it relates to walking, physical activity, or general use by adults and older adults

*Data Collection: Systematic Review*

Once articles have been identified based on inclusion criteria, features pertaining to the built environment will be extracted according to the articles organization hierarchy or grouping if one is provided. If one is not provided, the specific features and functions discussed in the article will be pulled into a list and later organized. Additionally,

direction of influence will be collected if provided by the article. Saturation of features will help indicate that a sufficient job has been done in pulling content from the literature.

Features will be operationalized by the following definitions of built, social, or natural features:

Built: Feature is an artifact enacted by humans

Social: Feature is a non-artifact enacted by humans

Natural: Feature is a non-artifact that is occurring without humans

## **Phase Two: Delphi Study**

### *Sampling Approach: Delphi Study*

The study will use a non-probability purposive sampling technique and snowball sampling. Purposive sampling is most appropriate for this study given the need to select participants based on area of expertise. Expertise will be operationalized by (1) career specialty, (2) years of experience, (3) and knowledge in one or more of the following areas: Urban Planning and Design, Management of Outdoor spaces, Gerontology, Public Health, and Human-Animal Relationships. Experts will include both academic professionals and practitioners. To be included as a possible expert, they will need at least 5 years of relevant work experience. Experts do not necessarily have to have expertise in the overlap of disciplines being studied. 30-45 experts will be enrolled for participation. The number of enrolled experts needed for a Delphi study varies widely with panel sizes ranging from 10-1700 experts (Powell 2003). The estimated 30-45 experts are based on prior similar Delphi studies (Burnette et al., 2003; Hsu & Sandford, 2007; Olawumi et al., 2018; Pikora et al., 2003).

Participants will be selected from a variety of sources including nonprofit organizations, universities, and government agencies. Due to the unique nature of this study, recruitment will not be limited by region. Additionally, experts from various types of geographic locations and governing structures by country and state may help make the results more generalizable. Experts will be initially contacted via email to determine interest in participation and to screen inclusion criteria. Experts who are eligible and are willing to participate will provide informed consent. Participant identification will be kept private from other participants. Below is a list of potential sources of recruitment. Committee members will be involved in identifying and recruiting experts.

Veterinary Medicine- (Human-Animal Bond)

Virginia Maryland College of Veterinary Medicine

Center for Human-Animal Interaction- Virginia Commonwealth

OHAIRE Purdue

University of Tennessee

Lincoln University

University of Denver Institute for Human-Animal Connection

Gerontology

Center for Gerontology at Virginia Tech

Blacksburg Aging in Place Leadership Team

Center for Healthy Aging Roanoke, VA

Urban Planning and Design

Planning directors of towns

Urban Institute

Brookings Institute

University of Virginia: Urban Affairs and Planning

Virginia Tech

Due to the nature of this research involving human subjects, Institutional Review Board approval will be necessary for the Delphi Study. IRB approval will be received before any data collection of participants. Each participant will provide informed consent.

*Data Collection: Delphi Study*

The experts' task will be to modify and add to the organization of features developed in phase one as well as rate and provide relative importance to the features identified through the content analysis. Experts will also provide explanations to their responses. Within the Delphi study, a series of three rounds will be conducted. Questions will be emailed to participants with instructions and a deadline to return their answers. Participants will be given at least two weeks to complete each round followed by at least a two-week break to allow time for data assessment. The three rounds are described below including how the questions will be presented, analyzed, and returned to participants.

*Round One*

Consistent with existing literature utilizing the Delphi approach, the first round will present features identified from the literature review to the experts (Pikora et al., 2003). Based on the literature review, the categories will be grouped by overarching domains such as function, safety, destination, and aesthetics. Within these high level categories will be the features. Experts will be asked to modify or add to the features and



then provide feedback in a text box about how they would change the feature. Ratings of features will occur in round two.

Once the features are assessed by the expert panel, they will be reorganized and modified to represent feedback and addition of features. The newly organized features will be presented in round two. Additionally, in round one, participants will be asked to provide their perceived level of importance around walkable environments as well as characteristics about their job.

### *Round Two*

Round two will be more structured. Participants will review the organizational hierarchy from round one, provide a point value from 0 to 100, and give rationale to the ranking of the features. Without having completed the first round, which will dictate the second round, the following example illustrates how experts might score the features. The actual categories may be different than what is presented below. However, rating features between 0 to 100 will hold true. For example, dog friendly facilities may be one of two elements under destination and off-leash area one of five characteristics under dog friendly facilities. The features within the elements and characteristics will be given a value between 0-100. So if both elements under the domain were thought to be of equal importance, each would get a value of 50. The descriptive statistics (mean, median, range) from all experts will be calculated for each element and characteristic and presented back to the experts in round three (Burnette et al., 2003).

### *Round Three*

In round three, participants will be presented with their score along with the group mean. Participants will have an opportunity to revise their score and provide an

explanation for why they wish to stay or change. Interquartile ranges (IQR) will be used to indicate level of agreement. In Pikora et al. (2003) an IQR less than 10 was considered a high level of agreement for that variable. Features receiving high agreement will be marked by an IQR at or below 10. The characteristics with the moderate agreement will be noted by an IQR between 11 and 15.

### **Phase Three: Photovoice**

#### *Sampling Approach: Photovoice*

As part of an ongoing partnership with a local senior living community in Blacksburg, VA, older adults living within this planned senior living community will be asked to participate in photography and interviews, known as Photovoice. Warm Hearth Village will be the primary recruitment facility due to location and scale of active and independent living as well as neighborhood like setting. Additionally, the Center for Gerontology at VT has a list of volunteers that may also be used for recruitment to allow for more diversity in the sample. A non-probability purposive sampling technique will be utilized. Given the focus on neighborhood and park-based walking and dog walking, dog owners who reside in independent living will be recruited. Around 20 older adults will be interviewed (Lockett et al., 2005; Ronzi et al., 2016), with a sampling frame that includes heavy and medium/light walkers (heavy walkers defined as 4 or more 30 minute walks a week), dog owners over the age of 65 (Bornioli et al., 2018), and an equal balance of males and females. Same as the Delphi study, eligible participants will provide informed consent.

Due to the nature of this research involving human subjects, Institutional Review Board approval will be necessary for Photovoice. IRB approval will be received before

any data collection of participants. Each participant will provide informed consent.

*Data Collection: Photovoice*

Following the Delphi study, older adults will be recruited from senior living communities, specifically Warm Hearth Village. The following application of the Photovoice technique presents one option to capture photos by way of the participant, however the typical use of Photovoice may have to be modified given the addition of the dog. Pilot testing will help determine the best and safest way to capture photos of the walk. Additionally, presentation of printed photos may also have to adapt to accommodate time and cost restraints.

They will be given the option to use their personal phone camera or disposable camera and asked to take pictures of the outdoor environment where they typically walk, specifically physical features that are appealing or unappealing to both them and their dog. Delphi results will not be shared with participants to avoid biasing their perspective. The features may be perceived as either an enabler or barrier to walking in the space. Participants will be asked to take pictures of at least two walks over the course of two weeks. Participants will also provide context to their walk including time of day, weather, who joined them, location of the walk, and length of walk. Cameras will be collected after two weeks to print photos. If photos were taken on their phone, instructions will be given to export through email. While some features are hard to capture via photographs like shade or comfort, abstract concepts have the ability to be captured through interviews (Ronzi et al., 2016)

After printing photos, individual interviews will be set up. While Photovoice often utilizes focus groups, interviews are being used to capture individual stories, create

an open dialogue between the interviewer and participate, and remove the challenge of group thinking (Hart, 1991). Participants will narrate the walks captured from the photos. Participants will be asked to describe the most influential features. Additionally, I will collect demographic information, dog-ownership status, walking frequency, and functional competence. I will use the self -efficacy walking scale (McAuley et al., 2000) and short form health survey (Ware et al., 1996) to measure functional competence. Interviews will be recorded with permission and last 20-30 minutes. Features mentioned during interviews will be grouped by theme and presented back to the Warm Hearth community.

### *Pilot Testing*

Data collection through video recording was tested in November 2018 to determine viability of the methodology. An older adult volunteered to walk with a body video camera. The volunteer chose a familiar 30-minute walking route and narrated her experience. Pre and post walk surveys were also tested to determine clarity. The camera was challenging to use due to the clip covering the screen. In reviewing the recording, audio was spotty and did not pick up on the voice clearly. Additionally, a second person walking and high winds worsened the sound quality. The pilot test proved the method to be less than ideal. Photos and recorded interviews seemed to be a more ideal method.

### **Precedence**

Precedence in study design was demonstrated by Pikora et al. (2003) where existing literature served as the first source of identifying built environment features used in a framework for walkability. A Delphi study was then conducted to rank relative

importance of features. The study lacks consideration for the needs of older adults and dog walkers. Experts were primarily from urban planning, whereas this study will also include experts from gerontology and veterinary medicine. Pikora et al. (2003) provides precedence to the proposed methodology as an effective and viable way to gain consensus about the built environment.

Studies by Burnette et al. (2003) and Meijering et al. (2015) also demonstrate precedence in using the Delphi technique to gain consensus. Burnette et al. (2003) aimed to prioritize gerontological research topics using 46 experts and three rounds of questioning. The study provided precedence in how to assess and condense the data captured in each round. Meijering et al. (2015) explored research priorities in landscape architecture, providing precedence with the use of both academic experts and practitioners.

### **Study Limitations**

Article reviews and extraction of data will be limited to one reviewer, creating possible bias in the summary of key findings; however, the development of a new organization structure will have input from myself and one other investigator. To mitigate the possible exclusion of relevant features, the organization will be presented and modified by a panel of experts.

The Delphi study technique introduces a number of potential study limitations including unintentionally guided responses, unrepresentative respondents, and low response rates. Although the study design intends to give respondents the freedom to develop their own opinions and not conform to norms, the researchers can sometimes unintentionally lead respondents in their answers. This would introduce potential bias

into the data. Selecting multiple experts from each field provides credibility to the information collected; however, their opinions may not adequately represent their field. Different locations, places of employment, and years or experience may play into the responses. Also, due the length of participation and the need for participants to provide feedback in three different rounds, the study may experience a lower than expected response rate. To overcome the potential limitations of response rate, expert buy in, commitment, and interest will be sought before enrollment.

Additionally, experts are not the target population or end-user and their opinions may not align with those of older adults. However, they are stakeholders and have an interest in the health and well-being of older adults, animals and the communities in which they oversee.

Potential limitations to Photovoice include: lack of generalizability, participant drop out after taking photos, and unintentionally guided responses. Limiting recruitment to Warm Hearth comes with inherent limitations such as homogeneity of participant demographics.

## DISSERTATION ORGANIZATION

My dissertation is a manuscript format consisting of three papers centered around the intersection of the built environment, older adults, and dog walking. The dissertation includes five chapters starting with an introduction, followed by three self-contained papers, a conclusion and reflection, and appendices.

**Chapter 1 – *Introduction*:** Chapter one provides a background and justification for the included studies. A literature review on the intersection of built environments, active aging, and human-animal companionship shows where there is overlap between topics as well as the point of departure for the dissertation. An overview of the research design is provided based on the initial proposal. The research design for each study was further developed and refined to fit the setting and population. As a result, there are minor differences between the initial proposal and research described in the following papers.

**Chapter 2 - *Convergence of Features in the Built Environment to Promote Walking among Adults and Dog Owners: A Systematic Review*:** This paper presents how I systematically searched for articles about the built environment and the influence it has on general walking and dog walking. I identified, organized, and compared features within the included articles. I development a new organization of features which served as the basis for the Delphi study completed in Chapter Three. A version of Chapter Two was presented at the Active Living Conference in Charleston, SC in February 2019.

**Chapter 3 - *Coming to Consensus on Environmental Features that Support Older Adult Dog Walkers: An Interdisciplinary Delphi Study*:** This paper presents how I implemented a three round interdisciplinary Delphi study to prioritize features within the organization developed in Chapter Two. I describe the interactive process used to survey expert

panelists and determine which features achieved consensus. I also describe how I defined consensus and analyzed the results. Expert panelists achieved consensus on 25 out of 71 features. Personal safety was most important features among those that met consensus.

**Chapter 4 - *Motivations Behind Walking the Dog for Older Adults: Insights from Guided Walks and Interviews*:** In this paper I describe how I captured the perceptions about the outdoor environment among older adult dog walkers from a senior living community using the Photovoice technique. The paper demonstrates how Photovoice can be adapted to accommodate walking with a dog through the use of a photography assistant. Results from thematically coded semi-structured interviews are presented along with supporting photographs from 12 walks. Older adults from this study overwhelming identified elements in nature as influential to walking the dog and providing enjoyment.

**Chapter 5 - *Conclusion and Reflection*:** Chapter 5 summarizes key findings from each of the three studies along with the culminations of results. Lesson learned along with notable challenges from the three studies are described. Lastly, I present future research ideas that build off study limitations and introduce new methodology to study older adult dog walkers.

**Appendices** – Appendices A – J provide additional documentation of the research studies including consent forms, sample surveys, interview scripts, and photos from guided walks.



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**Chapter Two – Convergence of Features in the Built Environment to Promote**

**Walking among Adults and Dog Owners: A Systematic Review**

## ABSTRACT

In the United States, more than 80% of adults fail to meet physical activity guidelines, contributing to the high prevalence of obesity, cardiovascular disease, and cancer. Features of the built environment (e.g., presence of sidewalks, lighting, access to amenities) can encourage more physical activity, especially among older adults. Dog ownership is also known to motivate physical activity in this group. However, literature to date primarily focuses on features of the built environment that are influential to general walking and dog walking separately. To determine which features are mutually beneficial to both adults and dog-related activities, existing literature was synthesized through a systematic review to identify, summarize, and compare relevant design features of outdoor public spaces that encourage physical activity among adults and dog walkers. Peer-reviewed literature was searched using 16 standardized terms and the following inclusion criteria: 1) published between 2003- 2018; 2) study population of adults or older adults; 3) and included built environment features affecting general and dog walking. A total of 357 articles were identified for screening, and 15 systematic reviews and 20 original studies met inclusion criteria. The review articles included features of the built environment influential to physical activity in adults, and the original articles included features of the built environment influential to dog-related activities and walking among dog owners. Aesthetics, safety, and parks and open space were the most frequently identified features influencing physical activity, inclusive of walking, among the review articles. Features related to dog walking primarily included dog-related infrastructure (i.e., dog waste bags and dog policy signage) within parks and public open space, proximity of parks and public open space, and aesthetics and scenery.

Surprisingly, just because features were dog-supportive, such as dog parks, does not mean they encouraged walking once at a park. Several studies that emerged from the search process found that dog parks, off-leash areas, and enclosures are associated with increased sedentary behavior among owners and do not provide adequate outlets for walking. Namely, not all built environment features intended for dogs align with increased walking. Blending features from the built environment that encourage general walking, like aesthetics from nature and well-maintained amenities, safety from traffic, and proximity to high quality parks and also accommodate the dog through signage and waste dispose may lead to convergence and increased user appeal. Ultimately, the goal is more organization of built environment features pertinent to both older adults in general and dog-related activities in particular. Understanding is lacking about how features are prioritized. Therefore, the results are intended to be incorporated as input to a Delphi study, described separately in Chapter three. Identifying features of the built environment with mutual appeal for older adults of many ages and dog owners offers planners the opportunity to design more inclusively for multiple species. Creating more conducive spaces will serve as a viable approach to increasing activity levels among older adults.

## INTRODUCTION AND BACKGROUND

Within the United States, chronic diseases, such as obesity, hypertension, and heart disease, cause significant limitations in daily living for one in 10 adults and account for 70% of all deaths (Booth et al., 2012). Chronic diseases are widespread, contribute to rising health care costs, and are often preventable through lifestyle choices (Booth et al., 2012; Green & Klein, 2011; Wang et al., 2016; Watson et al., 2016). Regular physical activity can help reduce these health risks while also providing emotional and social benefits (McCormack et al., 2010). Unfortunately, more than 50% of American adults are physically inactive (Wang et al., 2016). With increasing age, adults become even less likely to participate in physical activity, and their risk of chronic disease is higher than that of their younger counterparts (Green & Klein, 2011; Watson et al., 2016). This combination creates a huge health care burden (King & King, 2010). Regular physical activity can help mitigate the burden, given that appropriate social and environmental supports are accessible and available (King & King, 2010).

One of the most common and universally safe types of physical activity is walking (Clark & Scott, 2016; Saelens & Handy, 2008, Cutt, 2008). Walking spans many purposes, including those for travel, leisure, and exercise. Walking is not only a desirable form of physical activity, but also applicable to a large number of people. Walking contributes to meeting daily physical activity guidelines, which recommends adults get 150 to 300 minutes of moderate activity each week (“Physical Activity Basics | Physical Activity | CDC” 2019). It also contributes to overall well-being, independence in daily living (Valenti et al., 2016), and opportunities for socializing with family and friends (Mulley et al., 2017). Physical activity is further enhanced by companion animals like

dogs and the benefits can include lower stress levels, decreased feelings of loneliness, higher self-esteem, lower blood pressure, and increased levels of physical activity (Cutt et al., 2007). Dog owners often experience many of these benefits through dog walking (Cutt et al., 2007).

The built environment, which includes the physical aspect where people live and work, can either promote or deter walking by the features and experiences it provides or lacks (Saelens & Handy, 2008). Since the advent of motorized transport, the design of the built environment has largely focused on cars and not pedestrians (Kerr et al., 2012). The result is that many neighborhoods lack the features desired for safe and efficacious walking (e.g., crosswalks, sidewalks, connected routes, and close proximity to destinations). Design features like high residential density, mixed land use, short block lengths, and grid street patterns are associated with more walking as compared to areas centered around car travel (Michael et al., 2006; Saelens et al., 2003). Additional benefits of walkable neighborhoods include higher levels of community cohesion and sense of community (Toohey et al., 2013). Given the association between the built environment and physical activity (Clark & Scott, 2016), neighborhoods designed with appealing features for pedestrians such as safety, aesthetics, and comfort can provide a needed outlet for increasing physical activity (Saelens & Handy, 2008). Intentional neighborhood design that promotes walking can also provide additional layers of safety through the visibility provided by residents walking outside (Holloway et al., 2013).

General walkers as well as dog walkers require supportive and tailored built environments (Cutt et al., 2008a), especially for walking to be initiated and sustained. While there may be features inherent to walkable environments that are mutually desired

by both general and dog walkers (e.g., safety and walking paths) (Cutt et al., 2007), others may not be desired as equally. For example, someone walking for leisure may be motivated by proximity to destinations and aesthetics (Saelens & Handy, 2008), whereas a dog walker may want designated exercise areas and waste stations (Gaunet et al, 2014). Considering dog specific features within the built environment is relevant because 39% of households in the US own a dog (Gaunet et al., 2014) and have the potential to walk with their dog(s). Walking the dog is one way for them to “do their business” and burn off energy. Older adults in particular may benefit from dog ownership and dog walking due to the prevalence of sedentary behavior in this age group. Older adult dog owners have shown to not only have a mobility advantage (speed and distance walked) but also greater sustained walking over time (Thorpe et al., 2006).

While dog ownership rates in the United States are similar to that of other countries, the rate at which individual owners exercise or walk their dog varies (Cutt et al., 2008a). A study from Australia found that 40% of dog owners walked their dog in the last week, contrasted with a study from the U.S., which found up to 60% of dog owners had walked their dog in the last week (Bauman et al., 2001; Cutt et al., 2008a; Suminski et al., 2005). While social and environmental factors can impact general physical activity (Mahmood et al., 2012), they can also influence the decision to walk the dog (Cutt et al., 2008a). Environments that support the presence of dogs may encourage dog owners to walk more frequently, thus contributing to overall physical activity recommendations and the reduction of social isolation.

During the urban planning and landscaping design process, animals are often overlooked, with priority going to human users (Tarsitano, 2006); yet the spaces used by

general walkers and dog walkers are often shared (Fletcher & Platt, 2016). Prioritizing mutually important features for general and dog walkers is challenging because design guidelines are not necessarily animal integrated, and the literature often separates these user groups (Jackson et al., 2013; Kerr et al., 2012; Westgarth et al., 2014). Also, dog walkers are not necessarily intentionally included in the general walking literature about walkability (Deehr & Shumann 2009; King et al., 2011). The outcomes and recommendations from these studies lack a perspective that recognizes the interconnectedness of human health, the environment, and animals (*One Health Basics* 2018): a perspective known as One Health. Considering how the environments between humans and animals, particularly dogs, are shared can optimize the health of humans by mitigating risk and promoting benefits associated with coexistence of humans and animals and creating environments that allow multiple species to thrive. Understanding how the built environment influences walking for both general walkers and dog walkers is critical to determine what is mutually relevant between these groups of people and their canine companions. Considering how the built environment influences many types of users has the potential to create more equal opportunity to participate in walking.

Given the health benefits for owners and their canine companions from walking, the purpose of this study is to review associations between the built environment and walking that focus on general walking among adults and walking among dog owners. The objectives of the research presented in this paper are to (1) create a new organization of features that merges findings from the literature on general walking and dog walking (2) identify the key built environment features that influence walking among adults and dog



owners, (3) and assess agreement and disagreement about factors in the built environment that influence general walking and dog walking.

### **Overview and layout of paper**

This paper is organized in two parts. Part One describes the methods I used to obtain the papers in this systematic review and the results from completing the search. Part Two describes the specific approaches used to extract the data needed to address each of the objectives along with the results and discussions for each objective. The objectives were dependent on identifying a set of literature that represented the current body of knowledge around the built environment and general walking and dog walking.

## **PART ONE: BUILDING THE DATA SET OF PAPERS**

### **METHODS**

#### **Search strategy**

I conducted a search between July 2018 and August 2018 using EBSCOhost and followed the PRISMA guidelines checklist for systematic reviews (Liberati et al., 2009). I only included English language studies from peer-reviewed journals published between 2003-2018. A combination of systematic reviews and primary articles were used, based on the current breadth of literature about the influence of the built environment on general walking and dog walking. I searched the following terms within titles to identify systematic reviews about the built environment and walking among adults:

*(built environment OR physical attributes OR neighborhood OR park OR open space AND walk OR activity AND systematic or review)*

I also searched for primary articles about dog walking. I searched the following terms within abstracts:

*(built environment physical attributes OR neighborhood OR park OR open space AND walk OR activity AND human-animal companionship OR human-animal relationship OR dog-ownership OR dog walking)*

Variants of the terms, such as those in spelling, were also used to capture the greatest number of relevant articles. I screened titles and abstract for relevance using my inclusion criteria.

### **Inclusion criteria**

For inclusion, review articles needed to meet the following characteristics: (1) addressed features of the built environment that influence walking among adults (2) included either objective or perceived features, and (3) were a review article on the intersection of the built environment and physical activity.

Original articles needed to meet the following characteristics to be included: (1) addressed features of the built environment that influence dog walking (2) included either objective or perceived features, and (3) were about the intersection of the built environment and dog walking. Articles that focused on the relationship between walking and dog ownership but lacked information on built environment features pertaining to dog walking were excluded. For primary studies, all methodologies were included.

In both searches, I excluded studies about walking related to children and teens because the primary focus was on the unique needs of adults, both non-dog owners and dog owners. Features included the physical, social, and natural aspects of the outdoor environment along with contextual features. Additional articles were included from manually reviewing citations within reviewed articles. Duplicate articles were removed.

## RESULTS

### **Number of articles that met inclusion criteria**

The search yielded 194 potential review articles and 632 primary articles. After removing duplicates, I screened 66 review articles and 291 primary articles for eligibility. In total, 357 articles were screened, 296 were excluded, and 61 articles underwent a full text review. Twenty-six of the 61 full text articles (22 review articles and 39 primary articles) were excluded because they did not meet inclusion criteria with reasons. The articles either were not systematic reviews, reviewed only tools or models, focused on youth, or did not include specific built environment features. Thirty-five articles (15 reviews and 20 primary articles) met inclusion criteria. Figure 2.1 summarizes the methods and number of articles following the PRISMA guidelines.

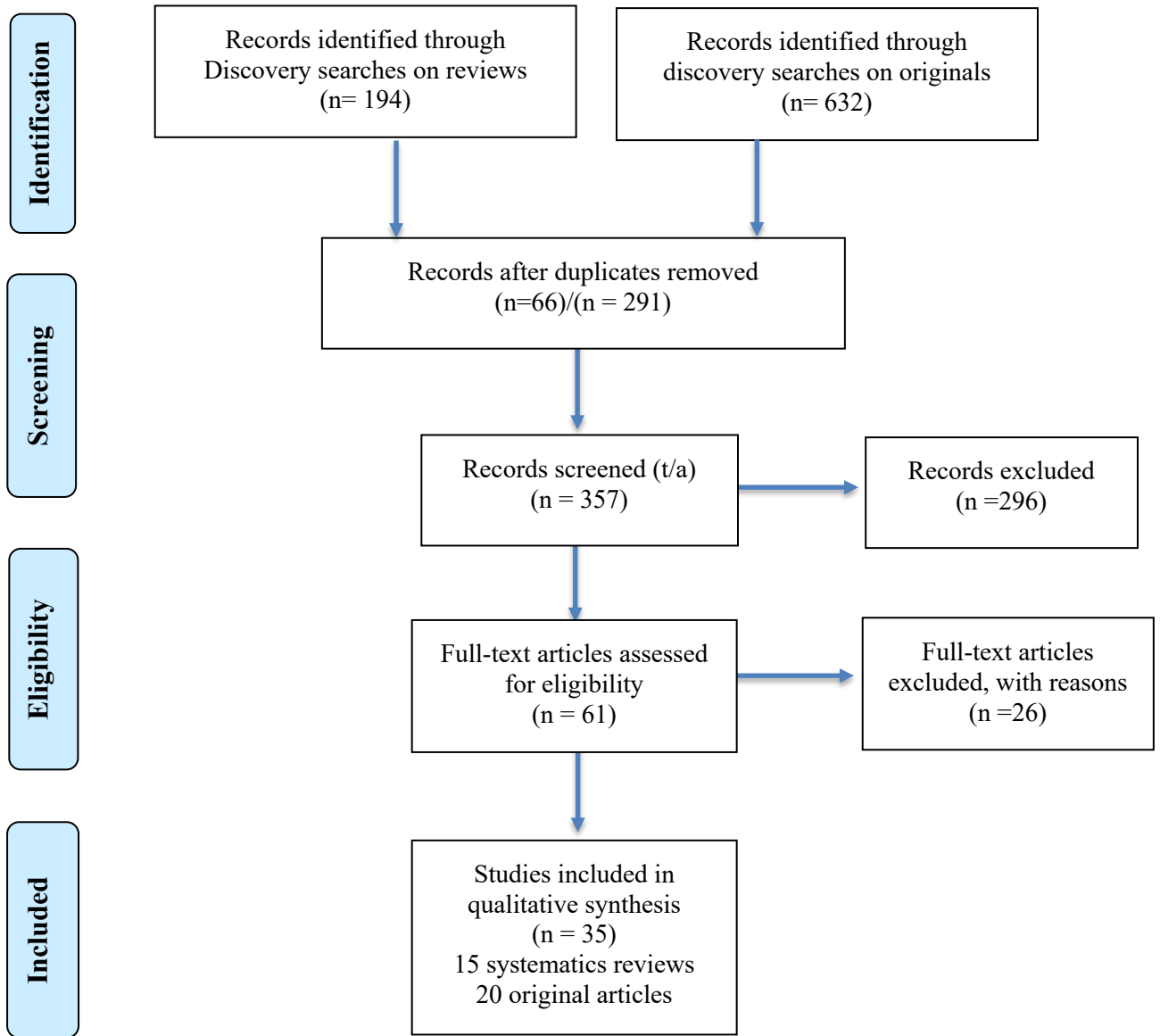


Figure 2.1. Flow diagram based on PRISMA guidelines

## **PART TWO: METHODS, RESULTS, AND DISCUSSION OF OBJECTIVES**

### **OBJECTIVE 1**

**Objective 1: Create a new organization of features that merges findings from the literature on general walking and dog walking.**

The following section describes how the data was extracted from the articles, the steps involved with organizing the features, and final organization structure intended to be incorporated as input to a Delphi study, described separately in Chapter three.

### **METHODS**

#### **Data extraction**

I extracted lists of features, which included both physical and contextual attributes of the built environment, as they were presented in the studies into new data tables. Examples of physical features included sidewalks, lighting, fencing, pocket parks, whereas accessibility and aesthetics were examples of more contextual features. First, articles were searched for preexisting organized lists of features, followed by descriptions of features. Features extracted included single words such as fencing, shade, and safety as well as phrases like “off-leash areas” and “mix of recreational destinations”. Two separate data tables were generated, one for review articles and one for primary articles. At this stage, no duplicates were removed.

#### **Data organization**

The primary task of *Objective 1* was to create a new organization of features in preparation for a future Delphi study. Reducing the total number of features in a new organization would thereby reduce the cognitive load placed on participants. Current organizational structures did not meet the criteria of reducing cognitive load and blending

both features for general walking and dog walking. Additionally, the new organizational structures needed to make equal comparison of features which was lacking in existing structures. For example in a study by Eisenberg et al. (2017) the four main feature categories included design, destination, density, and composite index whereas a study by Smith et al. (2017) included active transport infrastructure, parks and playgrounds, and walkability components as the main feature categories. These existing structures were not appropriate to present to a panel of experts in a future Delphi study, therefore a new structure was developed.

Before attempting the three approaches described below, which led me to the development of a new organization, I did an initial scan of existing frameworks and taxonomies. I reviewed some of the hierarchies used in the original articles but didn't find any that seemed right. The categories were dissimilar and did not compare "like" features. There were however clearly some different hierarchical levels of detail. For example, in the study by Eisenberg et al. (2017), within the category of Destinations, *distance to transit, number of transit stops, recreation facilities, and retail and services* were sub-features. I knew a hierarchy of some sort would likely be part of any organizing strategy. This ended up being the basis for the third and final approach I used.

I also looked at existing taxonomies from the built environment and landscape architecture domains that might be used to organize features. An example includes CSI Masterformat ("MasterFormat Specification Divisions" 2020). The challenge was these taxonomies introduced unfilled categories because associated variables were not identified in the review. These taxonomies also failed to capture many of the attributes of the walking environment that are emergent on a systems scale.

### *Overview of three approaches*

To accomplish the task of reducing total number of items after combining features from two sets of literature I (1) removed duplications and (2) combined synonyms to preserve detail. Through these steps I was able to identify features, reduce the number of features, and create a new organization representative of two bodies of literature. Features were not prioritized because this was the goal of the Delphi study, not this systematic review.

Three different organizational approaches were attempted before identifying an approach that accomplished the above task and met the criteria needed for the Delphi study. The first approach relied on checking basic frameworks to guide organizations of features, the second approach relied on grouping features based on physical and contextual attributes, and the third approach looked at the walking experience of the pedestrian and grouped features based on likeness. The approaches are described below.

#### *Approach one*

First I looked at simpler frameworks using a satisficing approach (Frankenfield 2020). I organized features into the following groups: built (constructed by humans), natural (naturally occurring), social or a combination of the three. While some features fell into obvious categories such as crosswalks and traffic calmings being built features, others required more interpretation. Greenery and park amenities could be natural features but also built. Phrases such as pathway variety, proximity to shops, safety from traffic, and access to beaches made the labeling even more challenging. Beaches are natural but access could be achieved through built interventions. Due to this ambiguity, themes did not emerge.

### *Approach two*

With the second approach, I separated features into two categories, physical or contextual, in an effort to make more equal comparisons of features. For example, trees and parks were considered physical features and aesthetics and cleanliness were considered contextual. The approach proved to be too coarse and left the features stripped down. The lists were too still too large and without adequate context therefore like items could not be grouped.

### *Approach three*

In my third attempt, I organized features based on likeness to one another and the walking experience of the pedestrian. The categories were smaller than in the second attempt and contextual items were grouped together. For example, benches and picnic tables were grouped under seating; asphalt, pavement, and gravel were grouped under surface type, and curb cuts, block lengths, and sidewalks were grouped under street features. I named each category base on the theme. The initial themes included: large scale natural features, general amenities, surface types, deterrents, pathways, seating, natural elements, street features, destinations/ services, dog specific amenities, neighborhood design, and contextual features.

I combined the variables within the categories from the review and primary articles. Not only were like variables grouped together but variables with similar meanings were listed together in an attempt to preserve possible disciplinary nuances of wording or language that would later be sorted out in the multidisciplinary Delphi panel. For example, debris/ litter/ trash and stray animals/ unattended dogs were like variables grouped under deterrents. Similarly, ice/ puddles/ snow were grouped together in



deterrents because they were weather hazards and off-leash dog areas/ dog parks/ dog zones were grouped under dog specific amenities because they were areas for the dog to run. Variables beyond the scope of this review were removed because the scale was considered too large, for example: zone form, pedestrian systems, microscale urban design, and infrastructure.

The 12 categories were further consolidated. For example, seating was grouped under amenities, large-scale natural elements under natural elements, and surface type under path design. Additionally, some categories like dog specific amenities did not remain because the variables could be appropriately grouped elsewhere. For example, off-leash dog areas/ dog parks/ dog zones were listed under destinations. Once the variables were in final categories, category names were modified to better represent the overarching themes. Seven categories emerged from the literature on general walking and dog walking. The final categories included *design goals*, *path design*, *path amenities*, *destinations*, *interaction with motorized traffic*, *interaction with nature*, and *deterrents*.

## RESULTS

### Final organization of features

The following categories merge features identified from review articles and primary articles. Groupings were organized around the experience of walking from the pedestrian standpoint.

#### *Design goals*

- access/ accessibility/ availability of destinations
- aesthetics/ attractiveness
- cleanliness
- comfort/ thermal comfort

- connectivity of routes
- convenience/ directness of routes
- diversity/ mix/ variety of destinations
- dog friendliness
- enjoyable/ pleasurable/ peaceful/ purposeful
- family friendliness
- inclusiveness of routes, streets, and destinations
- maintained/ kept amenities
- maintained/ kept paths
- personal safety
- proximity/ distance to amenities
- proximity/ distance to destinations
- traffic safety
- visual interest

#### *Path design*

- connectivity/location of path
- entrances/ access points
- levelness/shape/width of path (hills/gradient, slope/incline)
- path use (pedestrian only, cycling, mixed use)
- surface type (asphalt, pavement, gravel, pebble, synthetic, earth, ground cover)

#### *Path amenities*

- appropriate seating
- boundary fencing/ fencing around dog area and playgrounds
- dog policies and signage
- dog waste stations
- equipment for games/ fitness
- lighting/ street lighting
- parking
- shelter/cover
- surveillance/ police presence
- toilets

- trash cans/ waste cans
- water fountains/ drinking areas
- way finding/ distance signage/ signage

*Destinations*

- barbecues/picnic areas/shelters/pavilions
- courtyards/rooftop gardens
- dog agility equipment/ dog exercise area
- man made water features
- monuments
- off-leash dog area/ dog park/ dog zone
- parks/public open space
- recreational facilities (sports fields, swimming pool, playing field, grassy play surface)
- restaurants
- separate children's play area/ playground
- services
- shops

*Interaction with motorized traffic*

- block length
- crosswalks/ crossings/ zebra crossings
- curb cuts/ ramps
- intersection size
- island in crossing/ raised platforms
- parking bays
- sidewalks
- stoplight timing/ crosswalk
- traffic calming/ controls/ stops
- traffic/ speed/ volume
- verge width
- width of road

*Interaction with nature*

- birds
- community gardens
- grassy open areas/greenspace
- landscaping (flowers, planters)
- natural vegetation (bushes, plants)
- natural water feature (waterfalls/ beach/lake/pond/ river/ wetlands)
- nature/nature sounds
- trees
- wildlife
- woodlands

*Deterrents*

- crime
- debris/ litter/ trash
- dog feces
- empty space/ crowded
- ice/ puddles/ snow
- obstacle/obstruction/physical barrier
- pollution (air, noise, sewer, fumes)
- privacy/ visibility
- road hazards
- strangers
- stray animals/ unattended dogs
- traffic
- vacant housing
- vandalism

## OBJECTIVE 2A

### **Objective 2a: Identify the key built environment features that influence walking among adults**

In the following section I describe how key features influential to general walking among the systematic reviews were identified, provide a summary of findings and study characteristics, along with a discussion of the key features identified. The systematic reviews on general walking and physical activity (n=15) served as the primary data.

## METHODS

### **Identifying key features**

To identify key features, primary findings were extracted for each review article. The findings were then organized around 12 overarching themes to adequately capture and organize the key features. In conjunction with an existing framework by Saelens and Handy (2008) which included eight correlates, four additional themes emerged from the findings. This method of identifying and organizing the key features was similar to the first one approach attempted in *Objective 1*. Each thematic category was then tallied. The tally represented the frequency at which corresponding key features emerged from the articles. Key findings that emerged repeatedly and the highest frequency are discussed in detail below. While some of reviews may have briefly mentioned aesthetics, safety, and/or parks and open space, unless it was discussed as a key finding, the features were not extracted and thus not part of the frequency counts. The purpose of this step was merely to summarize key findings across a large body of studies. Rigorous methodologies to prioritize features occurred in subsequent research phases.

## **RESULTS**

### **Summary of key features from general walking literature**

In Table 2.1, I present key built environment features identified by the review articles as influential to physical activity. Specific study results are not listed given the magnitude of studies (over 500) represented across the review articles.

Table 2.1: Summary of built environment correlates of physical activity from review articles

	Walkability/ Pedestrian Infrastructure	Public Transit	Parks/ open space	Proximity	Aesthetics	Recreational Facilities	Sidewalks/ footpaths	Connectivity	Access to destinations	Density	Safety	Land use mix
Bancroft et al. (2015)			X	X		X				X		
Barnett et al. (2017)	X				X				X		X	
Cauwenberg et al. (2018)	X	X	X		X	X						X
Cunningham & Michael (2004)					X		X				X	
Day (2016)	X			X	X	X						
Eisenberg et al. (2017)					X						X	
Hajna et al. (2015)								X		X		X
Kaczynski & Henderson (2007)			X	X		X						
McCormack et al. (2010)				X	X						X	
McCormack & Shiell (2011)	X	X	X	X				X		X		X
Orstad et al. (2017)	X	X	X		X	X	X	X	X	X	X	X
Saelens & Handy (2008)			X			X		X			X	X
Salvo et al. (2018)					X				X		X	
Smith et al. (2017)	X		X									
Wang et al. (2016)	X		X	X	X	X	X	X	X	X	X	X
	7	3	<b>8</b>	7	<b>10</b>	7	3	5	4	5	<b>8</b>	6

## **Study characteristics of review articles on physical activity and general walking**

The 15 review articles included research studies utilizing both qualitative and quantitative measures linking built environment features to physical activity. Physical activity, which included walking, was captured through objective measures like pedometers and/or subjective measures like self-reported surveys. Most reviews included articles using both objective and subjective measures of physical activity (n=7), followed by subjective measures (n=4), and objective measures (n=2). Two studies did not clearly report whether physical activity was measured through objective and/or subjective measures.

Features in the built environment were also primarily measured using both objective measures like GIS, and subjective measures like self-reported surveys capturing perceptions (n=9). Strictly objective measures of the built environment were the second most common (n=3), followed by subjective measures (n=2). One study did not clearly report how features in the built environment were measured. Some studies were consistent in the use of only objectively or subject measured features and physical activities, while others used a combination.

## **DISCUSSION**

*Aesthetics, safety, and parks and or open space* were among the key features associated with physical activity identified in the review articles and are discussed below in detail.

### **Aesthetics**

The most widely discussed finding in the review articles was aesthetics. Walking environments that included aesthetically appealing scenery appeared to be valued by adults across multiple age groups, however, was especially relevant for older adults (Barnett et al., 2017; Cauwenberg et al., 2018; Cunningham & Michael, 2004). One reason why older adults placed a high value on aesthetics may stem from the purpose of walking. Older adults often take



part in more recreational walking as compared to walking for transport, most notably after retirement (Cauwenberg et al., 2018). Aesthetically pleasing scenery plays into overall enjoyment (Eisenberg et al., 2017) and may be a primary reason for taking part in recreational walking (Cauwenberg et al., 2018).

While it is helpful to know the value of aesthetically pleasing walking environments, the articles do not equally define and expand on the specific qualities associated with aesthetics. Many different elements play into achieving aesthetic appeal from nature to maintenance and without adequate understanding, designs may fall short. For example, Barnett et al. (2017) identified greenery and aesthetically pleasing scenery, but did not provide any further information about what type of greenery. Cunningham & Michael (2004) and Eisenberg et al. (2017) also identified a positive association between aesthetics and physical activity but again did not elaborate. Day (2016) grouped aesthetics with cleanliness as did (Cauwenberg et al., 2018) noting littering and vandalism, but this does not adequately operationalize the meaning behind aesthetics.

The studies by McCormack et al. (2010) and Salvo et al. (2018) provided a higher level of detail about specific aesthetic qualities associated with physical activity. Unlike the studies by Barnett et al. (2017), Cunningham & Michael (2004), Day (2016), and Eisenberg et al. (2017), McCormack et al. (2010) and Salvo et al. (2018) included only studies using qualitative measures of the built environment such as focus groups, interviews, and Photovoice methods. Qualities associated with aesthetics both added to and took away from the surrounding environment. For example, elements in nature like trees, birds, and flowers, as well as views of mountains, waterfalls, and changing seasons supported physical activity. Fresh air, lack of noise, and well-maintained amenities like gardens and bathrooms were also aesthetic qualities

associated with increased physical activity. The qualities that took away from aesthetic appeal and were negatively associated with physical activity, including dog feces, trash, pollution, smells, poorly maintained gardens, and graffiti. The qualitative approach taken by these two studies allowed for rich data to emerge about the widely agreed upon feature of aesthetics. While objective measures may be more ideal for capturing features like street connectivity, density, and access to transit as it relates to the built environment and physical activity (Smith et al., 2017), qualitative approaches may be better at capturing individual preferences about ideal walking environments, such as is the case with aesthetics.

### **Safety**

Safety was identified as an important built environment correlate to walking by more than half of the review articles. What makes this finding valuable is how applicable it is to a range of user groups and settings. For example, while specific concerns may have differed within the studies, both younger and older adults valued safety when walking outside. A recurring concern related to safety is proximity to traffic (e.g., Barnett et al., 2017; McCormack et al., 2010; Wang et al., 2016). Salvo et al. (2018) recommends pedestrian bridges and separated cycling lanes for access over large busy roads and to keep pedestrians and cyclists feeling safe and distant from traffic. Pedestrian bridges also help older adults who identify having trouble crossing major roads without feeling like they have adequate time (Salvo et al., 2018). Parks were also identified as a safe and appealing reprieve to walking on main roads amongst busy traffic (McCormack et al., 2010). While parks provide a reprieve to traffic, access to parks is another concern (Kaczynski & Henderson, 2007). Parks only accessible by car are less desirable than parks accessible by walking (Wang et al. 2016).

### **Parks and open space**

The influence of parks and open space on physical activity and walking is discussed in a variety of ways by the review articles. Some of the included studies focus on the role of proximity and density of parks (Bancroft et al. 2015; Kaczynski & Henderson, 2007) whereas others looked at park quality and whether parks were equally utilized by less affluent communities (Cauwenberg et al., 2018; McCormack & Shiell, 2011; Smith et al., 2017). While in general close proximity to multiple high-quality parks and open space were positively associated with physical activity, the findings were also mixed. Only one study actually differentiated parks from open space and found open space was more consistently linked to physical activity as compared to parks and trails (Kaczynski & Henderson, 2007).

Mixed findings on whether or not park proximity and density contributed to increased physical activity was best described by Bancroft et al. (2015) and Kaczynski & Henderson (2007). The idea that placing parks within a close distance to home will increase walking is driven by the concept of New Urbanism which believes pedestrian travel is influenced by proximity of amenities (Kaczynski & Henderson, 2007). Multiple studies in the review by Kaczynski & Henderson (2007) found no such link (Duncan & Mummery, 2005; Lund, 2003). Frequency of recreational walking did not increase among those living with close access to parks. Within the same review, another study found parks to be the only variable associated with physical activity (Deshpande et al., 2005). Park users were four times more likely to engage in physical activity at least five times a week for over 30 minutes. Lack of specific age groups studied, information on park size, and limited qualitative studies may have contributed to the mixed findings (Kaczynski & Henderson, 2007; Orstad et al., 2017).

Bancroft et al. (2015) further supports the mixed findings, noting another reason could stem from the mix of objective and subjective measurements of park proximity and density. For

example, McCormack & Shiell (2011) and Smith et al. (2017) were among the articles that used only objective measures of the built environment such as GIS mapping whereas Bancroft et al. (2015) used both. The mixed findings as a result of mixed measurement approaches (mapping, audits, survey) are further supported by Orstad et al. (2017). Perceived or subjective measures of parks and open space were more significantly associated with physical activity than objective ones (Orstad et al., 2017).

Quality of parks and open space was also related to physical activity. Renovating parks to include upgrades like exercise equipment, new lighting, landscaping, and surface improvements was found to increase activity levels in adults (Smith et al., 2017). However, park use often disproportionately favored white adults, raising the issue of park improvements favoring socioeconomically advantaged groups (Smith et al., 2017). Bancroft et al. (2015) also raise concern with how parks can be “discounted” by surrounding neighborhoods with high crime. Implementing improvements in an effort to create higher quality parks and thus more activity may not provide equal benefits across different races and levels of affluence.

## **OBJECTIVE 2B**

### **Objective 2b: Identify key built environment features that influence walking among dog owners**

In the following section I describe how key features influential to walking the dog among primary articles were identified, provide a summary of findings and study characteristics, along with a discussion of the key features identified. The primary articles are dog walking (n=20) served as the primary data set.

## **METHODS**

To identify key features, primary findings were extracted for each article on dog walking. Unlike in *Objective 2a*, I did not use an existing framework to organize key features because the data looked a bit different coming from primary articles as compared to review articles. The data set was smaller and more specified. This difference can be seen when comparing Table 1 and Table 2. After key features were extracted from each article, those that emerged repeatably were discussed in detail below. Again, the purpose of this objective was to summarize key findings. Rigorous methodologies to prioritize features occurred in subsequent research phases.

## **RESULTS**

### **Summary of features from dog walking literature**

In Table 2.2, I present a summary of results on the relationship between features in the built environment and dog walking. Because the 20 studies on dog walking were primary research articles presenting individualized findings, Table 2.2 is organized differently than Table 2.1.

Table 2.2. Summary of results from primary articles on dog walking

Author	Sample	Data source	Activity measured	Results
Christian et al. (2009)	483 dog walkers	S	Dog walking	Local parks with close proximity to dog-supportive infrastructure was associated with regular dog walking.
Cutt et al. (2008b)	629 dog owners	S	Dog walking	Neither perceived nor objective access to POS was a significant factor in the <i>initiation</i> of dog walking. Perceived lack of access to POS with dog-supportive features was associated with less frequency of dog walking.
Cutt et al. (2008)	51 dog owners	F	Dog walking	Availability, accessibility, and quality of dog- friendly POS was associated with dog walking.
Coleman et al. (2008)	2199 dog walkers and non- walkers	S	General physical activity of dog owners	Dog owners/walkers were more likely to live in highly walkable neighborhoods (proximity to destination, mixed land use, connected streets, and high density) compared to owners/non walkers
Dalton et al. (2016)	15672, older adults	S	Dog walking and physical activity	Dog walking mediated the relationship between green space and physical activity
Evenson et al. (2016)	150 interviews; 2124 observations	O, I	Activity patterns of dog park users	Dog park visitors were less active than other visitors. Walking made up 20% of dog park visitor activity. Environmental factors may affect activity of dog park users such as seclusion, lack of shade, and enclosure size.
Gaunet et al. (2014)	396 dog owners	O	Dog-related activities	Characteristics of outdoor spaces including the presence of streets, squares, or parks shaped use pattern among dog walkers.
Kellner et al. (2017)	57,313 photographs of park users	O	Trail activity of dog walkers and non-walkers	Access points, scenery, and dog-related policies were positively associated with dog activities.
Lee et al. (2009)	267 adult dog park users	S, O	Activity patterns of dog park users	Proximity to dog parks was associated with increased likelihood of walking to the dog park. Size of dog park, presence of walking paths, and water features were positively associated with walking the dog.
Iojă et al. (2011)	5240 park visitors w/ and w/o dogs	S	Park activity of dog walkers	Dog walkers had different needs in urban parks than non-dog walkers and frequented the park more often. Proximity and accessibility were determinants of dog walkers. Dog walking was equal among age groups.
McCormack et al.(2016a)	1955 adults	S, I	Dog walking	Aesthetics and walkability were associated with frequency and likelihood of walking the dog.
McCormack et al. (2016b)	1875 visitors w/ and w/o dogs	O	Park activity (walking, dog related, jogging)	Off-leash dog parks modified visitor activity patterns. Off-leash areas alone did not increase dog-related activities. Trash cans, litter bags, and signage also needed to be present.
McCormack et al. (2011)	506 adult dog owners	S	Physical activity among dog owners	Participation in dog walking was higher among adults 40-59, in good health, who lived in grid like neighborhoods, and did not live within 1.6 km of an off-leash park. Frequency of dog walking was highest among those who lived within 1.6 km of off-leash area
Rock et al. (2016)	75 dog walkers	O, S	Park based dog walking	Off-leash areas were inconsistently associated with increased dog walking.
Lail et al. (2011)	428 dog and non-dog owners	S	Recreational walking	Dog owners were more likely to walk in the summer and winter than non-dog owners.
Shibata et al. (2012)	1926 older adults	S	Dog walking and physical activity	Residential density was associated with differences among dog walking frequency.
Sugiyama et al. (2015)	1465 adults	S	Neighborhood based walking	Dog-related facilities (water source and off-leash areas) were associated with an increased likelihood of walking POS
Suminski et al. (2005)	474 adults	S	Neighborhood based walking	Neighborhoods with above average safety were associated with dog walking among women.
Westgarth et al. (2016)	629 dog owners	S	Motivation to dog walk	Perceived access to POS with dog-supportive features was associated with lower odds of having a high motivation to walk the dog.
White et al. (2018)	280,790 adults	S	Leisure time physical activity	A positive relationship was found between green space and dog owners but not non-owners.

Note: S= survey, I= interview, O= observational, F= focus group, POS= public open space

## **Study characteristics of primary articles on dog walking**

Among the 20 included dog walking studies, surveys were the primary form of data collection (n=13), followed by observation (n=3), focus groups (n=1), and a combination of methods (n=4). Studies were conducted in multiple countries, with equal representation from the United States (n=5), Canada (n=5), and Australia (n=5). Studies were also conducted in Europe (n=4) and Japan (n=1). A summary of key features from the review articles are listed in Table 2. Close to half of the studies (n=9) focused primarily on dog owners or dog walkers, while the other studies included a combination of dog owners and non-owners.

## **DISCUSSION**

The key features identified in the primary studies on dog walking included *proximity and accessibility of public open space (i.e., green space and parks) with the provision of dog-supportive infrastructure (litter bags, trash cans, dog policy signage, and off-leash areas), designated dog parks, neighborhood walkability, and aesthetics.*

The relationship between proximity to public open space (POS) and dog walking was mixed even when dog-supportive infrastructure was available. Additionally, there was a difference between uptake or participating in dog walking (yes or no) and frequency (how often) of dog walking as it related to proximity to public open space and parks with dog-supportive infrastructure. For example, Cutt et al. (2008b) found no association between perceived or objective access to POS with dog-supportive infrastructure in the uptake of dog walking, but I did find that dog owners who perceived lack of access to POS were twice as likely to not walk their dog. McCormack et al. (2011) looked at proximity of parks to home residence based on objective measurements and found a positive association between frequency of dog walking and close proximity to parks with off-leash areas but a negative association with participation in dog

walking. Surprisingly, participation in dog walking was associated with being farther from parks with off-leash areas. Like the study by McCormack et al. (2011), Christian et al. (2009) also looked at objective measures of park proximity and found close proximity was associated with regular frequency of dog walking (more than 90 min a week).

The inconsistencies were also present in studies looking at general dog walking, not just those with the nuance of initiation and frequency. The study by Cutt et al. (2008a) was among the few that were qualitative in nature and identified a positive association between POS and dog walking. Accessible POS with dog-supportive infrastructure like litter bags and off-leash areas were considered facilitators to dog walking. In contrast, a study by Westgarth et al. (2016) found that perceived access to POS with dog-supportive infrastructure was associated with decreased motivation to walk the dog. The need to walk the dog regardless of having POS as well as dog walkers perceiving the supportive infrastructure as lacking may help explain some of these differences across studies.

Dog parks are a place for dogs to exercise and socialize, but they were not found to increase dog walking (Evenson et al., 2016; and Lee et al., 2009). As compared to other park users, dog park users walked less because they were predominantly just standing in the enclosure (Evenson et al., 2016). Dog parks that provide opportunities for the owners to walk while the dog plays may help alleviate sedentary behavior. For example, the addition of linear walking paths within a dog park encouraged more walking behavior (Lee et al., 2009).

Off-leash areas, while sometimes specially enclosed spaces, are often just areas designated by policy within POS, and were inconsistently linked to dog walking. For example, Rock et al. (2016) could not say after park observations whether the change in policies to allow dogs off-leash actually changed the walking behavior of dog owners. Another study by



McCormack et al. (2016b) actually found that off-leash designation actually decreased activity levels among dog owners, similar to dog parks. Additional supportive features like litter bags, water features, paths, and trails may be necessary to change activity levels among human users of these areas (McCormack et al. 2016b).

While aesthetics and general walkability of the outdoor environment emerged less than POS and dog parks, the studies that did identify these features were all consistent in the positive association it had with dog walking (Coleman et al., 2008; Kellner et al., 2017; McCormack et al., 2016a). Among dog walkers, perceived aesthetics and walkability were associated with walking the dog at least four times a week and may be features that help nudge dog owners to walk regularly (McCormack et al., 2016a). Likewise, scenic vistas and routes were predictive of use of POS by dog walkers (Kellner et al., 2017).

### **OBJECTIVE 3**

#### **Objective 3: Assess agreement and disagreement on key features in the built environment that influence general walking and dog walking**

The following section describes how I compared built environment features influential to walking behavior between the review and primary articles. I wanted to assess whether the correlations were similar or dissimilar between the sets of papers. This comparison allowed for a deeper understanding of features mutually relevant to general walkers and dog walkers and as well as identification of features that were user specific or in conflict. For example, some features like the role of off-leash areas were conflicting, whereas dog waste is discussed by both groups, but primary articles more readily address solutions. Other features like aesthetics were more congruent. Both the systematic review (n=15) and the primary articles (n=20) were used as the primary data set.

## METHODS

To assess agreement and disagreement on features in the built environment between the two sets of literature I looked to the key features identified in *Objective 2a and 2b*. First, I looked at whether the key features from each set of literature were discussed in the other set. I then compared key features that were discussed in both sets for either agreement or disagreement on the influence it had on walking. I also looked at intensity at which the feature was studied. For example, aesthetics was discussed as a positive influence on general walking and dog walking but was less intensely studied in the dog walking literature. I also noted key features that were exclusively discussed in only one set of literature.

## RESULTS AND DISCUSSION

Dog specific features were predominantly identified in primarily articles about dog walking; however, a few review articles did consider the built environment as it pertains to dog walkers. Dog parks and enclosed off-leash areas were positively associated with physical activity in two review articles (McCormack et al., 2010, Salvo et al., 2018). These findings contradict those from the primary articles about dog walking that found dog parks and off-leash areas did not consistently contribute to an increase in activity levels among owners and in some cases actually encouraged sedentary behavior. The review articles by McCormack et al. (2010) and Salvo et al. (2018) utilized a qualitative approach capturing individual perceptions whereas the primary studies focused on dog parks and off-leash areas mainly used observations. The role of dog parks and off-leash as it relates to dog walking is unclear and may largely be influenced by the type of measurement approach utilized.

Benefits of dog specific infrastructure such as water sources, litter bags and bins, and agility equipment were only mentioned in the review article by McCormack et al. (2010). This is

supported by numerous primary articles on dog walking which identify dog-supportive infrastructure as desired features by dog walkers (Christian et al., 2009; Cutt et al., 2008a; McCormack et al., 2016b).

In two other review articles, dogs were viewed more so as a social nuisance within the walking environment (Orstad et al., 2017; Saelens & Handy, 2008). Dog feces and fear of unattended dogs contributed to them being perceived as negative (Cunningham & Michael, 2004); Saelens & Handy, 2008; McCormack, 2016). Results from primary articles indicate a strong awareness of the issue of dog waste and the possible nuisance it can cause by offering solutions to the issue. The availability of litter bags was a recurring theme within dog-supportive infrastructure and possibly one of the most basic dog amenities offered by POS, parks, and dog parks (Cutt et al., 2008b; McCormack et al., 2016b; Sugiyama et al., 2015).

Aesthetics influenced both general walking and dog walking. Aesthetics was positively associated with general walking and provided enjoyment through natural elements and lack of unpleasantries like pollution, noise, and dog feces. Adults consistently valued walking in spaces that appealed to the senses. While it is not to say dog walkers didn't value aesthetics, it has not yet been studied as intensively as with general walking. Only two primary studies looked at aesthetics and the findings were in line with the results from general walking (Kellner et al., 2017; McCormack et al., 2016a).

Features relevant to dog activities like parks and public open space frequently emerged in the dog walking literature, but as with general walking, the influence it had on increasing walking was mixed. Parks in many cases did not correlate with increased walking by humans, either with or without dogs (Bancroft et al., 2015; Cutt et al., 2008b; Westgarth et al., 2016). However, in other cases, parks did provide desired appeal and increased the likelihood to walk

(Sugiyama et al., 2015). Parks and public open spaces that prioritize aesthetics, include dog-supportive infrastructure, and provide spaces to walk with the dog on and off-leash like a walking path, may effectively blend key features to encourage walking across multiple user groups.

## LIMITATIONS

This study was unique in reviewing other review articles on general walking as well as comparing them to primary articles about dog walking. Most systematic reviews pull primary articles as a point of comparison; however, it is not unprecedented to use my approach (Saelens & Handy, 2008). Synthesizing review articles presents challenges due to the volume of studies discussed and the variety in methods used across the studies. For example, the 15 review articles cumulatively represent findings from over 500 research articles. This volume of articles is difficult to summarize, but still has immense value. Looking at reviews that have pulled features from relevant primary articles has contributed to comprehensiveness of my final list of built environment features.

Ideally the search for articles, review of articles, and extraction of features would have been completed by more than one person. However, I completed this systematic review without the use of a second reviewer. Not having a second reviewer limits the reliability of my findings. For example, the summary of key environmental correlates to walking in Table 1 would have been stronger had a second reviewer confirmed the same interpretation of each study. A second reviewer did assist with the organization of features in objective 3.

While this study attempted to capture the current knowledge around the influence of the built environment on general walking and dog walking, the primary source of articles were those readily available in full text. It is likely that other sources of information such as less retrievable

articles not pulled by the search engine would contribute to this knowledge base. It is a weakness of this study to not have exhausted every source of information, however, given the features would be reviewed again by a panel of experts in a Delphi study, the articles which I did include provided an adequate starting point.

## **CONCLUSION**

Across 15 review articles on built environment correlates to physical activity, key features were identified. Aesthetics, safety, and parks and public open space were among the most consistently identified features. When compared with articles about dog walking, aesthetics and park and open space were mutually shared features. Aesthetics features like gardens, birds, and well-maintained amenities contributed to the walking experience among general walkers and was particularly relevant for older adults. Dog owners also valued aesthetics, but a greater understanding of this criterion as it relates to dog walking is still needed.

Both sets of articles had inconsistent findings about the possible influence of parks and public open spaces on walking. In some instances, close proximity to parks was not associated with increased activity levels, whereas in other cases physical activity increased after improvements were made to park quality. Parks and public open space with dog-supportive infrastructure like litter bags and dog policy signage often made those spaces more appealing to dog owners, but did not always translate to increased dog walking. Specific age groups and underlying motivations associated with walking dogs may warrant being studied due to these inconsistencies.

Within the articles about dog walking, dog parks and off-leash areas were two of the most commonly studied but inconsistently linked features to dog walking. Results from the review studies identified positive associations between off-leash areas and physical activity, but this was

not fully supported by the primary studies on dog walking. The primary articles described dog owners as often being sedentary in dog parks and off-leash areas unless walking paths were available.

To the best of my understanding this is the first systematic review to look at correlates of general walking and dog walking together. Given that these outdoor walking spaces are typically shared, it is advantageous to identify features that appeal to different user groups, find overlap, and recognize solutions to mitigate differences.

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**Chapter Three – Coming to Consensus on Environmental Features that Support Older**

**Adult Dog Walkers: An Interdisciplinary Delphi Study**



## ABSTRACT

Well-designed outdoor environments provide opportunities to improve both physical and mental health through walking and social interactions. The challenge is designs often fall short and the spaces end up feeling generic, lack desirable features, and are not inclusive across age groups. Tailoring these spaces to meet the needs of older adults, the largest growing subset of our population, while leveraging the motivational characteristics associated with dog ownership, can help create well-designed environments particularly appealing to older adult dog walkers. To better understand what features in the outdoor environment are most important to meeting the unique needs of older adult dog walkers, panelists were recruited from urban planning and design, management of outdoor spaces, gerontology, public health, and human-animal relationships to complete a Delphi Study. The three round Delphi study was completed by 25 panelists. Seven categories of features including design goals, path design, path amenities, interaction with motorized traffic, interaction with nature, destinations, and deterrents to walking, developed through a systematic review of the literature, were presented to panelists through online surveys. A total of 25 out of 71 features achieved consensus among the panelists. Consensus on importance was defined by whether or not the interquartile range of each feature was equal to or less than the set threshold. A 100-point scale was used to determine importance of each feature. Among the features that achieved consensus, *personal safety* had the highest level of importance (*mean (M)* = 93.20, *standard deviation (SD)* = 11.54). The subsequent most important features, some desirable and some undesirable, that achieved consensus included *dog waste stations (desirable; M = 87.95, SD = 11.37)*, *unattended or unleashed dogs (undesirable; M = 84.50, SD = 23.89)*, *attractive walking spaces (desirable; M = 83.88, SD = 10.81)*, *trash cans (desirable; M = 83.55, SD = 13.50)*, and *fear of experiencing crime (undesirable; M = 83.50, SD =*

29.42). Out of these top six features, they represent the categories of design goals, path amenities, and deterrents, with each represented twice. Based on the features that achieved consensus and were considered the most important, outdoor spaces designed for older adult dog walkers need to feel safe, be aesthetically pleasing, reduce conflict with other dogs, and provide basic dog amenities like dog waste stations and trash cans. Ensuring outdoor spaces provide features for both older adults and dogs may be an effective strategy to increase walking habits for this at-risk population.

## INTRODUCTION AND BACKGROUND

Well designed, high quality public open space has the potential to improve overall quality of life and promote physical activity while also providing social and environmental benefits to the community (Carmona, 2019). Public open space includes elements of the built environment such as parks, green spaces, and walking trails (Koohsari et al., 2015; Taylor & Hochuli, 2017). On a personal level, these types of outdoor environments impact physical and mental health through activities such as exercise, viewing nature, experiencing a change of scenery, and dog walking (Carmona et al., 2004; de Bell et al., 2018). Access to high quality public open spaces also creates opportunities for social interactions and helps build a sense of community cohesion (Bornioli et al., 2018; Carmona et al., 2004; Toohey et al., 2013).

From an environmental perspective, green spaces, a type of public open space, can offer reprieve from the city landscape and allow people to get closer with nature and enjoy the surrounding greenery and wildlife (de Bell et al., 2018; Jennings & Bamkole, 2019). The benefits of green spaces like community gardens and parks extend beyond the human user and provide ecological benefits. Positive environmental impacts include reduced air pollution, moderation of temperatures, reduction of noise, and storm water filtration (Wolch et al., 2014).

While public open spaces are desirable and offer immense benefits, they are not always valued in a way that results in well planned and designed outcomes (Carmona et al., 2004). Public open spaces often lack tailored features and adequate access for certain users (Ward Thompson, 2013). These shortcomings can make the spaces less desirable and less likely to improve the quality of life for those who wish to use them (Carmona, 2019; Othman & Fadzil, 2015; Thompson, 2013).

Designing outdoor environments to meet the unique needs of specific users while still feeling inclusive to other groups is a complex design challenge. It is complex because there are many stakeholders, constraints about what existing outdoor spaces can achieve, a finite amount of money available to spend on any design project, and a lack of awareness about what the needs actually include (Leyden et al., 2017; Loukaitou-Sideris et al., 2014). While these barriers make the development of tailored outdoor environments challenging, many cities and parks have overcome them. For example in Portland, Oregon a memory garden was created for seniors to include smooth walking paths, wayfinding, and sensory experiences (Loukaitou-Sideris et al., 2014). In Finland, multigenerational playgrounds allow not only children but adults and seniors to engage in active play as well (Loukaitou-Sideris et al., 2014). Considering how outdoor environments are intended to be used and identifying the associated needs of stakeholders can make children, families, older adults, disabled individuals, those exercising, and even dog walkers more likely to interact with the space.

Older adults in particular are an at-risk user group often overlooked in the design process, yet they have the potential to benefit most from well-designed outdoor environments (Othman & Fadzil, 2015). Older adults are important to consider because they are among the most inactive age group and the largest growing subset of our population (Colby & Ortman, 2015; King & King, 2010). With increasing age, older adults experience progressively less physical activity, contributing to the high prevalence of obesity, cardiovascular disease and cancer in the United States (Green & Klein, 2011; Watson et al., 2016). Supportive outdoor environments play a vital role in reducing these risks through opportunities to walk and stay active (Giles-Corti & Donovan, 2002; Koohsari et al., 2015). Many of these benefits are negated if the environment is

not accessible, safe, appealing, well-maintained, and generally well planned to meet their changing needs.

A motivating factor toward physical activity for this group is dog walking (Toohey & Rock, 2011). Dogs serve as a conduit for physical activity through the motivation, companionship, and social support they provide to owners, if supportive infrastructure in outdoor spaces is available and accessible (Cutt et al., 2008). However, the current literature around designing outdoor environments for older adult dog walkers is unclear, unlike the literature on the walking needs of the general population (Hajna et al., 2015; McCormack & Shiell, 2011; Saelens & Handy, 2008; Salvo et al., 2018; Stewart et al., 2016). Current literature does not include the layered complexity of dog walking and relevant features of shared outdoor spaces for older adults. As a society, we need to better understand how these spaces should look and feel so the design is aligned with the motivations and needs of older adults trying to stay active.

The purpose of this study is to help develop consensus among various experts around the design of outdoor environments that can specifically benefit older adult dog walkers and develop a set of priorities that planners can use to reduce the complexity during design of outdoor spaces for walking. While city and regional planners are typically the experts that make design decisions and oversee the development of public open space like parks and walking trails, they could benefit from the insights of other experts when designing for specific user groups. Insights from experts from disciplines spanning gerontology, public health, veterinary medicine, urban planning, and management of outdoor environments could help provide an all-encompassing view of the design priorities for older adult dog walkers.

## **Research questions**

My primary research question was to determine which of 71 features identified in a systematic review of the literature on built environment correlates of general walking and dog walking achieved consensus by a panel of experts. Among the features that achieved consensus I wanted to know if they were considered important or unimportant. Consensus indicated agreement of importance and was defined by whether or not the interquartile range of each feature fell within 15% of the total point range which was 100. Consensus did not necessarily indicate importance. Secondly, I wanted to know which features were considered important but did not meet consensus and whether discipline-specific responses explained the differences. Lastly, I wanted to know which features were considered unimportant and did not meet consensus.

## **METHODS**

### **Overview**

Using the Delphi technique (Burnette et al., 2003), I conducted three iterative rounds to determine which features in the outdoor environment as it pertains to older adult dog walkers were considered important by a range of panelists. The Delphi technique is a structured way to elicit opinions from panelists about a particular topic area in an effort to reach greater consensus among the group (Burnette et al., 2003). While other methods exist to gain consensus, such as the nominal group process, the Delphi technique provides advantages such as the ability to participate from different locations, elicit input without direct pressure from peers, and allow for iterations of questioning (McMillan et al., 2016). Disadvantages to the Delphi technique are challenges in operationalizing expertise and participant fatigue with survey completion (Burnette

et al., 2003). For me, the advantages outweighed the concerns and I determined it to be the best approach to bring together diverse disciplines and opinions.

In line with the Delphi technique, panelists provided open-ended feedback and generated additional features in round one, ranked the importance of each feature in round two, and re-ranked the features based on group median in round three (McMillan et al., 2016). Data collection was completed online using Qualtrics.

The study began in December 2019 and was completed in August 2020. The study was completed during COVID-19 and therefore we allowed longer response times and increased the time between rounds. Participants were sent up to two reminder emails for each round and had the option to opt out. IRB approval (protocol number 19-421) was granted by Virginia Tech before any study activities took place. The consent form is available in Appendix C.

### **Sampling approach: Delphi study**

I used a non-probability purposive sampling technique in conjunction with snowball sampling to recruit participants to serve as expert panelists. Expertise was measured by (1) career specialty, (2) years of experience, (3) and knowledge in one or more of the following areas: urban planning and design, management of outdoor space, gerontology, public health, and human-animal relationships. Panelists included both academics and industry professionals. To be included, potential panelists needed at least 5 years of relevant work experience and knowledge about one area of interest. Panelists did not have to have expertise in the overlap of disciplines being studied. Participants were selected from a variety of sources including nonprofit organizations, universities, and government agencies. Due to the unique nature of this study and the ability to administer the study online, recruitment was not limited by region.

For a Delphi study, the panel should include no less than 15 panelists (Burnette et al., 2003); however, past Delphi studies vary in recruitment with numbers anywhere from 14 to 279 panelists (Burnette et al., 2003; Meijering et al., 2015; Olawumi et al., 2018; Pikora et al., 2003; Stewart et al., 2017). I recruited 56 participants by email to determine interest and eligibility. Email scripts are provided in Appendix D. An additional six participants were recruited via snowball sampling (Sadler et al., 2010). Of the 62 potential participants, 39 participants provided informed consent online. Two participants declined because they felt they did not have adequate expertise and 23 did not respond to the initial recruitment email. For round one, 39 participants responded, 32 completed the round two survey, and 25 completed the round three survey.

### **Data collection: Delphi study**

#### *Round one*

The goal of round one was for panelists to review, modify, and add to a list of environmental features generated from a previous systematic review I completed. First panelists answered demographic questions including area of expertise, years of education, years of experience, and whether they worked in academia or as a practitioner. Next, I presented features to the panelists across the following seven categories: design goals, path design, path amenities, destinations, interaction with motorized traffic, interaction with nature, and deterrents. These categories and corresponding features, both positive and negative, were derived from a previous systematic review completed by me in 2019. Peer-reviewed literature was searched using 16 standardized terms and the following inclusion criteria: 1) published between 2003- 2018; 2) study population of adults or older adults; 3) and included built environment features affecting general and dog walking. 357 articles were screened, and 15 systematic reviews and 20 original



studies were included. Environmental features were extracted and thematically grouped and formed the basis for the first round of data collection in this study.

Panelists decided whether the features should be kept as is, needed further clarification, or needed to be reworded. If a feature needed to be clarified or reworded, panelists provided further explanation on how they thought it should be worded or why it was confusing. Panelists also had the opportunity to add features not listed and change the titles of categories to something they thought was more appropriate. The features presented to panelists in round one are listed in the next section. A sample of survey one is provided in Appendix E.

#### *Round one categories and features*

Seven categories of features were presented to panelists in round one. Clarifications, examples, removal of redundancies, and the addition of new features based on panelist feedback in round one is presented in the section titled **Round two categories and features**.

#### *Design goals*

- access/ accessibility/ availability of destinations
- aesthetics/ attractiveness
- cleanliness
- comfort/ thermal comfort
- connectivity of routes
- convenience/ directness of routes
- diversity/ mix/ variety of destinations
- dog friendliness
- enjoyable/ pleasurable/ peaceful/ purposeful
- family friendliness
- inclusiveness of routes, streets, and destinations
- maintained/ kept amenities
- maintained/ kept paths
- personal safety

### *Path design*

- connectivity/ location of path
- entrances/ access points
- levelness/ shape/ width of path (hills/gradient, slope/incline)
- path use (pedestrian only, cycling, mixed use)
- surface type (asphalt, pavement, gravel, pebble, synthetic, earth, ground cover)

### *Path amenities*

- appropriate seating
- boundary fencing/ fencing around dog area and playgrounds
- dog policies and signage
- dog waste stations
- equipment for games/ fitness
- lighting/ street lighting
- parking
- shelter/ cover
- surveillance/ police presence
- toilets
- trash cans/ waste cans
- water fountains/ drinking areas
- way finding/ distance signage/ signage

### *Destinations*

- barbeques/ picnic areas/shelters/pavilions
- courtyards/ rooftop gardens
- dog agility equipment/ dog exercise area
- manmade water features
- monuments
- off-leash dog area/ dog park/ dog zone
- parks/public open space
- recreational facilities (sports fields, swimming pool, playing field, grassy play surface)

### *Interaction with motorized traffic*

- block length

- crosswalks/ crossings/ zebra crossings
- curb cuts/ ramps
- intersection size
- island in crossing/ raised platforms
- parking bays
- sidewalks
- stop light timing/ crosswalk
- traffic calming/ controls/ stops
- traffic/ speed/ volume
- verge width
- width of road

#### *Interaction with nature*

- birds
- community gardens
- grassy open areas/ greenspace
- landscaping (flowers, planters)
- natural vegetation (bushes, plants)
- natural water feature (waterfalls/ beach/ lake/ pond/ river/ wetlands)
- nature/nature sounds
- trees
- wildlife
- woodlands

#### *Deterrents*

- crime
- debris/ litter/ trash
- dog feces
- empty space/ crowded
- ice/ puddles/ snow
- obstacle/ obstruction/ physical barrier
- pollution (air, noise, sewer, fumes)
- privacy/ visibility

- road hazards
- strangers
- stray animals/ unattended dogs

I compiled the responses for each feature for round one to determine modifications before proceeding to round two. This was the only round in which panelists could modify the seven categories or the 81 features. For each feature, I tallied the responses to determine how many participants said the feature should be kept as is, needed further clarification, or needed to be reworded. I generated a separate list was for possible new features. For example, I added *curated nature experiences* and *viewsheds* within interactions with nature. Due to the fact that in round two, panelists could use a zero importance rating to personally delete any given feature, the research team did not delete any features in round one. However, some features were merged with others if consistent mention was made of overlaps. If panelists thought the feature was unimportant, they were asked to note this in round two. One of the most common clarifications needed was the addition of examples. For example, in design goals, *inclusiveness of route, streets, and destinations* were considered too vague and warranted modification according to 75% of the panelists. The design goal was changed to say *universal path design (e.g., welcoming to all ages, animals, abilities, and types of users)*. Panelists also found it confusing when too many synonyms were listed for a feature. For example, under path design, *levelness/shape/width of path (hills/gradient, slope/incline)* was changed to *physical path features (levelness, width, incline, and shape of path)*. Removing synonyms, giving examples, using plain language, and removing subjective meanings provided more clarity to the initial list of features in preparation for round two. While most features were modified slightly during this round, a few were unchanged, including *dog waste stations* under amenities and *pollution (e.g., air, noise, sewer, fumes)* under deterrents. Changes to features were incorporated into round two. Out of the 71

features presented to the panelists in round two, 11 features were considered new or added to the categories based on feedback in round one.

### Round two

In round two, panelists were emailed the new survey and asked to rate the importance of each feature. More specifically, I asked participants to use the slider bars to indicate how important they thought each newly modified feature was on a scale of 0-100, with 0 being less important and 100 being more important. A slider bar, as seen in Figure 1, versus numerical entry was used to reduce the cognitive load on participants scoring the 71 features across seven categories. For each feature, the group median was calculated for reference in round three. Group median was used as the point of reference because it was the primary statistic used in calculating interquartile range, the determination for consensus.

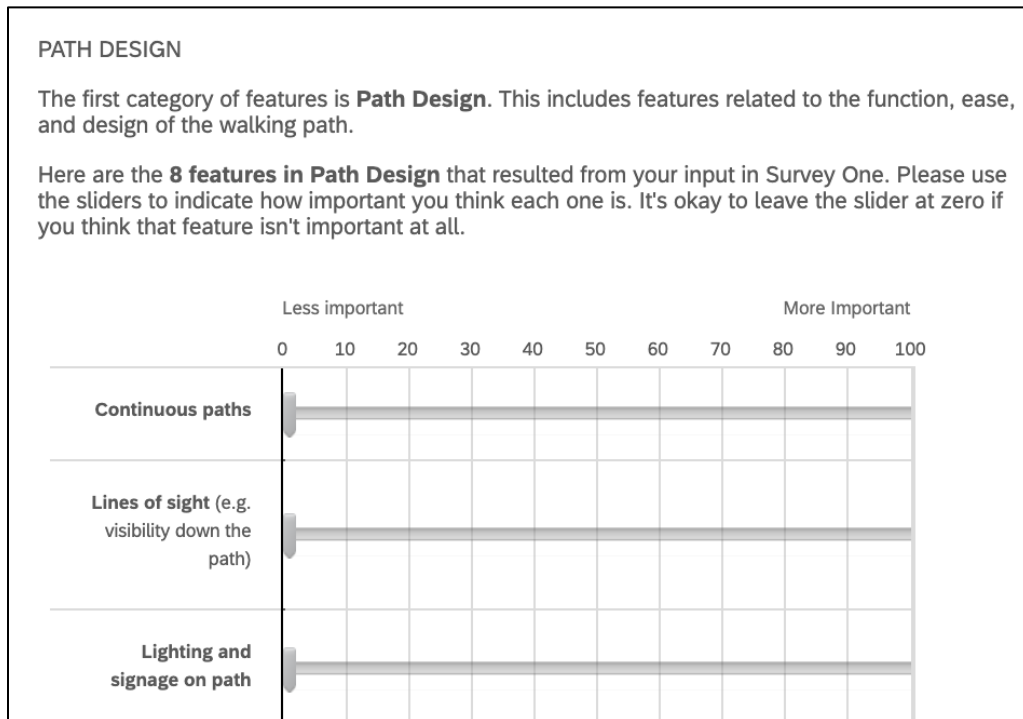


Figure 3.1. Round two survey example of feature ratings

### *Round two categories and features*

The following categories of features were revised from round one and presented in round two and three to the panelists. Descriptions of each category were added after round one and are provided below.

#### *Design goals*

Below are 11 *design goals*. Design goals are overarching and something the walking environment aims to achieve. These design goals contribute to overall user experience and may encourage use and activity among older adult dog walkers.

- access to destinations and community resources
- attractive walking space (e.g., interesting and appealing landscapes, streetscapes, and scenery)
- comfort from rain, wind, sun, heat, or cold (e.g., shade and seating)
- connected walking paths (multiple path options linked together)
- dog friendliness (e.g., allows dogs and has dog specific features like dog waste stations and play areas)
- opportunity for active and semi active transport (bus, bike, train, e-bikes, e-scooters)
- personal safety (e.g., from other people, animals, the environment, and traffic)
- types of destinations within walking distance (e.g., café, shops, and community center)
- proximity of destinations (e.g., distance to get to desired destination)
- universal path design (e.g., welcoming to different ages, animals, abilities, and type of users)
- well-maintained amenities and path (e.g., clean restrooms and lack of debris)

#### *Path design*

Below are eight features of path design. Path design included features related to function, ease, and design of the walking path.

- location of path (e.g., in relationship to residence)
- continuous paths
- lighting and signage on path
- lines of sight (e.g., visibility down the path)
- number of entrances and access points to walking path
- path designation (footpath, bike path, horse path, and shared path)
- physical path features (levelness, width, incline, and shape of path)
- surface type (paved, gravel, ground cover, or earth)

### *Path amenities*

Below are 15 path amenities. Path amenities included features the user may encounter along and around the walking area that are intended to improve the experience. Path amenities may provide comfort, convenience, safety, and enhanced enjoyment of the walking space.

- seating (e.g., comfortable benches throughout walking path and gathering spots)
- availability of refreshments or food
- available parking (e.g., ADA accessible, free, and multimodal)
- distance signage and route maps
- dog policy signage (e.g., leashed vs off-leash areas)
- dog waste stations
- fencing to separate areas of different use (e.g., playgrounds and dog parks)
- fitness equipment on the path
- lighting throughout walking areas
- public art and monuments
- safety and security features (e.g., railings and emergency call boxes)
- shelter from the weather
- trash cans and recycling bins
- water fountains for humans and dogs
- year round restrooms

### *Destinations*

Below are 9 destinations. Destinations included appealing places the user may seek out or stop at along the walk path.

- built gathering spaces (picnic areas, barbeques, and shelters)
- areas for recreation (e.g., sports and play fields, grassy play surfaces, and playgrounds)
- community resources and services (e.g., community centers, YMCAs, post office, and universities)
- dog runs and play areas separated by breed size (e.g., dog park)
- nature trails
- parks and open green space
- restaurants (coffee shops, bakeries, and outdoor cafes)
- shopping and retail (e.g., supermarkets and pet stores)
- water features for humans or dogs (ponds, rivers, beaches, and fountains)

### *Interaction with motorized traffic*

Below are 9 features associated with interactions from motorized traffic. Interactions with motorized traffic included features meant to improve safety for pedestrians in shared spaces with cars, buses, and motorcycles.

- block length between intersections
- street crossings at both intersections and mid block crossings (i.e., zebra crossings)
- curb cuts and ramps along sidewalk
- island in crossings for pedestrians
- presence of wide sidewalks
- pedestrian walk signals at crosswalks
- traffic calmings (e.g., roadway narrowing, road diets, and speed bumps)
- motorized traffic speed and volume
- border width between road and walking path



### *Interaction with nature*

Below are 8 features associated with interactions from nature. Interactions with nature included features in the natural landscape that are both manmade and natural.

- landscaping (seasonal flowers and plants)
- natural vegetation (bushes, plants, and fruit trees)
- water feature (waterfalls, beaches, ponds, and wetlands)
- nature sounds (birds, waterfalls, and leaves falling)
- Wildlife (ducks, birds, turtles, and rabbits)
- woodlands (e.g., areas with lush trees)
- viewsheds (views of mountains, valleys, and fields)
- curated nature experiences (community gardens, botanical garden, and butterfly habitat)

### *Deterrents*

Below are 11 deterrents. Deterrents included potentially negative features in the walking environment. The negative features can impact safety, convenience, ease, and enjoyment of the walk.

- fear of experiencing crime
- entry barriers (e.g., lack of public transit, too far to travel, and lack of parking)
- fear of witnessing civic disturbances (e.g., gangs and vandalism)
- ice, puddles, snow, and mud
- lack of amenities (e.g., no restrooms, seating, and lighting)
- pollution (e.g., air, noise, sewer, and fumes)
- poor maintenance (e.g., dog feces, debris, trash, and run-down facilities)
- traffic near walking area
- unattended or unleashed dogs
- uneven or poorly maintained path surface
- unwanted wildlife and plants (breeding birds, bears, skunks, mosquitos and poisonous plants)

### Round three

In the last round, the goal was to nudge panelists to meet greater consensus about the importance of each feature by comparing their responses to the group median. The survey in round three was redesigned to autofill the response of each panelist from round two. Alongside their response was the group median for each feature. Panelists were then able to decide if they wished to change their response to move closer to the median. Unlike round two, their response was provided in the form of a number entry, as seen in Figure 3.2. The reason was to allow more precise entry of their score. The slider bar, while quick, is more challenging to arrive at an exact number. For example, if a panelist selected the score of 67 in round two and wanted to keep their score, they would just enter 67. I included a free response box allowing panelists to elaborate on their responses if they felt strongly about certain features.

**PATH DESIGN**  
Below are 8 features of **path design**. This includes features related to function, ease, and design of the walking path. Our goal is to understand which path design features are most relevant to older adult dog walkers.

In survey two, you provided a score of importance from 0-100, with 0 being unimportant and 100 being very important. The group median and your score are provided below. Please indicate your new score or enter your current score if you do not wish to change.

		Please indicate your new score
<b>Continuous paths</b>		
Median	Your Score	<input type="text"/>
76	#{e://Field/Q12_7}	
<b>Lines of sight (e.g. visibility down the path)</b>		
Median	Your Score	<input type="text"/>
70	#{e://Field/Q12_6}	
<b>Lighting and signage on path</b>		
Median	Your Score	<input type="text"/>
80	#{e://Field/Q12_8}	
<b>Location of path (e.g. in relationship to residence)</b>		
Median	Your Score	<input type="text"/>
82	#{e://Field/Q12_1}	

Figure 3.2. Round three survey example of feature ratings

### *Analysis for consensus*

A variety of methods have been used and are considered acceptable when determining consensus in a Delphi study. These methods include interquartile range, subjective analysis, coefficient of variation, certain level of agreement, and mode, mean, and median rankings (Stewart et al., 2017). While there is lack of agreement on the best approach to determine consensus (Stewart et al., 2017), interquartile range is widely used in other Delphi studies and is considered a robust method (Burnette et al., 2003; Pikora et al., 2003; Ramos et al., 2016). I used interquartile range to determine consensus. Interquartile range is the difference between the upper and lower quartiles which represents the middle 50% of values (Ramos et al., 2016). A smaller range indicates higher consensus, a larger range indicates lower consensus, and an interquartile range of zero means perfect consensus. In this study, perfect consensus was neither expected nor achieved; therefore, interquartile range alone did not determine consensus. To determine consensus, I set a threshold for the interquartile range. Using this threshold, the interquartile range either fell within and consensus was achieved, or it fell outside and consensus was not achieved. Other Delphi studies using interquartile range have used a threshold of 10-20% of the overall score range (Burnette et al., 2003; Pikora et al., 2003; Ramos et al., 2016). Given the wide range of disciplines brought together in this study and the uniqueness of the topic, I set the limit to 15%, which equates to a threshold of less than or equal to 15. Features that achieved consensus were categorized as having a high degree of consensus (IQR less than or equal to 10) or a moderate degree of consensus (IQR between 11-15).

Consensus did not determine importance. Scores were between 0 and 100 and a higher median or mean indicated greater importance. In addition to mean and median, standard

deviation was calculated for all 71 features as these three statistics are key measures reported within Delphi studies (Hsu & Sandford, 2007)

To compare perceived importance among the features that achieved consensus, I compared their mean scores. I used the mean score because once features achieved consensus, statistical difference between features was calculated using the mean score and standard deviation. I used the Wilcoxon Rank Sum Test and corrected for multiple comparisons using Bonferroni correction. I used the Wilcoxon Rank Sum Test instead of a t-test because the features and categories that I used to compare means did not meet my check for normality using the Shapiro-Wilk test. I report the z-score and p-value for the Wilcoxon Rank Sum. The asterisks in the table reporting the results denote significance, adjusting for multiple comparisons using Bonferroni correction. I also compared the difference in scores based on the panelists' disciplines, for example, the mean score for a feature among public health panelists vs. gerontology panelists. To compare scores for importance between disciplines and academic vs practitioners, I used Analysis of Variance. Analysis of Variance is used to analyze the differences among group means in a sample.

#### *Panelist sample and consensus*

Of the 62 eligible panelists, 39 completed round one, 32 completed round two, and 25 panelists successfully completed all three rounds of the Delphi Study. The overall response rate was 40%. Of the 25 panelists, 11 were practitioners, 10 worked in academia, and four identified working in both. All 25 panelists reported at least six years of relevant work experience. Participants reported expertise in the following areas of discipline: 14 in human-animal relationships, 10 in gerontology, 10 in public health, five in urban planning and design, and five

in management of outdoor spaces. Selection of expertise was not mutually exclusive, meaning panelists could have knowledge across multiple areas and therefore select multiple disciplines.

After completing round two, out of the 71 features across 7 categories, 2 features achieved consensus when the interquartile range was set to 15% (from a scale of 0 to 100). In round three, 25 participants responded to the survey and out of the 71 features across 7 categories, 25 features achieved consensus. The two features that achieved consensus in round two also achieved consensus in round three. The interquartile range was set to 15%.

## RESULTS

### Features that achieved consensus

In total, 25 out of 71 features achieved consensus among the 25 panelists after three rounds of the Delphi study. At least one feature from each category is represented in Table 3.1. The category with the most features that achieved consensus was *deterrents*, which included six features. *Interaction with motorized traffic and path amenities* both include five features. *Design goals* included four features. *Path design* included three features, and *destinations* and *interaction with nature* each included one feature that achieved consensus.

*Design goals* had the highest mean based on the features that achieved consensus in the category. It also had the lowest standard deviation compared to other categories. *Design goals* was only statically greater in their perceived importance from the other categories of *path design* and *interaction with nature*. When compared to *design goals*, the mean score of other categories was not significantly different.

Table 3.1. Highest level of importance among categories based on features that achieved consensus

Category	Number of features	Number of consensus features (percent)	Mean	SD	z	p	Sig.
Design Goal	11	4 (36%)	81.92	16.22	-	-	-
Path Amenity	15	5 (33%)	80.15	17.79	106.5	0.131848	
Destination	9	1 (11%)	79.27	17.16	105	0.198520	
Deterrent	11	6 (55%)	79.15	27.79	125	0.312948	
Interaction with Motorized Traffic	9	5 (56%)	78.62	24.26	115	0.201222	
Path Design	8	3 (38%)	74.28	21.40	52	0.002947	*
Interaction with Nature	8	1 (13%)	67.77	22.32	57.5	0.004717	*

Note: Significance includes Bonferroni correction, confidence interval is 0.008

The top three most important features that achieved consensus based on mean were *personal safety*, *dog waste stations*, and *unattended or unleashed dogs*. The feature with highest level of importance was *personal safety* ( $M = 93.20$ ,  $SD = 11.54$ ) followed by *dog waste stations* ( $M = 87.95$ ,  $SD = 11.37$ ), *unattended or unleashed dogs* ( $84.50$ ,  $23.89$ ), *attractive walking spaces* ( $83.88$ ,  $10.81$ ), *trash cans* ( $83.55$ ,  $13.50$ ), and *fear of experiencing crime* ( $83.50$ ,  $29.42$ ). Out of these top six features, *design goals*, *path amenities*, and *deterrents* are all represented twice.

All of the features that achieved consensus included a high degree of perceived importance. On a 100 point scale, with 100 indicating high importance, all the features that achieved consensus scored above a mean of 66 with the highest mean score of 93.20.

Additionally, the top six most important features were derived from the previous systematic review. Four of the 11 features added by the panelists in round one met consensus and included *nature trail*, *lighting and signage on path*, *view sheds*, and *lines of sights*.

The importance of *personal safety* was not significantly different from *dog waste stations* and *unattended or unleashed dogs*, the second and third most important features that achieved

consensus. However, *personal safety* was perceived to be significantly higher in importance than 19 other features that achieved consensus. All 25 features that achieved consensus are listed in Table 3.2 and include their mean, median, and standard deviation of importance.

Table 3.2. Features that achieved consensus among 25 panelists after three Delphi rounds

<b>Category</b>	<b>Feature</b>	<b>Mean</b>	<b>Median</b>	<b>SD</b>	<b>z</b>	<b>p</b>	<b>Sig.</b>
<i>Design Goal</i>	<i>Personal safety (e.g., from people, animals, the environment, and traffic)</i>	93.20	98.0	11.54	-	-	-
Path Amenity	Dog waste stations	87.95	90.0	11.37	28	0.00231	
Deterrent	Unattended or unleashed dogs	84.50	92.0	23.89	30.5	0.00938	
<i>Design Goal</i>	<i>Attractive walking spaces (e.g., interesting and appealing landscapes, streetscapes, and scenery)</i>	83.88	84.0	10.81	31	0.00191	*
Path Amenity	Trash cans and recycling bins	83.55	85.0	13.50	10	0.00024	**
<i>Deterrent</i>	<i>Fear of experiencing crime</i>	83.50	91.5	29.42	23	0.00220	
Interaction with Motorized Traffic	Pedestrian walk signals at crosswalks	83.50	95.0	26.13	18	0.00971	
Design Goal	Universal path design (e.g., welcoming to various ages, animals, abilities, and type of users)	82.24	86.0	20.79	33.5	0.00432	
<i>Path Amenity</i>	<i>Dog policy signage (e.g., leashed vs off-leash areas)</i>	79.91	80.0	11.22	20	0.00032	**
<i>Interaction with Motorized Traffic</i>	<i>Border width (e.g., space between the road and walking path)</i>	79.59	85.0	19.01	6.5	0.00006	**
Destination	Nature trails	79.27	81.0	17.16	19	0.00080	*
<i>Interaction with Motorized Traffic</i>	<i>Curb cuts and ramps along sidewalk</i>	79.27	84.5	19.53	3	0.00009	**

Category	Feature	Mean	Median	SD	z	p	Sig.
<i>Deterrent</i>	<i>Poor maintenance (e.g., presence of dog feces, debris, trash, and rundown facilities)</i>	79.14	84.0	22.46	10.5	0.00026	**
Path Amenity	Safety and security features (e.g., railings and emergency call boxes)	78.86	85.0	26.28	4.5	0.00011	**
Path Design	Location of path (e.g., in relationship to residence)	78.46	85.5	23.72	22	0.00068	*
Deterrent	Uneven or poorly maintained path surface	78.32	85.0	25.25	15	0.00029	**
Path Design	Lighting and signage on path	77.92	80.0	19.77	4.5	0.00011	**
Interaction with Motorized Traffic	Presence of wide sidewalks	76.73	88.5	28.44	15	0.00047	*
Deterrent	Entry barriers (e.g., lack of public transit, too far to travel, and lack of parking)	75.86	90.0	30.80	15	0.00047	*
Interaction with Motorized Traffic	Island in crossings for pedestrians	74.00	85.0	28.18	3	0.00006	**
Deterrent	Fear of witnessing civic disturbances (e.g., gangs and vandalism)	73.59	86.0	34.93	13	0.00059	*
Path Amenity	Available parking (e.g., ADA accessible, free, and multimodal)	70.45	80.0	26.59	10	0.00015	**
Design Goal	Comfort from rain, wind, sun, heat, or cold (e.g., shade and seating)	68.36	75.0	21.73	1	0.00002	***
Interaction with Nature	View sheds (e.g., views of mountains, valleys, and fields)	67.77	70.0	22.32	5	0.00002	***
<i>Path Design</i>	<i>Lines of sight (e.g., visibility down the path)</i>	66.46	70.0	20.71	3	0.00003	***

Note: Significance includes Bonferroni correction, confidence interval is 0.002; features with a high consensus are indicated with italics.



### **Important features that did not meet consensus**

Out of the remaining 46 features that did not meet consensus, the top five most important features based on mean importance were *dog friendliness (design goal, M=84.32, SD= 12.22)*, *physical path features (path design, M=83.46, SD=13.28)*, *natural vegetation (interaction with nature, M=80.77, SD=20.99)*, *well-maintained amenities and paths (design goals, M=80.20, SD=22.12)*, and *surface type (path design, M=80.17, SD=15.90)*. I checked for disciplinary differences using an Analysis of Variance to see if this explained the lack of consensus. I found no statistically different score of importance, meeting the level of confidence 0.05, based on discipline.

### **Unimportant features that did not meet consensus**

Among the 18 features with a mean less than 66, none achieved consensus. The three considered least important were all within the category of path amenities, and each had a mean of 33. These included *public art and monuments (M= 33.45, SD= 25.53)*, *fitness equipment on the path (M=33.45, SD=20.98)*, and *availability of refreshments (M=33, SD= 26.25)*. *Public art and monuments* and *availability of refreshments* were two features added by the panelists in round one to the existing features pulled from the literature. Again, the discipline of panelists did not explain differences in their assigned scores of importance.

## **DISCUSSION**

### **The importance of personal safety and design goals**

The feature that achieved consensus with the highest perceived importance was *personal safety*. One possible explanation for why personal safety was ranked highest is that older adults are a vulnerable population (Milton et al., 2015). *Personal safety* for this population is a more critical concern than for other demographics because they have more trouble avoiding injuries

(Barnett et al., 2016; Wang & Lee, 2010). For example, older adults are more likely to experience loss of balance and strength, resulting in falls (Moyle & Binder, 2007). Ranking *personal safety* as an important feature also aligns with the literature. *Personal safety* was among the highest ranked environmental correlates to walking in a study by Barnett et al., (2016) and Wang & Lee, (2010). In both studies, personal safety included threats from crime and traffic, with crime being of greatest concern. The presence of dogs enhances self-perceptions of safety by feeling like crime is by deterred (Christian et al., 2016), which may lead to significantly more time walking. Dog walkers can also provide a sense of security to the community because they have “eyes” on the neighborhood and frequently surveillance activities (Christian et al., 2016).

*Personal safety* was a feature in the *design goal* category. The *design goals* that achieved consensus were collectively ranked highest among all categories and significantly higher than the path design and interactions with nature categories. One explanation for why *design goal* features were collectively perceived as more important is because *design goals* are overarching concepts. When considering creating spaces for older adults, a critical first step is setting design goals (Stanton, 2018). *Design goals* are an essential aspect to planning new walkable spaces as seen in the New Urbanist and Smart Growth design strategies (*Sustainable Street Network Principles*, 2012; *What Is Smart Growth?*, n.d.).

Two other features in the design goal category that achieved consensus and were perceived to have relatively high importance compared to other features were *attractive walking spaces* and *universal path design*. These features contributed to why the design goal category collectively was perceived as the most important. *Attractive walking spaces* are consistently a critical component in the literature correlated with walking (Salvo et al., 2018), dog walking (Cutt et al., 2008), and older adult outdoor physical activity (Michael et al., 2006; Zandieh et al.,

2016). *Universal path design* is also a fundamental concept in the design of the built environment for older adults (Carr et al., 2013). Universal design involves design of environments to serve a wide range of users without the need for adaptation (Carr et al., 2013). As it pertains to the neighborhood environment, a universally designed walking path should be accessible to a wide range of users within a population, comfortable, ecological, multi-sensory, and predictable (*ASLA Publishes Guide to Universal Design*, 2019).

Another possible reason features in the *design goals* category were collectively ranked as most important is because setting design goals are necessary not just for creating spaces for older adult dog walkers but also space for any group of people. For instance, in an initiative called Active Seattle which advocated for policies and projects to support walkability, urban planners developed central design goals around safety, equity, vibrancy, and health as part of their pedestrian master plan (Deehr & Shumann, 2009).

### **The importance of dog waste stations**

While *personal safety* was the feature that achieved consensus and ranked as the most important in this study, *dog waste stations (path amenity)* and *unattended or unleashed dogs (deterrent)* were ranked with the second and third highest mean score among all features that achieved consensus. There was also no significant difference in the mean scores of *dog waste stations (path amenity)* and *unattended or unleashed dogs (deterrent)* when compared against the mean of *personal safety*. While the focus of *personal safety* is on older adults, the focus of the second and third features, *dog waste stations* and *unattended or unleashed dogs*, incorporates the animal component. The findings suggest a need to incorporate both features for older adults and features that support the dog component. Previous review studies about the walking environment for older adults put little to no emphasis on the dog component and often overlook critical factors

like *dog waste stations* and how animals can be deterrents to others (Cauwenberg et al., 2018; Rosso et al., 2011). Cunningham & Michael (2004) do mention safety concerns from unattended dogs; however, they do not mention unleashed dogs, which are often under voice command, or suggest ways to mitigate unleashed dogs as a deterrent to other users of the space.

*Dog waste stations* are an important feature to consider when designing spaces for older adult dog walkers (Glasser, 2013; Hanson, 2013). Waste stations are necessary for long-term environmental sustainability (Mallin et al., 2000). Dog waste is a cause of environmental contaminants (Ervin et al., 2014). However, properly designed spaces for dogs, even high intensity areas like dog parks, do not necessarily contribute new contaminants to the environment (Garfield & Walker, 2008). The intensity of dogs does not correlate with contaminants (Oates et al., 2017). Proper signage, maintenance, and location of dog waste stations can effectively manage dog waste (Hanson, 2013; Oates et al., 2017). Placing *dog waste stations* at trail heads and park entrances and signage can help encourage dog walkers to properly dispose of waste (Hanson, 2013). “Hot spots” for dog feces are generally within 300 to 550 feet from parking lots (Hanson, 2013). Placing *dog waste stations* near existing trash cans, which can also accept dog waste, and recycle bins can also help encourage proper disposal behavior (Typhina & Yan, 2014). The presence of *trash cans and recycling bins* was another important feature in the results that achieved consensus.

Other important features may compliment *dog waste stations*. For example, *attractive walking spaces* (the fourth ranked feature for importance) using landscapes, streetscapes, and scenery can help control the impacts of dog waste on stormwater (Blackshaw & Marriott, 1995). The lack of dog waste stations can lead to an increase in fecal matter (Hanson, 2013). This known deterrent was another feature identified in the results.

While the installation of *dog waste stations* is an important feature, it can also present new challenges. For example, the plastic bags provided at these waste stations pose a secondary environmental hazard (Oates et al., 2017). In a prior study, dog walkers were observed leaving these plastic poop bags along the walking path (Oates et al., 2017). The color of bags may contribute to the lack of proper disposal. Bright colored bags like pink or red may help promote intended disposal behavior more than green bags that blend in with natural surroundings (Oates et al., 2017). Another factor contributing to dog walkers using *dog waste stations* is social pressures (Blenderman et al., 2018; Christian et al., 2017; Ebinger, 2019). Social interaction and programs that promote cleaning up after each other can increase the use of *dog waste stations* (Jason & Zolik, 1981; Jones & Lowry, 2004). The design of walking spaces can contribute to these social interactions, for example, through path design. *Wide sidewalks* are another feature that achieved consensus and can accommodate groups of people or a place to stop and gather without hindering others.

Dog walkers that understand the environmental impacts of dog waste are more likely to dispose of dog waste (Ebinger, 2019; Jason et al., 1980). Informational signs around dog waste stations explaining the environmental impact of dog feces on the environment may help dog waste stations to be more effective. The use of *signs* was another feature that achieved consensus as an important feature. *Signs* can serve multiple purposes: for example, signs can be used to link walking paths to smaller parks (Giles-Corti et al., 2005) and to nudge walkers to dispose of dog waste. Both features were identified as important and achieved consensus among the panelists in this study.

Another approach for *dog waste stations* are unique programs like the Park Spark in Cambridge, Massachusetts. This program not only provides *dog waste stations*, but also the

waste stations feed into a methane digester which converts dog waste into a usable energy form that powers lighting (Mazzotta, 2010). Such creative programs help provide multiple features that the results suggest are important. For instance, not only are *dog waste stations* provided along with information about the conversion of energy (information about the environmental impact), but also lighting is produced as a by-product, which was another important feature to encourage walking. Proper *path lighting* was one of the features that achieved consensus in the results. Proper *lighting* is also a critical component to mitigating *fear of experiencing crime*, which is another important feature identified as meeting consensus within *deterrents* (Boyce, 2019; Painter, 1996).

The presence of law enforcement can help reduce the *fear of experiencing crime* (Zhao et al., 2002). The use of law enforcement is also a recommended approach to enforce proper dog waste disposal (Hanson, 2013; Typhina & Yan, 2014), e.g., fining non-compliant dog owners (Oates et al., 2017). However, this approach does not always change behavior (Swann, 1999).

### **Unattended or unleashed dogs as deterrents**

On their face, the second most important feature that achieved consensus, *dog waste stations*, and the third feature, *unattended or unleashed dogs*, seem independent from each other. But similar to how *dog waste stations* are related to other important features that achieved consensus such as *deterrents* about *fecal matter*, *use of signage*, and even *lighting*, *dog waste stations* and *unattended or unleashed dogs* offer complementary design opportunities for promoting walking among older adults with dogs. For instance, the behavior of properly disposing of dog waste is higher among dog owners with dogs on-leash compared to dog walkers with dogs off-leash (Blenderman et al., 2018).

Off-leash dog areas can help promote physical health among their owners by impacting the frequency of dog walking (G. R. McCormack et al., 2011; Rahim et al., 2018), but can also act as a deterrent for walkers without dogs (Vaske & Donnelly, 2007) and in some instances can actually slow the walking speeds of dog owners (Christian et al., 2013). Off-leashed dog spaces can be controversial (Walsh, 2011). For instance, nearly three-quarters of people in one study experienced some form of conflict with off-leashed dogs or their guardians (Vaske & Donnelly, 2007). Some of the conflict noted in this report reflected purely perceptions of potential conflict (around 15%) rather than actual conflict (Vaske & Donnelly, 2007). Other studies provide corroborating evidence, suggesting the majority of the concern is for the potential for a problem, rather than an actual problem or conflict occurring (Rahim et al., 2018). In addition, dog owners and non-dog owners tend to believe that people are more disruptive to the environment than dogs (Bekoff & Meaney, 1997), stating, “people are more problematic than unruly dogs” (Bekoff & Meaney, 1997).

The design of spaces can help reduce the perception of potential conflict and mitigate the perception of unleashed dogs as a deterrent. For example, *dog policy signage (e.g., leashed vs. off-leash areas)* is critical (Rahim et al., 2018), which aligns with the findings of this study that such signage is a feature that both achieved consensus and ranked as important. *Lines of sight (e.g., visibility down the path)* can also be used to create opportunities for voice and sight commands of unleashed dogs. *Lines of sight* is another feature in the results that achieved consensus and ranked as important.

*Nature trails*, another important feature that achieved consensus in the results, can be helpful in mitigating the negative effects of unleashed dogs. For instance, unleashed dogs pay significantly more attention to their owners when in green spaces than in city centers (Mongillo

et al., 2014). The value of nature resonates with both dog walkers in general (Richards et al., 2013), and older adults in particular (Gagliardi & Piccinini, 2019). *Nature trails* are also more likely to be visited by dog walkers compared to more urban places such as shopping areas (Christian et al., 2009). Dog walkers prefer *nature trails* because they perceive these spaces as more appropriate for their dogs and receive enjoyment watching their dogs be in green environments (Westgarth et al., 2020).

The use of fences and other man-made barriers are strategies to designate on and off-leash spaces (Lee et al., 2009; Rock et al., 2016). The construction of off-leash spaces is an opportunity to build-in amenities that meet another important feature identified in the results: providing *comfort from rain, wind, sun, heat, or cold (e.g., shade and seating)*. This feature is often discussed with respect to the construction of benches and shelters (Glasser, 2013; Lee et al., 2009) at dog parks (Glasser, 2013). Dog parks, however, do not offer the same benefits of walking paths and trails (Evenson et al., 2016).

Specifically related to walking spaces, off-leash dog spaces are controversial (e.g., Rock et al., 2016). The lack of off-leash spaces can lead to dog walkers ignoring leash laws (Krohe, 2005). Off-leash spaces can contribute to dogs' well-being and should not necessarily be dismissed because they may be a deterrent to other users of the public spaces of which they are a part (Bekoff & Meaney, 1997). Finding design solutions that balance the needs of walkers both with and without dogs and that afford opportunities for dogs both on- and off-leash without deterring others is a design challenge (Rock et al., 2016).

One approach to mitigate off-leash dog spaces as a deterrent is through building community support around policies (Rock et al., 2016). Engaging users in developing and enforcing rules is necessary. For instance, in one study over three-quarters of the respondents



believed that “it is OK for a visitor to say something to a dog owner who does not have his or her dog under control” (Vaske & Donnelly, 2007). Dog owners are also more likely to leash their dogs when they believed other people expected dogs to be leashed than when they believe their dog was a threat to wildlife or people (Williams et al., 2009). Improved compliance may be achieved through community-based approaches to foster social norms for dog control (Williams et al., 2009).

Several other features categorized as *deterrents* also achieved consensus, including *poor maintenance* (e.g., presence of dog feces, debris, trash, and rundown facilities), *fear of witnessing civic disturbances* (e.g., gangs and vandalism), and *entry barriers* (e.g., lack of public transit, too far to travel, and lack of parking). These features should also not be overlooked in the design of spaces and may offer additional complementary design approaches. For example, when designed appropriately, off-leash areas can also reduce barriers to entry. Dog walkers are willing to drive further to trails and paths with appropriately designed off-leash dog areas (Westgarth et al., 2020). The availability and accessibility of maintained spaces for dogs and the provision of maintained dog-related infrastructure are important environmental factors that affect whether owners walk with their dog (Cutt et al., 2008).

### **Interaction with motorized traffic**

The category with the highest percent of features that achieved consensus was *interactions with motorized traffic*. Motorized traffic is a common concern among dog walkers. For example, in a previous study, a dog walker expressed, “walking around here, it’s horrible, isn’t it? You can’t talk to each other, you’ve got traffic everywhere...”(Westgarth et al., 2020). Similarly, some dogs are instinctively drawn to chase or lunge at cars, making close contact with motorized vehicles problematic while walking (Lowrey, 2019). In this Delphi study, I found that *border width* (the physical distance between motorized vehicles and older adult dog walkers) is

an important feature; so too are *wide sidewalks*, *pedestrian walk signals*, and *island crossings* for pedestrians. Integrating these features into street design is critical to keeping older adults safe (*Dangerous by Design 2019*, 2019).

*Border width*, the presence of *wide sidewalks*, and *islands in crossings* for pedestrians are not just important features for older adult dog walkers but for any walkable community (Christian et al., 2009; Duany et al., 2000; Owen et al., 2007). These are components of complete streets (McCann & Rynne, 2010; Schlossberg et al., 2013; Speck, 2012). Complete streets provide numerous benefits (Schlossberg et al., 2013). For instance, they not only help promote older adult dog walkers but are also a tool to combat threats like climate change (Masson-Delmotte et al., 2018; Walker, 2020). Fewer vehicles, and more prioritization given to pedestrians, means more diversity in people walking and cycling (*A Global High Shift Cycling Scenario*, 2015).

In other words, the importance of these features about interaction with motorized vehicles goes beyond just older adults and extends to the population at large. The numerous features (more than half) that achieved consensus in the study are evidence for their support among planners, public health professionals, gerontologists, and those who study human-animal relationships. Demand for larger *border widths*, the presence of *wide sidewalks*, and *islands in crossings* for pedestrians is not only being driven by sectors concerned with environmental sustainability, associated with traffic congestion, pollution, and urban sprawl (Bridges, 2014), but public health panelists (Haskins, 2018), and senior advocate groups (Lynott et al., 2009). The presence of dogs is an indicator for walkability (Walljasper & Spaces, 2007). Walljasper explains, “When you create a neighborhood that's friendly to dogs, it's friendly to people, too.

The traffic is not speeding and dangerous. There are green places to hang out and walk. So, dogs are a good indicator species.” (Dahl, 2007).

Many of the features identified in this study are not mutually exclusive. They offer complementary benefits in design. For instance, dogs are a large contributor to whether people walk (Sehatazadeh et al., 2011) and improving how walkers interact with motor vehicles can increase the presence of dogs (Walljasper & Spaces, 2007). Considering these features important for older adult dog walkers can lead to improved designs.

### **Limitations**

The study was carried out and completed during the COVID-19 pandemic. This may have impacted response rates, participant retention, and recall between surveys. Conducting research during a global pandemic is unprecedented and I was sensitive to circumstances by allowing more time between rounds than intended. While COVID-19 potentially introduced unmeasurable impacts, the study maintained an overall response rate of 40%.

Round one allowed participants to provide qualitative feedback about potentially important features gathered from the literature. While rich information was collected and integrated into round two, not all comments and suggestions could be fully represented. Participants were asked if features should be clarified, changed, or added but not removed to help mitigate the challenge of one person wanting a feature removed. Other Delphi studies have successfully included qualitative data in the first round like this study (Burnette et al., 2003; Meijering et al., 2015; Pikora et al., 2003). The value of bringing heightened clarity to the features and ensuring all potentially relevant features were represented in round two and three outweighed the limitations of including qualitative feedback.

A further limitation of this study was in the recruitment of participants. The research team represented the multiple disciplines the study intended to reach and therefore generated a list of potential participants, versus an open call for recruitment. Because of prior relationships with and/or knowledge of the research team member, potential panelists may have felt more compelled to participate. To minimize this limitation, snowball sampling was used to recruit others where possible.

## CONCLUSION

While there were 25 features that achieved consensus, some were more important than others. For instance, *personal safety* was significantly more important than *dog policy signage* (path amenity) and *lines of sight* (path design). These features, with varied levels of importance, are also not mutually exclusive. They complement one another and can serve multiple purposes. For example, the deterrent of *unleashed dogs*, which was among the top three features to meet consensus, can be mitigated through *dog policy signage* and improved *lines of sight* and thus improve the perception of *personal safety*. The features related to motorized traffic such as *wide sidewalks*, *pedestrian walk signals*, and *border width* can help meet sustainable development goals and incorporate into large planning initiatives like complete streets, smart growth, and new urbanism.

When considering changes to an existing walking space or in the development of new ones, the dog should not be an afterthought as seen in this study. Panelists agreed on the importance of dog specific features and deterrents including *dog waste stations* and *unattended and unleashed dogs* and saw them as critical elements to consider in walking environments. Dog specific infrastructure not only provides added conveniences and appeal for dog owners but helps to mitigate common nuisances such as dog waste for other users.

To the best of my understanding this is the first paper to bring together these distinct fields of study: urban planning and design, management of outdoor spaces, gerontology, public health, and human-animal relationships. I prioritized features for older adult dog walkers. Bringing these divergent fields together for a population that is underserved and increasing in size as America ages may provide more targeted design solutions when creating outdoor walking spaces intended for older adults and dogs, a growing segment of our population.

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**Chapter Four – Motivations Behind Walking the Dog for Older Adults: Insights from  
Guided Walks and Interviews**

## ABSTRACT

Older adults are the largest growing subset of the population in the United States. With increasing age, physical activity levels tend to decline, contributing to the high prevalence of obesity, cardiovascular disease and cancer in the United States. Older adults are also more likely to experience decline in social interactions and loss of community connectivity. Companionship from dogs can help mitigate the feelings of isolation and provide motivation to stay physically active given appropriate spaces are available to walk the dog. Outdoor environments that align with the needs, desires and abilities of older adults and their dogs can encourage and help sustain walking habits while also giving opportunities to socialize. To better understand how environmental characteristics influence and motivate dog walking among older adults, individual photographs were taken during walks with 12 older adult participants and their dogs when walking in their typical neighborhood. Using the Photovoice approach, the photographs from their walks were presented during in-person interviews to facilitate a discussion about features they thought were both positive and negative in their walking environment. The 12 participants were all over the age of 70 and lived in a planned senior living community. Using Nvivo software and thematic coding techniques, key environmental features were identified as important to dog walkers over 70 years of age in this study population. Interaction with nature including views of farmland, wildlife, and lush trees played an important role in providing older adults in this study with enjoyment and motivation to walk each day. The older adult participants had different preferences for the type of walking path and valued the available choices from unpaved dirt paths to paved asphalt paths to meet their desired level of challenge. Dog specific amenities like dog waste stations were universally desired among the sampled population. These stations were described as adding convenience to their walk. Opportunities to socialize with

neighbors and other dog walkers were also important. Safety from tripping, falling, other animals, and motorized traffic was a concern, but not of concern enough to prevent them from walking their dog. Access to different types of path surfaces and the underlying need to walk their dog played into their resilience to walk in a variety of conditions and through perceived safety concerns. The findings of this study suggest that walking environments intended for older adults with dogs need to provide experiences with nature, varying levels of challenge, and dog specific amenities to maximize fulfillment and use by this population.

## INTRODUCTION AND BACKGROUND

The proportion of the U.S. population subject to chronic disease is growing. By 2060, the number of Americans aged 65 or older is expected to reach 98 million, a nearly two-fold increase from 2014 estimates (Colby & Ortman, 2015). Older adults are among the most inactive demographic in our population (King & King, 2010). With increasing age, older adults experience progressively more physical inactivity, contributing to the high prevalence of obesity, cardiovascular disease and cancer in the United States (Green & Klein, 2011; Watson et al., 2016). The cost of physical inactivity is seen in economic expenditures, declines in quality of life, and global mortality (King & King, 2010). To further complicate the issue of inactivity, 40% of adults over 65 report having a disability (Kerr et al., 2012).

In older adults, chronic diseases can be delayed, prevented, and managed more successfully while improving overall quality of life through maintained physical activity. Little is linked to healthful aging as strongly as physical activity (Michael et al., 2006).

While an association between health and place is established through research evidence, the design of built environments to promote active aging of older adults is still lacking (Kerr et al., 2012). The built environment, which includes the physical aspect of where we live and work, can either promote or deter active aging by way of the features and experiences it provides or lacks (Saelens & Handy, 2008). Active aging refers to the ability and desire of older adults to incorporate physical activity, such as walking for exercise and pleasure, into their daily life, while also remaining socially engaged (Michael et al., 2006). With one in five Americans projected to be 65 years of age or older by 2030, there is a need to understand the role of neighborhood design in addressing the unique needs faced by this growing population and while also leveraging what motivates them to walk (Kerr et al., 2012).



Historical design practices have led to largely car dependent communities with little consideration for the promotion of wellness and walkability (Kerr et al., 2012). Older adults, especially those with disabilities, are vulnerable to community environments that hinder activity associated with healthy aging (Kochtitzky et al., 2011). Older adults' perceptions of their built environment as well as access to amenities influence both their ability to stay active and car dependence (Michael et al., 2006). Mounting evidence suggests that neighborhood design with high residential density, mixed land use, short block lengths, and grid streets patterns are associated with more walking than sprawling neighborhoods lacking these features (Michael et al., 2006; Saelens et al., 2003). Additional benefits of walkable neighborhoods include higher levels of community cohesion and sense of community (Toohey et al., 2013). Given the association between the built environment and physical activity (Clark & Scott, 2016) and the influential role of neighborhoods on healthy aging (Toohey et al., 2013), neighborhoods and parks designed with supportive features for active aging may pose a solution to the growing number of inactive older adults.

Correlates of active aging not only include physical and social environmental factors, but also may include human-animal relationships, specifically relationships with dogs (Toohey & Rock, 2011). Dog owners are not only more likely to meet physical activity guidelines via dog walking as compared to non-dog owners, but they are also at a decreased risk of cardiovascular disease and mortality (Kramer et al., 2019). Dogs can serve as a conduit to physical activity through the motivation, companionship, and social support they provide to their owners (Cutt et al., 2008). Additionally, dogs are bonding animals and may serve as an effective social bridge for older adults, thus reducing social isolation (Branson et al., 2017). Promotion of dog walking may be a powerful tool toward active aging, given its link to physical activity and social engagement;

however, neighborhood outdoor spaces are not necessarily inclusive of the needs of both older adults and animal users. Dog walkers require supportive infrastructure, just like general walkers (Cutt et al., 2008). Examples of supportive infrastructure include access to water and exercise areas (Sugiyama et al., 2015).

The challenge is trying to figure out what inclusive outdoor spaces should look like while also leveraging motivational aspects of dog walking. There is a complexity between the neighborhood environment, dog ownership, physical activity, and social interaction (Toohey et al., 2013). The intersection of these multiple elements may lead to better health promotion for older adults, but the evidence is not comprehensive. In this study we aimed to address these challenges to facilitate more targeted design solutions by exploring features in the built environment that influence dog walking among dog-owners 65 years of age or older.

The following research questions addressed in the research presented in this paper are:

- (1) what neighborhood design features motivate older adults to sustain walks with their dog and
- (2) how do deterrents and challenges in the neighborhood environment impact walking for this population?

## **METHODS**

Through one-on-one interviews, I elicited the opinion of older adult dog walkers living in a planned senior living community. A qualitative approach called Photovoice was utilized to capture older adult dog walkers' perceptions, both positive and negative, of their neighborhood walking environment. The purpose of Photovoice is to allow visualizations of individual perceptions (Nykiforuk et al., 2011) and story development to be described through photographs (Ronzi et al., 2016). The combination of interviews and the Photovoice approach allows for more organic and less biased feedback from stakeholders, whereas a survey approach may limit the

feedback and richness of responses. This approach produced rich data on perceptions of the older adult dog walkers. Similar approaches include photo elicitation, where interviews are guided by photos; however, in photo elicitation the photos are usually provided by the researcher and used merely as a guide (Harper, 2002), whereas in Photovoice, they are collected during actual stakeholder experiences. The photographed walks and interviews were approved by Virginia Tech's Institutional Review Board. The consent form is available in Appendix F.

### **Recruitment**

The primary recruitment site was a multilevel senior living community called Warm Hearth Village. Warm Hearth Village had an established partnership with Virginia Tech, making both staff and residents more comfortable with my research project. Warm Hearth Village is in Blacksburg, VA and has over 400 residents from active living to assisted living as well as an extensive walking path system. We recruited participants from residents in both active and independent living. We held three in-person recruitment sessions at the Village Center, a common gathering spot at Warm Hearth Village. The recruitment sessions provided information to potential participants and acted as an enrollment session with interested residents. Staff also posted flyers throughout the Warm Hearth community. Recruitment information is available in Appendix G.

We invited residents 65 years of age or older who owned a dog to participate in a guided walk at Warm Hearth. The guided walk was followed by an in-person interview. Residents who met inclusion criteria and wished to participate provided written informed consent, then answered a series of short surveys including demographic information (available in Appendix I), a 12-item short-form health survey, and a self-efficacy walking survey (McAuley et al., 2000; Ware et al., 1996).

## **Participants**

We enrolled a total of 12 participants who were 70 years of age or older. Six were female, four were male, and two were husband and wife couples. Participants lived in either the active or independent living neighborhoods of the planned community. Participants were Caucasian and all but one held at least a bachelor's degree. Seven held post graduate degrees. All participants were able to walk their dog on leash and walk unassisted. All but one reported no significant or chronic health issues.

## **Guided Walks**

Walks took place on site in Warm Hearth Village. Participants selected the walking route and length of the walk. The length of walks varied by participants with short walks lasting 20 minutes and long walks lasting 45 minutes. Spouses or friends were invited to join the walk if they wished. Residents at Warm Hearth walk their dog on a leash due to leashing policies, so it was potentially unsafe to have them also take photos at the same time as holding the leash. To alleviate this challenge, an assistant accompanied each walk. I walked alongside the participant and the dog and gave prompts to facilitate conversation about the walking environment, while the assistant took photographs of features in the environment that participants noted or described. Examples of photographs are provided in the Results section as well as Appendix J. Prompts included questions about safety, dog friendliness, aesthetics, connectivity of routes, choice of routes, traffic, visual interest, enjoyment, comfort, and conveniences. The assistant mainly listened to the conversation versus engaging in questions during the walk. The assistant tried to avoid taking photos of features not discussed by participants in an effort to not interject information into the interviews. The goal was to keep the photographs as close as possible to what the walkers might take on their own. Walks took place from October 2019-December 2019.

## Interviews

I conducted interviews within one to two weeks of the walks. Depending on the length of the walk, I selected 15-30 photos for the interview. Photos were loaded onto an iPad for the interview. Interviews were held at the time and location chosen by the participant, either at the Village Center or at the participant's home. While I conducted and lead all the interviews, another researcher assistant skilled in qualitative research accompanied me on the first three interview session to provide feedback and ensure consistent procedures. I recorded the interview for later transcription. Interviews lasted between 15 and 45 minutes depending on how much the participant wanted to share. Participants sat with the iPad and talked about the general environment shown in the photographs as well as specific features they liked and disliked either for them or their dog. I encouraged participants to talk first without any prompts besides the picture. Before recording began, I reminded participants about the design goals I was interested in such as dog friendliness, personal safety, aesthetics, and connectivity of the walking paths to help guide the conversation. Design goals were based of the organization of features developed in a previous systematic review presented in Chapter two and can be reviewed in Appendix H. Once participants finished speaking, I provided additional question prompts which can be reviewed in Appendix H to facilitate further discussion of the photos and focus on certain features mentioned on the walk. The investigator provided clarification for audio purposes when the participant did not specifically reference the feature. For example, the participant might have said, "Oh I remember that, that was such an eye sore" without saying what the feature was specifically. This type of statement would have posed a challenge during the coding of the transcript. After the interviews, participants were given a \$10 gift card for their time. Twelve residents in total were enrolled and 12 walks and interviews were completed. Of the 12

participants, two were couples. The couples both joined on the walk and contributed to the interview session.

## **Analysis**

Interviews were transcribed using a program called Nvivo. While the program accurately captured a large part of the interviews, all 12 transcripts still had errors. The transcriptions were cleaned for errors and clarity prior to coding.

A priori codes were identified before coding began. The coding scheme was developed from a previous study presented in Chapter three that prioritized features in the walking environment for older adult dog walkers. The transcribed interviews were coded independently by two investigators using these a priori codes. One additional emergent code was developed in the area of social interaction during the coding process. We developed code rules to provide a higher level of detail about how to code certain interview content. The investigators then reviewed the coded transcriptions for all the interviews together to identify areas of congruence or disagreement. If disagreement did occur, the investigators explained the rationale behind their chosen code, and together selected the best code or dual codes before moving forward. Next, all the responses were grouped by codes. These codes became the primary categories. Within each of the categories, specific themes emerged. The most salient responses for each theme were identified and used in the findings section.

The findings are organized around eight categories of features known to influence general walking and walking with a dog in the built environment. The data is grouped in the categories: interactions with nature, path design, natural deterrents, interaction with motorized traffic, path amenities, social interaction, destinations, and design goals. Seven of the categories were identified through a previous Delphi study that I completed in 2020, which examined built

environment priorities for older adult dog walkers. An eighth category of social interaction emerged from the interviews. Pseudonyms are used throughout this paper to maintain the confidentiality of the participants.

## **FINDINGS**

### **Interactions with nature**

The experience of being in nature was the most widely discussed topic across all participants. Nature provided immense benefit to all participants and was one of the most enjoyable aspects of their walk. There was widespread agreement about the positive benefits of nature and the role it played in their daily walks. Participants were both satisfied and fulfilled by being in nature. The primary themes that emerged from the interviews included change in seasons, viewing wildlife, views of nature, variety in how you experience nature, and sense of solace and contentment from being in nature. These themes are described below.

#### *Change in seasons*

Participants were captivated with the change in seasons, specifically Fall. While seasons and the presence of nature are location specific, it was one of the features that motivated them to walk each day. A participant, Drew, confessed, “Well, you can amuse yourself because it’s such fun watching the seasons come in the woods and the various changes. It’s delightful. Each season has its own unique characteristics.” Each day they experienced a small change and watched for the leaves to turn and fall. For another participant, Bonnie, the thing that stood out most in the environment was the “beautiful color.” She said, “We have so many nice trees. It’s outdoors. I really love being outdoors.” Nature was “not a sterile environment at all” according to Lily. As seen in Figure 4.1, she walked along and saw the burning bushes turn red, the leaves

change, and looked back on it and described it as “beauty”. The enjoyment of seeing the season change to Fall then to Winter was abundant. Many said they “just loved” this aspect of nature.



Figure 4.1. Burning bushes in bloom along main road

#### *Viewing wildlife and animals*

Wildlife and animals from surrounding farmland played a significant role in the interest and enjoyment of the participants’ walks. They looked forward to seeing wildlife and animal in their natural habitat, especially the cattle as seen in Figure 4.2 and deer. Lily said, “Well, it’s fun. You know, you look to do your pacing and you say, OK, I can make it through because the cows are next. Now, it’s deer. Usually deer are down there.”

Dogs also enjoyed the cattle according to Beth.

My dog Boomer really likes this particular part of our walk because this is the Virginia Tech cattle over here on the right. And he is so interested in them. He doesn’t bark or anything. He just is interested in them.



Participants enjoyed seeing the impact wildlife had on nature. Drew noticed the height of the grass in the cow pastures and Mark pointed out the tracks left in the mud by deer. Like Alice, who always looked for bears but never saw them, it was exciting searching for traces of wildlife.



Figure 4.2. Views from walking trail of Virginia Tech farmland with cattle

### *Views of nature*

Along the walks, participants not only watched for changing colors and wildlife, but they also soaked in the views of nature. Sarah enthusiastically said, “Oh geez, what’s not to like, beautiful weather, scenery and the beautiful trees. The view up here is gorgeous, you should see it in the evenings or mornings, just gorgeous”. Enjoyment from seeing the trees was a recurring theme. Like Sarah, participants often spoke about how much they loved the “beautiful” trees and nature. They watched the trees day after day become bare as an indication of Winter coming. Beth was among participants who enjoyed the views and described how much her dog enjoyed the scenery and setting:

Yes, I'm very much an outdoors person. And that's why I enjoy my dog so much, I think. And he's definitely an outdoor dog you can tell. He's a hound. OK. This would be some of the view of the Virginia Tech farm, and I wouldn't be surprised that maybe he's stopped here and he looks and I don't know if it's just the cattle that he's interested in. He also likes to look at the big trucks [in the distance].

Participants appreciated so many different types of views offered by nature on the walk. They enjoyed the variety offered in the landscape including the exotic plants, flora, fauna, and edible plants. Drew summed up the feeling, "They've done a nice job here of creating some walkways for we older folk. It's all pretty. It's easy walking, really".

#### *Variety in how you experience nature*

Participants enjoyed getting to choose where and how they interacted with nature. The three main types of walking areas included neighborhood sidewalks, paved nature trails, and unpaved wooded trails. While participants had different preferences for where they walked (wooded path vs. paved path), they all felt they were getting the right amount of immersion in nature. Beth's preference was walking in the woods:

This is a type of path that I enjoy because there isn't any sign of anything being close to us. I mean, we're in the woods really surrounded by the woods and this tree has just fallen. It wasn't there the time that I had walked before.

Drew echoed the desire to be surrounded by the woods: "This is an area where I think I mentioned to you further on when the trees actually arch over the path and when they're in full leaf, it's like walking in a tunnel." For those like Mark who sometimes preferred walking on the paved path, they still felt they could experience nature to the fullest. "Even if you don't go out into the woods, you're in the woods here on the trails." A few actually thought the woods had too

many disadvantages, but happily selected the shaded paved paths instead. These options kept their walks from being “boring”.

### *Sense of solace and contentment*

Nature was more than a place to walk and get exercise: it was somewhere participants and their dogs could go to recharge and renew. The natural environment provided them a sense of calm, peace, and opportunity for reflection. They enjoyed getting away from the typical hustle of everyday life. Deena described the feeling of getting out into the woods:

You know, it’s funny, I’m not sure why maybe I feel more like I’m hiking instead of just walking. You know, we spend so much time in our lives in paved areas that it’s nice to be away from some of that and just see how things used to be.

The natural setting was described as “peaceful” and “quiet” by numerous participants. Virginia said, “You know, it’s not cut down to where you know it’s just straight lines, it’s dimensional” and for her this created a peaceful feeling. Drew thought it was peaceful because the dog was content and just roamed the woods:

The dog has a world of his own to explore. I can be out of the picture on the long leash. And typically, the dog, I find on the paved areas the dog is out at the end of the leash pulling, going to get to the next smell. But in the woods, that’s much less common. He’s more often wandering.

Many participants like Drew talked about how the calm and contentment they felt in nature extended to their dog and they enjoyed this very much.

### **Path design**

As with the aspect of solace, nature impacted participants throughout the entire walk as did the design of the walking path. Participants were keenly aware of the surface on which they

chose to walk, the ease of transitioning on and off the walking paths, safety crossing the road, and the sufficiency of lighting. The primary themes that emerged within path design included surface type, accessible transitions, cross walks, and lighting.

### *Surface type*

The Warm Hearth community is made up of neighborhood sidewalks, paved walking trails, and wooded earth covered trails. Throughout the 12 walks, we experienced all the types of trails available. Congruent with the design goals of variety, participants appreciated having choices in the types of path. Deena emphasized, “You have your choice of so many different pathways that if you’re not comfortable walking longer distances or something, that’s a little less level, you don’t have to do it.”

Participants liked different types of walking surfaces. Bonnie’s preference exemplifies why many chose natural surfaces like in Figure 4.3: “I prefer the unpaved because, let’s say if you fell down there, you’re less likely to get hurt.” The desire to walk on a natural surface was echoed by half the participants. They often specified the type of natural covering they liked best. For example, Virginia “prefers the hard pan soil rather than the concrete,” and Mark’s “preference would be like a woodchip kind of a trail through the woods. That would be ideal. Soft on the little feet and soft. Because we’ve had people fall.”



Figure 4.3. Hard packed dirt walking trail in the wood

Some, however, favored a manmade surface such as a concrete sidewalk or a paved asphalt nature trail. Sarah talked about the path that went from her neighborhood to the Village Center as a “nice paved asphalt path that goes through the woods.”

#### *Accessible transitions*

In the active living neighborhood of Warm Hearth, the single-family homes have driveways. The driveways were initially built with a large transitioning bump from the road to the driveway. Later, the majority of the transitions were modified at the owners’ expense to improve accessibility, a concern for almost all participants who walked in the neighborhood. Sarah emphasized,

Oh, and we’re enjoying the new level driveway, so it’s much nicer when you pull your car in and you don’t get the bump, bump, bump, bump that we had before and it’s much safer. We were concerned as we get older so and someone may be on crutches or on a walker or even in a wheelchair. They would not be able to access

her own driveway. I mean, they can, but it's much easier and it's much safer when you step off to go to your mailbox that you don't have to step down. So, we're in a process of trying to convince everyone in the neighborhood to do it.

Participants wanted a seamless transition when walking from the street up to the sidewalk; driveways were one point of access. The poor transition of the driveways was a safety concern and an annoyance. Jack explained, "Not only are you driving on it, that's where you often will walk on and off the sidewalk." Along with many others, Jack was happy to see that, "over the summer, 41 of the 55 [driveways] have changed that and took the curb out, and so now it is nice and gradual."

Curb cuts were also a point of access. Participants wanted curb cuts to avoid stepping on and off the curbs similar to the driveway transitions. Deena explained,

Here's where I wish we had a curb cut across because I end up going out someone's driveway and walking in the street.... Or if you know, I'm with the dog, if I went across the street to go over to see them, got to go down over the curb again, which, you know, earlier, I mean if I was your age, I wouldn't think twice about it. But as you get older, you start thinking about things that would make it just more accessible and just encourages you to get out.

The mere presence of curb cuts was not enough to make them helpful. They also needed to be in a convenient location. Participants felt the curb cuts in the neighborhood were in the wrong location, rendering them useless. Jason emphasized, "I've kind of wondered myself why there hasn't been a curb cut there. And interestingly enough, there is another curb cut further up, which is kind of in an odd, I think in an odd spot." Like many others, Jason walked from the neighborhood to the Village Center. In order to use the curb cut to transition from the sidewalk



to the street they had to detour uphill. No one wanted to make the detour on the way to the Village Center. Instead, they walked through the grass and stepped off the curb which could be a challenge for some walkers. Putting a curb cut at the corner “would be a logical spot for one” said Jason.

### *Crosswalks*

The desire for connected crosswalks was echoed by the majority of participants, who wanted to be able to cross the main road with ease accessing other paths. While crosswalks were present, participants like Beth explained, “Sometimes it would be nice if the crosswalks would meet, as we saw in that other one. Trail goes off, but you can also walk across but there [aren’t] any sidewalks there to walk on.” Similarly, Bonnie felt it would be a simple fix to improve the safety and ease of walking on certain paths: “All they have to do is pave that left side and you could go right to the crosswalk.” Figure 4.4 is an example of an unconnected crosswalk.



Figure 4.4. Crosswalk to Village Center with no connection to other paths

## **Lighting**

Lighting throughout the walking area was consistently identified as an important feature for older adult dog walkers. Perceptions that lighting was adequate allowed walking early in the mornings or evenings even though most did not walk their dog during these times. While lighting was discussed many times, how the older adults perceived the quality of lighting varied. Some felt the lighting was “marginal” throughout the neighborhood. Deena explained these shortcomings:

They have put in a little bit of lighting along the pathway up to the Village Center. It would be nice to have more lighting in here. The lighting at the very entrance way is more in ground focused, more on the trees. So, it doesn't really light up this area very well.

Alternately, Daniel thought more lighting would detract from the walking experience. The tradeoff of more lighting was a problem to him. He explained, “Oh, I think it's adequate. I've heard some people want to put up streetlights, but I think that would kind of destroy the whole atmosphere of the area.”

## **Deterrents in nature**

Even for the ideal walking path, nature still created deterrents and obstacles. Nature posed significant safety concerns while others were merely a nuisance. The primary deterrents that emerged within in nature included natural slipping and tripping hazards, unwanted wildlife and dogs, and improved maintenance to mitigate risks.

### **Natural slipping and tripping hazards**

As participants walked along their chosen path, whether a nature trail or neighborhood sidewalk, they frequently encountered tripping and slipping hazards as a result of natural



elements. Natural elements that created slippery surfaces on the walking path were a primary concern. Deena said, “I noticed the other day when I walked up through there and it had been raining, there was a lot of water running right down the sidewalk. And again, when leaves come down, you know, that can be pretty slick. So you just have to be observant.” The impact of weather such as rain was “obviously a big thing” for them. Lily explained, “I do not walk on it if it’s really muddy because I have slipped before. Never fallen but slipped.” Deena thought moss was pretty but created another layer of challenge “especially if you have leaves in the Fall coming down it sort of covers up the mossy areas that are damp and it’s easy to lose your footing”. Drew like many others felt these slipping hazards were “a little rough, but manageable.”

Tripping hazards came from roots, limbs, and debris from trees. Beth explained, “Sometimes if it is a tree that has fallen and we have to figure out our way to go, either over it, or around it”. This required maneuvering around the path or getting off the path to pass. Lily worried about fallen nuts on the path. She said, “It is treacherous to walk on especially for people that are not steady on their feet.” Participants had to be diligent. For example, Virginia was always watching for tree roots and anything that could be underneath the leaves. The roots felt like “obstacles” to Drew as seen in Figure 4.5, but he was thankful to see remnants of paint that had been sprayed on them to help walkers spot the hazard.



Figure 4.5. Exposed tree roots along unpaved walking path

Participants did not have to walk on the wooded dirt trails to encounter nature imposed tripping hazards. Deena gave the perfect example, “they’ve paved over [the ground], but yet roots have kind of broken it up a little bit. And then you have the landscape timbers that are rotting again. For tripping can be a hazard. So I think all of that needs to be maintained.” The interface of a manmade surface like asphalt and a natural surface like grass proved to be a tripping hazard as well. Dylan explained his accident, “In fact, the only time I’ve fallen recently was about 4 or 5 days ago on this path. Just like this right here, and I was I just I don’t know why, but Elsa [the dog] and I kind of moved too far to the left that I just stubbed my toe here into the grass.” Deena saw a similar problem on the sidewalk where a trench had formed next to the grass as seen in Figure 4.6. She said, “it’s so easy if your dog is pulling to look at something or if you turn around or talk with someone to twist an ankle on it”. Nature created an array of tripping hazards that with “careful” navigation could be overcome.



Figure 4.6. Tripping hazard along sidewalk where trench has formed

### **Unwanted wildlife and dogs**

The presence of wildlife and other dogs throughout Warm Hearth was both an incentive and deterrent for dog walking. As Sarah explained, she doesn't go into the wooded areas because of "things like Lyme disease and everything". She said "I don't take any chances with ticks and fleas. But some people don't worry about it and they just plow through. So I said, go ahead. But Cooper [the dog] and I are more cautious. He's very allergic to flea bites."

Similar to ticks, skunks were on participants' minds while walking. Jack said, "Yes. So I do think about skunks every once in a while. Every once in a while, there would be an odor out here," which would be unpleasant and concerning for them. Dylan said skunks were the only animal of concern he ever ran into. He thought they were spectacular creatures but was thankful they typically ran in the other direction.

Participants were on the lookout for not only wildlife but other dogs as well. They liked encountering friendly dogs on a leash but not aggressive or stray ones. Deena shared her worries:

As far as safety from other animals. There have been a couple of occasions where adjoining property, not part of Woods Edge or Warm Hearth, they have a couple of really large dogs and they have broken through their fence and have come over and intimidated people.

Deena also encountered an aggressive dog in her neighborhood. She described how one came lunging at her and “knocked its owner over in the driveway trying to get toward Coco [Deena’s dog].” She was fortunate to be across the street but emphasized how important it was to be vigilant. Beth felt fearful when she encountered a stray dog but was thankful to have her dog Boomer as protection. “He seemed to know from Boomer’s barking that he better stay away. He was a big dog and had he not been friendly. It could have been dangerous.” said Beth. These encounters described by Beth and Deena were among many close calls and animal annoyances for the participants. Like the trip and slip hazards, confrontations with wildlife and dogs were not enough to prevent them from frequent dog walking.

### **Improved maintenance to mitigate risks**

As participants encountered natural hazards and deterrents, they pointed out possible improved maintenance. Lily said, “And that part of the trail, once you get to the end of that, which this is, you saw it was not well-maintained at all because the railroad ties are falling apart and the spikes are coming out.” Maintaining a natural environment was a tricky task but if done right could have many benefits. Deena explained:

Aesthetically, it would be nice if some of the trees were maintained, you know, the dead brush. I think partly it’s a fire hazard and not as aesthetic. But I realize if

you're trying to just be totally natural, they let it go. So there's that balance that I think needs to be worked on.

Unlike the railroad ties and dead brush, some maintenance issues had been dealt with. Virginia explained, "I did go down on the sidewalk when there was a raised portion of the concrete, the walkway concrete. And it's since been fixed." Participants recognized other aspects of nature like falling leaves and wildlife as being "natural." While measures could be taken to blow the leaves off the path, a majority were okay with these elements being present.

### **Interaction with motorized traffic**

Throughout the walk, participants also encountered automobile traffic. The path and nature were always present while they encountered traffic only at some points along the walk. The primary themes that emerged from interaction with motorized traffic included traffic volume and speed and pedestrian awareness.

### **Traffic volume and speed**

Participants were well aware of the traffic volume and speed of cars throughout Warm Hearth Village. They understood the safety concerns and "always watched for traffic;" however, they did not all perceive the issues associated with traffic to be the same in their community. Many thought the car traffic was a non-issue and a real benefit for the neighborhood, while others felt their safety was jeopardized as a result. Sarah said:

Well, it's fine. The reason it's fine is because we don't get much traffic. Only traffic we get here is from residents. And then once in a while, some workers or something coming through. But traffic is never a problem. And if it is, traffic is very...I mean, they drive slowly.

Participants echoed Sarah with comments like “people [drivers] are pretty cautious” and “you know rush hour is one car an hour”. This group perceived their personal safety to be high and traffic volume and speed to be low.

Others felt the opposite. Close to half of participants were concerned about the traffic while they were out walking their dog, particularly when they crossed the street. Daniel was among those worried and said, “Oh and this, this is the main crosswalk, which is probably the most dangerous one because people are coming up and down the hill here”. Certain crosswalks like the one mentioned by Daniel in Figure 4.7 were described as “tough” because employees would be heading to work and just “zoom” through it. Lily thought the fast cars were a huge hindrance and said, “They don’t pay attention, in fact, the other night I was almost hit, and I had a flashlight with me.” This heightened concern was also prominent when walking on the street at the back of the neighborhood where sidewalks were not present. Virginia shared her experience:

I mean, I’m very aware when a car goes by. I watch it. It’s not like I just jump off and keep my back to the car. Yeah. I mean, we’re an aging community. And so it’s not this. I wouldn’t recommend it. I wouldn’t recommend it.





Figure 4.7. Main crosswalk on Warm Hearth Drive

### **Pedestrian awareness**

Pedestrian awareness by motorists naturally came up in the interviews particularly for those who thought traffic was a problem. In general, they felt change was warranted but didn't know how to change motorist behavior. Mark explained how the drivers can get complacent, "They have a sign. You can get used to signs and can ignore them". A feeling of discouragement was shared by participants trying to brainstorm solutions. Lily said, "I don't know what you can do. You know, you'd have to have a crossing guard I think to make them stop. But they don't. And they turn." Ideas were suggested to bring continued awareness through newsletters, emails, and more signage, but they questioned how much could actually be done. Deena said, "You know, I'm not sure. Certainly, we're not going to be building overpasses, pedestrian bridges or anything, but just whatever can be done for awareness."

## **Path amenities**

Path amenities offered additional conveniences along the walk and elevated participants' experience. The ones pertaining to dogs were desired most. Primary themes that emerged within path amenities included dog waste stations, off-leash dog areas, sitting areas, and nature signs.

### **Dog waste disposal stations**

Given the focus on dog walking, almost all participants had to deal with dog waste at some point on the walk. All participants wanted to conveniently dispose of dog waste. They recognized the importance of picking up after their dog out of respect for others walking, but they did not want to carry the waste bag until they returned home. Jason explained:

It's very convenient for me [dog waste disposal stations]. I don't know, but people live on the other end of the development. But for me, it's pretty convenient because it's not far. So yeah, it's very convenient for me. So I have no complaints.

Participants who walked the short neighborhood loop agreed that the dog waste station was a convenient amenity that allowed them to "pick up what they left behind." Others saw room for improvement. Participants like Lily, who ventured beyond the neighborhood to other trails, said "they need another thing for disposal there," highlighting voids in areas without dog waste stations as seen in Figure 4.8. Deena liked the convenience of having bags that were usually stocked; however, she thought "it would be nice to have that done more frequently [restock bag] and also in the warmer months to have, you know, the trash emptied."





Figure 4.8. Dog waste station without trash receptable

### Off-leash dog areas

Similar to the dog waste disposal stations, participants wanted dog specific amenities to make the walk more convenient and enjoyable. Many expressed a desire for a space where their dog could be off-leash. Julie explained:

Well, I suppose if there was two things, a little dog park. I don't know if they ever thought about doing that up at that little park place where I said a bench would be good, having a little dog run. I'd love to be able to take her off-leash, Let her be a dog...play.

While there was a fenced dog park at Warm Hearth, no participant had ever visited it. Julie was among the majority who felt that the dog park was too far away and insufficient. Deena described the type of off-leash area she would use.

I think one overriding thing that again was mentioned. I would love to have an open space where he [the dog] could just run off-leash, not the confined doggy park.

They're just little and not interesting, but I understand why there's a leash law. But it would be nice to have a big grassy area, for example, with some shade. I know other people have complained that the dog park that you know, where they have put it in the summertime is just way too hot to enjoy being out there.

### **Sitting areas**

Participants recognized the value in having designated sitting areas, even if they themselves did not use them. Lily used a bench to tie her shoe, but remarked, "People do sit on the benches every now and then." Bonnie thought benches provided a nice reprieve during the walks: "On a hot day we just sit here and take a break and rest and cool off." Bonnie added, "Yeah, the benches are there everywhere for people, you know, to walk even way down in the woods, there are benches."

In general, participants perceived that the benches were plentiful and were widely dispersed throughout the community. Gazebos were also mentioned as being a nice covered spot to "sit down and look at the meadow," but no one actually mentioned ever using it.

### **Nature signs**

Congruent with the findings about the significance of nature, participants valued learning about the trees and plants around them from reading the posted nature signs, which were located along the paved nature trails. Drew liked the "little signs about the poplar tree," and Mark liked seeing "all the different exotic trees and variety." These simple yet interesting moments with nature added an additional layer of enjoyment to the walk.

### **Social interaction**

When participants set out on their walks, they talked about the features to which they looked forward--nature, wildlife, dog friendly conveniences, and the company of others. This

social interaction added an element of enjoyment on their walk. The primary themes that emerged from social interaction included a sense of security from knowing the neighbors, social experience for people and dogs, and interaction with those you don't know well.

### **Sense of security from knowing the neighbors**

Dog walking allowed participants an extra opportunity to get to know their neighbors. "It's good to see other neighbors and say hello once in a while," said Jason. He said he was more likely to see people out walking their dog than anything else. The familiarity with the people they met while out walking the dog gave them a sense of security. Julie liked looking at the houses on her walk and said, "I know the people in them. And so it gives me a warm, friendly, friendly feeling." Deena felt similar and said, "I know who they are, values, that type of thing" and this contributed to her sense of security.

### **Social experience for people and dogs**

Seeing people and dogs while out walking provided enjoyment and a social outlet. Jack, like so many others, reveled in watching the interaction of the dogs, "So, you know there's a social aspect for both the dogs and the dog walkers." Jack explained:

We have to run to go greet him (a dog). And they have a very intense two second greeting. Nose to nose and then that's it. So I like the social aspect, not only for the dogs, but for the humans. It is interesting there's approximately 90 people who live here in Woods Edge. And it is interesting how the dog walkers know each other, but the other folks don't necessarily know their neighbors.

Participants felt there was plenty of opportunity to interact with people and dogs while on the walking trails but not at the dog park. Daniel said, "There's never any dogs in there." And for that reason he didn't go. Others like Dylan thought "you have to have some sort of critical mass

of people dropping in. And it hasn't happened." Participants were drawn to socializing with people and dogs and were not attracted to areas lacking them.

### **Interaction with those you don't know well**

Dog walking allowed participants new opportunities to casually socialize. Lily explained, "And, you know, walking a dog, you meet people that you wouldn't meet otherwise. I'm sure I said that to you because I know everybody in this neighborhood." Some participants were uncomfortable talking to neighbors, but dog walking made engagement much easier. Jack said, "One neighbor is sometimes a little difficult to talk with. But if we talk about her dog, talk about the weather, we get along fine." The expectation to have a quick conversation with those you don't know as well felt manageable especially for people like Julie who said, "I'd say I'm pretty introverted, but I do enjoy seeing [people] just for five minutes. That's enough".

### **Destinations**

Different destinations were present along the walk, but these features were less prominent. Some destinations came up merely from walking past them on the route while others were discussed when talking in general about places within Warm Hearth that felt significant to them. The primary themes that emerged within destinations included dog parks and community centers.

### **Dog parks**

A recurring comment was the desire for a more appealing dog park. Participants emphasized that it would be a nice destination and place to visit on a walk, but it needed improvements. Across the 12 walks, no one went inside the fenced area. Comments like "the dog park... ehh" and "the dog park is over there, which we never use" summed up the participants' attitudes. Others wished the dog park actually had dogs and people inside. Dylan said, "It's kind

of desolate. People would get together and let their dogs play together. The dogs don't play together here. It's very rare you see dogs interacting in a friendly way, and the weeds come up there. You're stuck with those weeds." The dog park lacked the bustling and attractive atmosphere needed to make it a useful destination. Figure 4.9 provides a visual of the dog park.



Figure 4.9. Dog park enclosure at Warm Hearth Village

### **Community centers**

Walking to destinations was not a prominent feature for the dog walkers. If specific destinations were mentioned, participants often referenced the Village Center, a centrally located, multipurpose community center with workout facilities, a café, and meeting spaces. Multiple paths and routes led to it. Participants felt they could easily get there on their walk even if they veered slightly off the trail. Bonnie said, “there was an unauthorized path that goes to the Village Center, of course everybody uses it now. It's terrific.” The Village Center was a valuable resource in general, but participants could not utilize its resources while walking the dog because

it was not dog friendly. It was a destination participants wished they could use while walking the dog. Julie explained the challenge:

In the summertime, I eat lunch up there quite a bit. I can walk up to the place and I call the girl ahead and say, would you pack my lunch? I'll be at the door. I can't take her [dog] in, but she'll look up and see me. And if somebody is out there, they'll say I'll hold her and you can go in, but you just don't take them."

### **Design goals**

Design goals represent overarching arching aims that a space strives to achieve. It is often not one feature but rather a collection of features. The achievement of certain goals is connected with the user's perception of the walking spaces. The primary themes that emerged from design goals included aesthetics, safety, variety, and maintenance.

### **Aesthetics**

For many participants, the Warm Hearth community offered them a great sense of pride for the aesthetics of their surroundings. According to Sarah, "I love it, that's why we built here. It's a very quiet, safe neighborhood, and it's beautiful." Lily had a similar response, "All the houses are pretty and it's clean and it's neat, the little boxes on the hillside." And further, "You know it's a pleasant walk and it makes you get out. I mean, we walk every day no matter what." Participants admired the attractiveness of the neighborhood and scenery as seen in Figure 4.10 and remarked that it motivated them to go outside.





Figure 4.10. Scenery of Warm Hearth Village neighborhood

## **Safety**

Participants had different feelings about what constituted safety as it relates to traffic, nature, and deterrents. Most regarded that the environment where they lived and walked was safe. Julie explained, “Well. If there is somebody here that looks suspicious or doesn’t belong here. There are so many people here they would notice it.” She felt “perfectly safe and sound” walking in her neighborhood. This sense of security from knowing one another was further explained by Sarah. Sarah said, “If we ever have neighbors that come out they are always friendly and always know the dogs, and that’s always nice to know.” Participants recognized that challenges in the walking environment could put them at risk or impact their safety. Some felt that challenges in the walking environment pushed them in a good way but were hard to come by. According to Dylan, “It’s hard to come by (challenges) when you’re living in a place like this

because for good reasons. All of the temptations on their [Warm Hearth's] part are in the other direction. They want to keep you safe.”

### **Variety**

Among the 12 walking tours, no two were alike. They varied in length and type, either being wooded, neighborhood based, or both. Having options made the walks feel interesting and enjoyable. Mark explained, “We’ve got miles and miles and miles of trails. And that’s the best thing. We’ve got choices. We could be gone for hours here and never leave the campus or encounter the same trail.” Having variety in where they walked and what they encountered kept participants intrigued and curious. According to Drew, “Over time it could get boring except it never does because he [the dog] is always finding something different or I see something different.” Having choices within a dynamic walking environment kept the walkers willing and able to see more not only for their own entertainment but also for their dog.

### **Maintenance**

The appearance and upkeep of the neighborhood was a prominent topic for most participants. Maintenance of landscaping, homes, roads, and walking paths were easily noticeable to them on the walks and identified as an important goal. Sarah observed, “You know everything here is well-maintained. You don’t have to worry about it.” Even when describing the maintenance of more secluded walking paths, participants felt pleased with how the community was keeping up with issues. Beth said:

The road is maintained very well. The paths are maintained well, but some of the more obscure paths where the tree was falling down, they can’t get their little go cart type vehicle in there. So they have to actually walk the path and that takes a little longer to get it cleared off. And sometimes if they’ve been there a long time,



I'll stop at the maintenance building and say I found a tree that's down on trail number so-and-so and they'll get to it. They're very good. They're very cooperative.

### **Short-form health survey and self-efficacy walking scale results**

As part of my data collection, I asked participants to complete two surveys: the short-form health survey (SF-12) and a self-efficacy walking scale. Results for the SF-12 are reported for physical and mental health. For the 12 participants, the average physical health and mental health scores were 48.7 ( $SD=8.1$ ) and 53.7 ( $SD=6.7$ ) respectively. The national average for adults over 55 in physical health is 48.6 ( $SD= 11.7$ ) and 52.3 ( $SD=10.6$ ) for mental health (*NLSY79 Appendix 19: SF-12 Health Scale Scoring | National Longitudinal Surveys*, n.d., p. 12). Participants reported an average self-efficacy walking score of 76 ( $SD=30.8$ ), with 0 being no confidence in walking and 100 being highly confident in walking.

## **DISCUSSION**

Many features play a role in older adults walking their dog. Certainly, the necessity of the dog needing activity is part of the reason older adults walk. However, the maintenance and enjoyment of the habit of older adults walking their dog is more complex than just this necessity. My results identify prominent features like the interaction with nature, walking hazards, adequate walking paths, dog friendly amenities, and opportunities for socialization as features that contribute to the maintenance and habit of older adults dog walking. The prominence of these features varies and both supports and extends prior research (Christian et al., 2009; McCormack et al., 2016).

The difference between previous research and my findings is the focus specifically on older adult dog walkers. While other studies explain the influence of similar features related to

general walkability, being outside, or dog walking (Barnett et al., 2017; Christman et al., 2020; Cunningham & Michael, 2004; Loukaitou-Sideris et al., 2016) I highlight and make comparisons to how these previous findings fit with my findings specifically about older adult dog walkers. Older adults who walk their dog are unique because they may experience health protection later in life due to increased social and physical engagement (Toohey et al., 2013).

The following subsections discuss why these features likely influence older adult dog walkers. I start with the interactions with nature and explain how nature provides benefits for older adults. This is followed by subsections about walking hazards, adequate walking paths, dog friendly amenities, and opportunities for socialization. The discussion ends with the limitations of this research and opportunities for future research.

### **Interactions with Nature**

Nature was a prominent feature for walking among the older adults in my study. However, the importance of nature varies in the literature. One reason is in the way nature is often described. Some studies group nature with aesthetics or just mention aesthetics in general, while others more narrowly focus on specifics like the influence of garden spaces or flowers (Christman et al., 2020). For example, a review by Cunningham & Michael (2004) found aesthetics of the walking environment to be important to older adults. While nice landscaping was mentioned by Cunningham & Michael (2004), specific natural elements were not discussed. Similarly, a systematic review by Barnett et al. (2017) found greenery and aesthetically pleasing scenery was positively associated with physical activity levels among older adults. However, the study did not distinguish specific features associated with the scenery and whether or how it was related to nature. The challenge is what specific aesthetics contribute to this positive influence and how are these features related to nature.

In my study, I found pleasing aesthetics associated with the design of homes, lack of power lines, and just a general feeling of pleasantness and neatness positively influenced the walking experience for older adults. More directly related to nature, I also found that natural aesthetics like the color of the leaves, views of farmland, flowering bushes, and tree covered walking paths contributed to their enjoyment of walking. My findings align with previous research about park design that suggests water ponds, raised flower beds, natural looking paths, and favorable animals like squirrels and birds were valued among older adults in a park setting (Loukaitou-Sideris et al., 2016). Participants in my study explained the enjoyment they got from watching wildlife that posed minimal nuisance, seeing deer by the water, and walking by a neighbor's gardens, which all coincide with the findings from Loukaitou-Sideris et al. (2016). The setting for my study was more neighborhood based and included a dog versus being in a park, but the details from this prior study by Loukaitou-Sideris et al. (2016) about what people enjoy about a park provide a reasonable reference and support for my specific findings about nature. One reason for the similarities in findings may be because of the similar qualitative methods used in both studies. Loukaitou-Sideris et al. (2016) utilized focus groups to elicit open-ended feedback similar to my interviews and observations with older adult dog walkers.

More directly related to walking, rather than park design, McCormack et al. (2016) identified neighborhood features for dog walkers and found natural elements were closely linked to recreational walking with the dog. McCormack et al., (2016) measured the appeal and attractiveness of the neighborhood environment through the presence of tree plantings along the street, points of interest along the walking path, and well-maintained public and private gardens. These features are similar to the features I identified like having variety and abundance of trees to view, interest points along the walk included farmland with cows, wildlife, and natural foliage

from plants. McCormack et al., (2016) also previously linked neighborhood aesthetics, often through natural elements, with increased frequency of walking among non-dog owners. In this sense, neighborhood aesthetics is desired by all types of walkers, not just those with dogs and should be of particular focus for this age group with and without dogs.

A reason why nature may be a prominent feature contributing to walking is the mental benefits it provides. Exposure to nature is associated with reduced psychological problems such as stress, anxiety, and depression and improved physiological outcomes for people with cardiovascular disease and cancer (Repke et al., 2018). These numerous benefits contribute to improved overall health and well-being (White et al., 2019). While aware of the benefits of nature, or not, participants in my study self-reported their physical and mental health using the SF-12 survey as slightly above the national average for the 50+ age group. This is surprising given that the physical health score generally decreases dramatically after the age of 55 and participants were all over the age of 70. In my study, older adults who walked their dog were also able to maintain a higher level of physical health than what is expected for older age groups (Jakobsson, 2007; *NLSY79 Appendix 19: SF-12 Health Scale Scoring | National Longitudinal Surveys*, n.d.). More research is needed to explore the effects of nature and whether its motivation for walking, especially among older adult dog walkers, specifically contributes to their increased physical well-being.

### **Path design**

While older adults in my study described the immense benefit from being in nature with their dog, they also described the necessity for adequate path design between path types. A common focus about path design among participants was the safety between a path and roadway.

Preference of path surface varied, but all participants valued smooth transitions on and off the walking path because of tripping concerns.

Reducing trip hazards was a common theme in the walking literature specific to older adults. But path design is challenging to address because no one surface type is universally desired. Across 12 walks, the surface type varied. Some participants liked a smooth wide sidewalk or paved path, while others liked walking on an earth surface like packed dirt. Participants liked having the option to choose different types of paths to meet their comfort level.

The idea of choosing path type by comfort level fits within the Environmental Press Model (Lecovich, 2014; Moore, 2005). The Environmental Press Model says that capacity, demand, and opportunities interact to create either an optimal fit or a misfit with the person and setting, and for this study walking environment (Lecovich, 2014; Yang & Sanford, 2012). The Environmental Press Model helps explain why some participants intentionally chose the more challenging route because it pushed them to test their balance. On the other hand, some participants in my study liked feeling sure footed so they avoided obstacles by staying on the paved paths.

### **Walking hazards**

A prominent element that participants were acutely aware of and took into consideration when walking with the dog were hazard and deterrents. Hazards include both tripping and slipping hazards when walking and hazardous threats from unknown animals on the path.

While tripping and slipping hazards posed safety concerns at times, the participants in my study were not deterred from walking each day. Rather, participants in my study either adjusted their route to avoid the hazards or accepted the presence of the tripping or slipping hazard and prepared themselves for the encounter by increasing their level of care. My findings about

concerns with tripping and slipping hazards is consistent with a study by Lockett et al., (2005), which identified fall hazards from compromised walking surfaces (water, cracks, unevenness) as being impactful to older adults. Where my findings differ is the significance related to these hazards. Lockett et al. (2005) reported some hazards like snow and ice to be “insurmountable barriers” for certain participants, especially if they use devices to assist them walking. The motivation provided by the dog needing to be walked may have helped my participants overcome the tripping and slipping hazards. Additionally, the frequency of walking due to their dogs among participants may have also allowed them a greater level of comfort and familiarity with their surrounding area and giving them the ability to avoid known tripping and slipping hazards. These hazards may have been different in the winter with the presence of snow and ice or if someone was using an assistive walking device.

The participants in my study also described feeling uncomfortable and at times unsafe when they encountered certain types of wildlife like skunks and other unknown dogs that were potentially aggressive. Encounters with stray or aggressive dogs are documented by others as a deterrent in the walking environment (Cutt et al., 2008; Westgarth et al., 2014). However, similar to the deterrents in nature, and with the tripping and slipping hazards, the study participants described how they continued to walk almost every day even with the threat of unknown animals. Like the tripping and slipping hazard, the dog may have provided some level of comfort and safety that otherwise might not exist when dogs are not present. For example, some participants mentioned stray dogs not approaching because they had their own dog by their side. Having a dog seemed to reduce the feeling of vulnerability and gave them a sense of confidence over the deterrent of stray or aggressive animals.

## **Dog friendly amenities**

Along the path, participants described another prominent feature as conveniences associated with walking the dog. The most commonly discussed was dog waste stations. Participants described not wanting to carry the dog waste, nor did they want to walk out of their way to dispose of it. Leaving the waste behind was not an option and was considered an unacceptable practice in the community. The need for dog waste disposal stations is commonly discussed (Cutt et al., 2008; Gaunet et al., 2014; McCormack et al., 2016; Sugiyama et al., 2015; Westgarth et al., 2016). The need for dog waste stations appears universal among users of walking spaces with and without a dog (Blenderman et al., 2018). Dog waste stations would contribute to a universal desire across age groups and users for parks and recreation areas to be aesthetically pleasing and free of dog waste (McCormack et al., 2010).

Dog waste disposal stations alleviate a common nuisance for other users when spaces are shared by dogs (McCormack et al., 2010). Dogs however are sometimes banned from public places due to their potential nuisance (Weston et al., 2014). For example, Martha's Vineyard banned dogs from a local beach because dog owners were not adhering to waste clean-up (Sennott, 2020). Simple solutions like dog waste stations can benefit both walkers with and without a dog. The challenge with dog waste stations and why they can seem sparse is the associated maintenance. Someone has to clean out the waste stations to avoid further nuisance from the odor. Participants noted this as an issue especially during the warmer months.

## **Social interaction**

Participants in my study described how walking the dog allowed for increased opportunities to socialize with other walkers and neighbors each day. Consistent with a study from Toohey et al., (2013), older adults who walked their dog regularly in a neighborhood

setting were more likely to experience social cohesion and engagement than those who did not have a dog. While we did not have a comparison group, participants universally felt that walking their dog allowed them to socially connect with people they may not have otherwise seen. For older adults this is particularly relevant given the prevalence of loneliness and isolation among this age group (Kim & Clarke, 2015; Toepoel, 2013). Some participants lived alone and walking their dog gave them a reason to leave the house and feel connected with the people living around them. This type of benefit of walking the dog extends beyond the physical activity to improve socialization.

### **Limitations and future research**

The Photovoice technique I used helped me understand preferences of older adult dog walkers. However, there are several limitations with this method and how I implemented it. In my study, an assistant took the photos along the walk guided by the conversation between myself and the participants. Usually, participants take the photos themselves in Photovoice (Mahmood et al., 2012; Ronzi et al., 2016). This may have introduced bias by unintentionally capturing features not directly mentioned or valued by the participants. Often many features were present in one photo. The assistant took the photos because the older adults in my study were walking with a leashed dog. I originally planned for participants to take photos but realized this was unsafe for them to hold a camera, walk, and maintain control of their dog. Taking photographs of features they specifically pointed out was the best way to mitigate the limitation.

Photographs were a useful tool during interviews because they helped visually tell the story of the walks. However, not all features could be captured through the photographs. For example, features that were not tangible at that moment like social interactions, disliking the dog park, or wishing there was a bench were not photographable. This required more prompting



during the interviews because the photos did not capture all features participants discussed on their walk. Photo prompts can still help. My research assistant and I tried to take photos on the walk that would help naturally remind them of the features mentioned in conversation. For example, the research assistant took photos of seating on a neighbor's porch to remind them about mentioning wanting a bench during the walk.

I chose Warm Hearth Village as my sampling frame because of an existing relationship, their willingness to be part of the research study, and the variety of walking trails on the property. An unintended limitation of this sample frame was my study population ended up being homogenous. Participants were white, affluent, and highly educated. All but one participant held at least a bachelor's degree with many having post graduate degrees. Additionally, all participants self-selected to live in a nature oriented planned retirement community. The context of this setting and the homogeneity of the population limits my ability to generalize findings to different populations and settings. My study offers a reasonable methodology to understand walking environments for older adults walking with a dog. Future research can build on these limitations by broadening the sample population and setting. Less affluent groups of people, more variety in race, and non-senior living communities would warrant being studied in the future. Preferences in walking environment likely vary between different groups of older adults and it would be beneficial to understand other perspectives.

Future research should also capture the walking experience in other seasons, climates, and settings (urban, suburban, and rural). I walked with older adults during the Fall and some features were season specific such as changing leaves. Gaining insight into other season specific features would be helpful when designing year-round walking areas (Kimura et al., 2015).

## CONCLUSION

In summary, my findings show that older adults from this study placed significant value on nature when walking their dog and are fulfilled both emotionally and physically by the experience of being in a natural environment. The ability to overcome deterrents and obstacles along the path suggests a high level of resilience to continue the walking habit even when challenges exist. Access to different types of path surfaces and the underlying need to walk the dog played into this resilience to walk in a variety of conditions. Dog specific path amenities like dog waste stations added a desired level of convenience and reduced the need to take a detour on the walk. Opportunities to talk with other dog walkers and neighbors provided an outlet to socialize and was yet another reason for older adults to walk their dog each day. Identifying the environmental features relevant to older adults while also including dog related amenities may help older adult dog owners maintain more frequent walking habits. Designing walking spaces that are uniquely appealing to older adult dog walkers by incorporating natural elements, path choices, and dog specific amenities has the potential to increase physical activity, reduce isolation, and improve the overall well-being of this population.

When designing walking spaces for older adults with and without dogs, it is important to consider the different level of challenge and experience appropriate for the range of users. While it may be easy to assume that removing all forms of risks is desirable, for example, only having smooth surfaces, this may actually be insufficient challenge for some older adults. Walking spaces would ideally provide options in the type of walking path including paved and unpaved surfaces with varying levels of challenge to meet older adults at their current level of ability. Due to the potential frequency that comes with walking a dog, design of walking spaces should also provide layered interest and change in the form of natural elements and well-maintained dog

waste stations. I identified specific natural elements that resonated with older adults in this study that could be advantageous to consider in design. These elements included having an abundance of lush trees along the path, diversity in colors through plant life, incorporating views of nature like farmland, and creating opportunities to see wildlife in its natural habitat. Combining path options, natural elements, and dog waste stations with opportunities to socialize made the experience of walking dogs highly enjoyable for participants. For planners and designers of outdoor spaces, the inclusion of these features and experiences may be more likely to draw in older adult dog walkers while still maintaining appeal to non-dog walkers.

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## **Chapter 5 – Conclusion and Reflection**

## CONCLUSION

In completing a systematic review, Delphi study, and guided walks and interviews with older adults at Warm Hearth Village, I have identified and described the features within outdoor walking environments pertinent to some older adult dog walkers. Each method brought a different perspective about what matters most to older adult dog walkers. Gaining different perspectives from experts and older adults gave a more all-encompassing view of what should be included and considered in the design of outdoor walking spaces.

Through the systematic review I identified features relevant to general walkers and dog walkers. Aesthetics from nature, well-maintained amenities, and lack of unpleasantness like litter and smells were consistently associated with general physical activity and walking as was safety. Parks and open space were inconsistently associated with physical activity. In some instances, close proximity to parks was described as increasing activity levels and in other cases living close to a park did not impact walking levels.

Within articles about dog walkers, aesthetics was also associated with increased walking, but was not as frequently studied as features like off-leash dog areas, dog parks, and dog supportive infrastructure (i.e., litter bags, waste stations, and dog policy signage). Off-leash dog areas were inconsistently associated with dog walking just like parks and open space in the general walking literature. Dog parks were not associated with dog walking unless features like a walking path were included. Dog supportive infrastructure was important for dog walkers; however, evidence on whether parks with these features increased dog walking was conflicting. Study results were mixed about the direction of association between dog walking and proximity to parks with dog supportive infrastructure.

Through the Delphi study in the second part of this dissertation, expert panelists achieved consensus on the relative importance of 25 features from the outdoor walking environment. Among the features that achieved consensus, personal safety had the highest level of importance followed by dog waste stations (desirable), unattended or unleashed dogs (undesirable), attractive walking spaces (desirable), trash cans (desirable), and fear of experiencing crime (undesirable). As in the systematic review, dog supportive infrastructure (i.e., dog waste stations and leashing policies) were considered important. Based on the features that were considered important and achieved consensus, panelists valued features for both the owner and the dog. Opportunities to walk in safe, attractive spaces with dog supportive infrastructure was considered ideal for older adult dog walkers. While off-leash dog parks were frequently discussed in the systematic review, Delphi participants diverged in their opinion on the relative importance of this feature in influencing the decision to walk. The variability among expert panelists on the importance of off-leash dog parks may reflect mixed associations with dog walking as well as the controversy that sometimes accompanies off-leash areas in parks. Controversy exists around off-leash dog areas because of the potential conflict and safety concerns that can arise between other dogs and people when dogs are not leashed.

The Warm Hearth study added another layer of perspectives from older adult dog walkers, who serve as representatives of the stakeholder group that could ultimately benefit from the findings of this study. The initial research proposition of correlating appeal to walking self-efficacy was not tested. Instead, I synthesized themes from the set of individual perceptions of study participants. Participants identified nature and elements within it like tree covered paths, flowering bushes, leaves changing with seasons, and wildlife as some of the most enjoyable aspects of walking their dogs. Nature contributed to an aesthetically appealing walking

environment. The positive contribution nature had on walking the dog consistently emerged from the interviews with participants. Congruent with findings from both the Delphi study and systematic review, aesthetics, which emerged as a category within design goals, was positively associated with walking one's dog. While aesthetics was found across all three studies to be an important feature positivity correlated with walking in older adult dog walkers, the value older adults placed on nature in the Warm Hearth study was not shared by the expert panelists in the Delphi study. In the Warm Hearth study, older adult dog walkers identified many individual features within nature that were important to them such as changing colors of leaves, viewing wildlife like cattle and deer, and lush tree cover on the path, whereas expert panelists in the Delphi study only achieved consensus on one feature within nature: viewsheds.

Safety concerns were on the minds of older dog walkers in the Warm Hearth study, such as tripping, slipping, and unleashed or aggressive dogs; however, the older adults were able to overcome these deterrents to their walking behaviors. To them, these safety concerns were inconvenient, but they continued to walk their dogs each day. Safety also emerged as an important factor from the systematic review of the general walking literature and from the Delphi study. However, unlike the systematic review and Delphi study, I was able to gain an understanding of exactly *how* older adults perceived safety and the personal impact it had on them while dog walking. The Warm Hearth study allowed rich details to emerge and reasons behind the specific impacts of features such as those about nature and how dogs serve as protective factors against deterrents.

Collectively, these three studies bring together knowledge about what makes walking environments most ideal for older adult dog walkers. While the ability to generalize to diverse groups of older adults is somewhat limited due the selected research setting of Warm Hearth

Village, I did gain diverse perspectives from experts across multiple disciplines. Warm Hearth Village is situated with a natural non-urban setting and residents are highly affluent. The features identified as important across the three studies included *aesthetics* from inclusive of elements like views of nature and well-maintained amenities, *safety* from motorized traffic, crime, unleashed dogs, and personal injury, as well as *dog supportive infrastructure* like dog waste stations and dog policy can help inform future design decisions targeted at increasing walking and socializing among older adults with dogs and without dogs. The importance of *path design* including lines of sight and lighting emerged more prominently in the Delphi study and Warm Hearth study and should also take priority. Providing ultimate appeal to some older adult dog walkers, could be achieved through including features that promote personal safety like mitigating fall risk, support the presence of dogs through dog waste stations, while at the same time including features that add to the aesthetics and create an immersive feeling with nature. Creating well aligned walking environments through the inclusion of these mutually agreed upon features would add to the enjoyment and ease of walking one's dog. It also has the potential to translate into increased walking and opportunities to socialize, both of which contribute to the mental and physical health of older adults.

### **LESSONS LEARNED**

Each study design offered a unique and advantageous way to address the associated research questions, however there were also challenges that should be considered when implementing each methodological approach. The lessons I learned from completing a systematic review of reviews, a Delphi study, and guided walks utilizing the Photovoice approach are discussed below.



## **Precautions of doing a systematic review on review articles**

The initial rationale behind doing a systematic review of systematic reviews was that I could more efficiently gather articles about the built environment and the role it played on physical activity by leveraging others' collections of studies. There was an expansive amount of literature on the intersection between the built environment and physical activity and it seemed inefficient for my review to replicate work already done in these studies. Reviewing reviews allowed me to pull features that had already been compiled from multiple studies. What I did not anticipate was the variety of ways the built environment was measured and the challenge of summarizing key findings across the reviews.

Pulling features from reviews was efficient because many of the reviews had tables with features organized based on their synthesis. I felt I was able to capture a breadth of features and create a reasonably comprehensive list of features moving into the Delphi study. I did not realize, however, how different one review would be from the next in the way features were described. Some were large scale like pedestrian infrastructure, while others were specific like benches. Identifying and extracting the features was simpler than organizing the features. This is why it took three attempts to land on a method that seemed to work. If I could go back, I think I would have tightened the inclusion criteria particularly around the methodologies of included studies. A few less studies that were more congruent in methodologies and types of studies included may have eased the challenges with organizing the features. There were redundancies across studies so I don't think it would have been substantially less representative of the literature but would have made the process of organizing features more streamlined and apparent.

Lastly, I did not realize how challenging it would be to synthesize the key findings from the 15 review articles. Cumulatively, the reviews included over 500 studies. Trying to determine

how the results either conflicted or built on one another was challenging because within the reviews there were contradictions. The key features within the reviews were not always presented in a clear list in the results sections. It required some degree of interpretation at times and this added to the challenge. I think again tightening the inclusion criteria may have made the synthesizing more concise because the studies would have been slightly more homogeneous in either population (adults, older adults, or both) or methodology (qualitative vs. quantitative).

### **Things to consider when managing a Delphi study**

Prior to starting the Delphi study, I made the decision to use Qualtrics as the primary survey tool. I knew how to build basic components of the survey like uploading the consent form and asking basic demographic questions, but I did not have a solid grasp on how to actually build questions that allowed for rich input during the qualitative round (round one) and which allowed panelists to change responses in the third round. Also, because round one and two were dependent on the results of round one, I could not truly pilot these rounds ahead of time. This made the development of the surveys for round two and three time consuming and challenging.

In round two, determining a layout that did not feel overwhelming to present 71 features took a few iterations. A sample of the final Delphi surveys are available in Appendix B. There were also limitations in what Qualtrics was capable of doing. For example, I wanted panelists to be able to hover over the features to see examples. This would have reduced the number of words on the page. Qualtrics confirmed this was not possible so I determined the best possible alternate layout. When it came time to develop survey two, I had to move forward in a timely manner with minimal piloting because panelists had already completed round one.

In the third round, I had to figure out the best way to present panelists with their score from round two, the group median, and the option to change their score. I had not fully considered the method by which I would make individualized surveys for each panelist. I considered manual entry until I found a more elegant way to manage scores for round three. Qualtrics had the capability to upload files with scores attached to names and email addresses from round one and two. It was better than manual entry because the chance of human error was less. It did require a learning curve on my part and more time to develop and test the survey. The study was completed during the COVID-19 pandemic, so I allowed more time between surveys and this worked in my favor.

Looking back, two to three weeks between surveys was not enough time to process the data, develop new surveys, and test whether they worked. Had I fully developed the surveys before the study began, piloted the questions, and had place holders for responses, some of these challenging timing constraints would have been minimized. Unfortunately, the nature of this study did not really allow for this level of development beforehand. Certain aspects could not be predicted such as panelists wanting examples for the majority of features and how many people responded.

### **Provisions when using photography with older adult dog walkers**

Typically, with the Photovoice technique, the camera is put in the hands of the participants so the photos are from their perspective. I did not find any studies that utilized Photovoice with dog walkers which presented an interesting challenge. How would they hold on to the dog leash and manage a camera? I felt this task was too much to handle and potentially risky. After piloting the use of a body mounted camera to capture features on a walk, I found the sound from the camera footage was inaudible due to car noise and the images only captured what

was directly in front of the person. The best alternative I found was for a researcher to accompany the walk and take photos. This seemed like the safest way to capture the walking experience while still maintaining the perspective of the participant. Having myself and another researcher on the walk allowed me to focus on the participant, prompting them to discuss the environment, while the other researcher captured representative photographs based on our conversations.

The approach worked well. During interviews, the photos effectively triggered memories from the walk and felt personalized to participants' viewpoint of the environment. Printing high quality photos within a week was too costly so I presented them on an iPad. Some participants worried they would “break” the iPad but they quickly got the hang of flipping through the chronologic photos. The outcome was as if they were narrating a story of their own walk.

The walks and interviews were completed prior to the onset of COVID-19. Had this study been completed during COVID-19, safety would have been a concern particularly during interviews since social distancing was recommended. As an alternative, photos could have been presented via Zoom and interviews recorded virtually.

Another point to note was my decision to let participants select the parameters around the walk. This included time of day, which walking route, how long, and who accompanied them. I wanted the walk to feel comfortable and in line with their preferences. I think this was the right choice. In the end, participants were able to take us on *their* walk and point out the features they notice every day. Had I selected the route and length of time to walk it could have felt misaligned with each participant's abilities. The choices varied between participants, so I was still able to experience the variety in walking paths offered at Warm Hearth Village. The choice did not limit what was captured through photographs.

## IMPLICATIONS FOR FUTURE RESEARCH

Future research would not only aim to address limitations, such as those presented around generalizability in the Warm Hearth study, but also expand into other methodologies to quantitatively capture data that was otherwise qualitative. The first research idea would expand the Photovoice technique to other settings and populations and the second research ideas would capture biometric data about the walking environment.

### **Expanding the Photovoice technique to capture perceptions of more diverse groups**

The benefits of doing my study at Warm Hearth Village included an existing relationship between the community and Virginia Tech and a convenient location. Warm Hearth Village was excited to accommodate my study and this support proved to be important for recruitment. With the benefits came significant limitations in my ability to generalize to more diverse groups. Participants were highly affluent and their race white. I cannot say the preferences of this group such as valuing nature and choice of walking paths would also apply in other settings or with less affluent older adults. For these reasons it would be advantageous to use the same methodological approach and Photovoice with a more diverse setting and groups of older adult dog walkers.

Exploring other senior living communities with different levels of access to walking trails and nature would provide an interesting comparison. I would be able to understand if the prominent features I found at Warm Hearth Village were desired across different settings or if preferences varied based on where older adults lived. Exploring non-senior living communities would also provide insights into preferences based on setting.

In addition to exploring settings, I want to include understanding preferences in the walking environment among a more heterogeneous sample of older adults. This could include different affluencies, races, and medical conditions. For example, our participant group was

physically quite healthy and needed no assistance with walking. Other groups of older adults may have some type of health issue but still walk the dog. These perspectives would be valuable to capture and compare to my existing data. This would likely require recruiting older adults from areas outside Blacksburg, VA, more resources to support travel and photography, and the development of new partnerships with other senior living communities.

### **Use of biometric measures to capture the walking experience of older adults**

After completing the Delphi study and Warm Hearth study, I saw value in measuring the subjective perspective of expert panelists and older adults. I was able to capture details about the environment that a predefined survey could not elicit. The systematic review highlighted differences in subjective and objective measures of the built environment and how different outcomes were found using the different measures. Therefore, I want to build off the Warm Hearth study to objectively measure how older adults observe their walking environment using an eye tracking device.

I would include both older adult dog owners and non-dog owners to see if there were differences in how each group observed features in the walking environment. The eye tracking device has the capability to objectively measure eye fixations. Fixations refer to the times when the eyes stop scanning the environment and hold its focus. The eye tracking device can then capture information about what the eye is fixating on. Basically, the device sees what has caught the participants attention and makes them take a pause. I want to understand if dog walkers fixate on different features in the environment as compared to non-dog walkers and what those features are. I also want to know how objectively measured features through eye tracking compare to those identified in the Warm Hearth study.

## APPENDICES

### APPENDIX A: ANNOTATED BIBLIOGRAPHY

Anderson, K. A., Lord, L. K., Hill, L. N., and McCune, S. (2015). "Fostering the Human-Animal Bond for Older Adults: Challenges and Opportunities." *Activities, Adaptation & Aging*, 39(1), 32–42.

The article provides a summary of current findings between pet ownership and older populations. While there are mixed findings about the benefits of pet ownership, there is strong opportunity for positive impacts on older adults. Benefits include higher emotional well-being and increased physical activity, whereas contradictory results indicated that pet ownership was associated with higher levels of psychopathology or no benefit at all. A need for more rigorous design that controls for confounding factors is suggested. This article discusses the many challenges faced by older adults who wish to own a pet. Of these include the barriers for adults in assisted living facilities. Most nursing homes are either not accepting of pets or lack appropriate design features to accommodate pet ownership. Alternatives for single pet ownership include facilities that have communal pets. Future research should assess the past and present role of pets among residents.

Coleman, K. J., Rosenberg, D. E., Conway, T. L., Sallis, J. F., Saelens, B. E., Frank, L. D., and Cain, K. (2008). "Physical activity, weight status, and neighborhood characteristics of dog walkers." *Preventive Medicine*, 47(3), 309–312.

Participants in the study were aged 20-65 and although not representative of an older population, the study was unique in the comparison of neighborhood walkability among dog owners and non-owners and associated walking levels. Participant walking levels were measured through accelerometers, minutes of dog walking were self-reported, and walkability levels were measured through GIS mapping. Dog owners who walked their dog had the lowest level of obesity and had significantly higher averages of minutes a day of physical activity compared to non-owners and dog owners/non-walkers. Non-owners were surprisingly the most likely to live in highly walkable neighborhoods; however, dog owners/walkers were more likely to live in highly walkable neighborhoods than owners/non-walkers. The study sample was majority white educated individuals limiting the generalizability to more diverse populations.

Cutt, H., Giles-Corti, B., Knuiman, M., and Burke, V. (2007). "Dog ownership, health and physical activity: A critical review of the literature." *Health & Place*, Part Special Issue: Environmental Justice, Population Health, Critical Theory and GIS, 13(1), 261–272.

This review accessed the relationship between dog ownership and physical activity and focused on the physical, social and policy related factors influencing physical activity among dog owners. The review highlights the need for improved study design methods and that much of the research lacks adequate sample sizes and generalizability. Dog ownership is associated with improved health benefits for their owners; however, evidence is lacking around the role policy and physical environment play on dog walking.

Health benefits of pet ownership among adults include lower blood pressure, lower cholesterol, lower mental stress and depression, and higher self esteem. Dogs were shown to be a form of social support, where social support can act as a predictor of physical activity. Social interactions and conversations with people were associated with dog walking and may facilitate social capital and sense of community. A contradictory study in Australia in middle aged pet owners found negative relationships between pet ownership and health. Future research should alleviate current design limitations, include longitudinal designs, address the influence of policy and environmental factors on dog walking, and utilize both qualitative and quantitative data collection methods.

Feng, Z., Dibben, C., Witham, M. D., Donnan, P. T., Vadiveloo, T., Sniehotta, F., Crombie, I. K., and McMurdo, M. E. T. (2014). "Dog ownership and physical activity in later life: A cross-sectional observational study." *Preventive Medicine*, 66, 101–106.

Older adults are at greater risk of chronic disease and disability; however, they are the most sedentary age group. There is a lack of representative evidence on the relationship between older adult dog owners and the facilitation of physical activity. The current study sampled 547 adults over the age of 65; however, adults in residential care facilities were not included. Accelerometers were used to measure physical activity levels and social capital was measured through the Social Capital Questionnaire. Only 9% of participants were dog owners, n=50; however, a significant positive effect was detected among dog owners and activity levels. Physical activity was 27% higher among dog owners. General health and physical function mediated the effects of dog ownership. The study suggests that dog ownership may positively influence older adults to be physically active.

Gaunet, F., Pari-Perrin, E., and Bernardin, G. (2014). "Description of Dogs and Owners in Outdoor Built-Up Areas and Their More-Than-Human Issues." *Environmental Management*, 54(3), 383–401.

The case study demonstrates the interaction between built environments, people and dogs. Observational data from three different park areas in Lyon, France provided insight into presence of dogs in parks and where there is opportunity to improve integration. Dogs were of little nuisance to people and the environment through out observations but there was a need for more variety in the types of areas that allowed dogs. The frequency and patterns of use varied by park location. A list of built environment features for each park and how that may have correlated would be useful.

Kerr, J., Rosenberg, D., and Frank, L. (2012). "The Role of the Built Environment in Healthy Aging: Community Design, Physical Activity, and Health among Older Adults." *CPL bibliography*, 27(1), 43–60.

The systematic review examines the relationship between the built environment and physical activity in older adults. The study break down articles into the following categories: total walking behavior to built environment variables, walking type to built environment variables, and physical activity to built environment variables. The focus was around how to improve active living or aging in place through addressing the



neighborhood environment. Part of aging in place includes mobility beyond the home to reduce isolation. Implications to study results indicate that older adults desire walkable neighborhoods with access to shops and transit and urban planning has an opportunity to develop new design solutions for this growing population.

Michael, Y. L., Green, M. K., and Farquhar, S. A. (2006). "Neighborhood design and active aging." *Health & place*, 12(4), 734–740.

In a series of nine focus groups, 60 adults over the age of 55 provided insight into the role of neighborhood design on their physical activity. Participants were placed in groups based on neighborhood. The questions asked about features they liked and disliked, activities they do without a car, how much difficulty they have walking in their neighborhood, and what their ideal neighborhood is like as they age. Photos were also shown of their neighborhood. Primary emergent themes included having destinations to walk, meeting others, staying active, lack of pedestrian infrastructure, feeling unsafe, attractiveness of landscape and buildings, and access to transportation. The sample included adults that identified as mostly active and may not represent those with disabilities or physical challenges. Also low SES neighborhoods were not represented.

Thorpe, R. J., Simonsick, E. M., Brach, J. S., Ayonayon, H., Satterfield, S., Harris, T. B., Garcia, M., Kritchevsky, S. B., and for the Health, A. and B. C. S. (2006). "Dog Ownership, Walking Behavior, and Maintained Mobility in Late Life." *Journal of the American Geriatrics Society*, 54(9), 1419–1424.

In a cross sectional and longitudinal study design of 2533 adults aged 71-82, dog ownership was shown to facilitate walking behavior; however, only a small amount of older dog owners actually walked their dog. Dog owners who walked their dog had a mobility advantage (speed and distance) similar to older adults who walk without a dog. The study raises the question of whether dog ownership encourages walking or those who like to walk obtain a dog. Participants at 3 years who walked their dog at baseline were twice as likely to meet recommended walking levels compared to other groups in the study. Neighborhood environment and psychosocial factors were not measured.

Toohey, A. M., McCormack, G. R., Doyle-Baker, P. K., Adams, C. L., and Rock, M. J. (2013). "Dog-walking and sense of community in neighborhoods: Implications for promoting regular physical activity in adults 50 years and older." *Health & Place*, 22, 75–81.

The study explores the relationship between: dog ownership, neighborhood characteristics, neighborhood based recreational walking, and sense of community. The cross-sectional design randomly sampled 884 adults over the age of 50 with a median age of 62. Surveys were administered by mail and phone. Participants were categorized into frequent dog walker (FDW), non-frequent dog walker (NFDW), and non-owner (NO). Frequency and distance of walking were measured using the International Physical Activity Scale. Neighborhood features of street layout, proportion of green space, and population density were captured using municipal level administrative boundary data. Sense of community was measured with the Psychological Sense of Community in the

Neighborhood Scale. FDW had higher odds of meeting greater than 150 minutes of walking each week and a higher sense of community than non-owners. Participants who lived in warped grid neighborhoods had higher odds of meeting greater than 150 minutes of walking a week. Frequent dog walking in older adults may have health benefits through increased physical activity and a stronger sense of community.

Winters, M., Barnes, R., Venners, S., Ste-Marie, N., McKay, H., Sims-Gould, J., and Ashe, M. C. (2015). "Older adults outdoor walking and the built environment: does income matter?" *BMC Public Health; London*, 15, 876.

In a cross sectional study of 1309 adults over 65, self-reported physical activity over the past 7 days was collected and compared against the Street Smart Score of participants home area. The study achieved a sufficient response rate of 74%. Motivations for walking were not captured. Increasing walkability was associated with increased walking, and demonstrated the influential role of built environments on older adults health. There was not a significant interaction between different income groups when comparing walking levels and neighborhood walkability.

## APPENDIX B: IMPLEMENTATION PLAN

The implementation plan is organized by task and corresponding subtasks. This section provides a description of each overarching task and then intended outcome after completing all necessary steps. Objectives 1-3 listed in research goals align with the tasks below. At the end this section, a project schedule and required resources are provided.

### ***Task 1: Identify features in the built environment***

Task 1 involves developing an initial grouping of built environment features relevant to older adults and dog walkers. These features will guide the questioning of the Delphi study. Subtasks needed to complete task 1 include:

- 1.1 Conduct content analyses of literature to identify key environmental features influential to walking in adults, older adults, and dog walkers.
- 1.2 Organize features in the literature based on overarching domain. The goal is to create an initial organization and structure to the different features within the built environment pertaining to walking in older adults.
- 1.3 Compare and contrast the features relevant to adults vs. dog walkers in order to see where there is overlap or opposition.

### ***Task 1 Outcome***

After completing task 1, an initial organizational structure will be developed and include relevant features organized based on domain. Task 1 will create the scaffolding to complete a structured and thorough Delphi Study. By identifying built environment features, experts in task 2 will be able to edit the features versus identifying new.

### ***Task 2: Validate features through a Delphi study***

Task 2 involves editing and ranking the features by a panel of experts and determining which features have high and low consensus. Subtasks needed to complete task 2 include:

- 2.1 Design the protocol for the Institutional Review Board at Virginia Tech. The protocol will include how participants will be recruited, length of participation, level of risk to participants, benefits, and what is being asked of participants. The application will also include a copy of the consent form, sample recruit emails, and questions intended for participants. This application will be submitted through the online system at Virginia Tech.
- 2.2 Identify and recruit experts from Urban Planning, Gerontology, and Veterinary Medicine
- 2.3 Develop a questionnaire for round one with a five point likert scale for each variable.
- 2.4 Evaluate the results of round one and organize features into a hierarchy of domains, elements, and characteristics. Develop a questionnaire for round two, which allow experts to assign relative importance to each variable on a scale from 0-100.
- 2.5 Conduct descriptive statistics from round two data, prepare summaries of individual results with group results, and present the findings back to the experts for round three.
- 2.6 Analyze data from round three. Calculate new means for features and summarize qualitative feedback provided by experts.

### ***Task 2 Outcome***

After completing task 2, a three round Delphi study will have concluded and the features identified in task 1 will be validated by expert review. A hierarchical clustering of features will be developed based on the relative importance of each variable.

### ***Task 3: Elicit opinions from older adults***

Task 3 involves interviewing older adults living in senior living communities to understand the features in the built environment they feel influence walking. Photos taken by older adults will guide the interviews. Design features identified by will be thematically coded. The themes identified through task 3 will be incorporated into the hierarchy of design features from task 2.

3.1 Secure commitments from senior living facilities and recruit older adults for participation.

3.2 Provide instructions for walk and conduct interviews.

3.3 Thematically code, summarize and present back themes to senior living community.

3.4 Develop a final ontology describing walkable built environments for older adults and dog walker based on the hierarchy from phase two and the themes from phase three.

### ***Task 3 Outcome***

After completing task two and three, I will compare the results. Differences in priority features may be explained by the nuanced individualized differences in competency among older adults.

I will then incorporate the identified themes from task three into the hierarchy of features resulting in a final ontology. The themes will provide qualitative descriptions of the features help to identify relationships between the domains and sub classes. The ontology will serve as a resource for planners who wish to create more inclusive spaces across age groups and companion animals. While the outcome is not a validated tool, the organized knowledge base could be used in the future to develop a design tool.

**Table 1: Project Schedule**

Tasks	Year 2 2018-2019			Year 3 2019-2020		
	May-Aug	Sep-Dec	Jan-April	May-Aug	Sep-Dec	Jan-April
<b>Task 1.0</b>						
1.1 Conduct literature analysis						
1.2 Organize features						
1.3 Compare and contrast features						
<b>Task 2.0</b>						
2.1 Design study protocol						
2.2 Recruit experts and gain consent						
2.3 Develop questionnaire for round one						
2.4 Create initial variable hierarchy for round two and questionnaire						
2.5 Conduct descriptive statistics for round two and present findings						
2.6 Conduct descriptive statistics round three						
<b>Task 3.0</b>						
3.1 Secure facility commitments						
3.2 Provide walk instruction and interview participants						
3.3 Code, summarize and present back themes						
3.4 Develop ontology of built environment features						
<b>Project Milestones</b>						
Dissertation pre-defense						
Dissertation defense						
Dissemination of results: conferences and publications						

**Table 2: Resources by Task**

Task	Resources
Task 1: Identify built environment features	Access to peer reviewed journals
Task 2: Validate features via Delphi Study	Commitment of experts and Qualtrics survey tool,
Task 3: Elicit opinions from older adults	Interview space, cameras, recording equipment

## APPENDIX C: DELPHI STUDY CONSENT FORM

*Title of research study:* Exploring Walkability Needs and Wants of Older Adults: A Delphi Study

Principal Investigator:  
Dr. Pamela Teaster, [pteaster@vt.edu](mailto:pteaster@vt.edu)

Other study contact(s):  
Carlisle Shealy, [ecs@vt.edu](mailto:ecs@vt.edu)  
Dr. Annie Pearce, [apearce@vt.edu](mailto:apearce@vt.edu)  
Virginia Buechner- Maxwell, [bmax@vt.edu](mailto:bmax@vt.edu)

Key Information: The following is a short summary of this study to help you decide whether or you would like to participate. More detailed information is listed later on in this form.

The purpose of this study is to understand which features in the outdoor environment are most important to walking among older adults. Participants will be asked to complete three rounds of surveys on online. The survey involves modifying a list of features and assigning relative importance to each feature. In the third round of surveys, participants will see their response as well as the average group response. Participants can keep their answer or change their answer. Participants will have one week to complete the survey and a two-week break between surveys. At the end of survey three, participations will be complete.

To be eligible for participation, you must meet the following criteria:

1. Have at least 5 years of relevant work experience in one or more of the following disciplines: Gerontology, Public Health, Urban Planning, and/or Human-Animal Companionship
2. If you are academic experts you need to have at least one relevant publication.
3. If you are a practitioner, you need to be involved in at least one relevant community based project.
4. Be available to participate between September 2019 and November 2019

Who can I talk to?

If you have questions, concerns, or complaints, or think the research has hurt you, talk to the research team at 540-818-7732 or by email at [ecs@vt.edu](mailto:ecs@vt.edu).

This research has been reviewed by the Virginia Tech Institutional Review Board (IRB). You may communicate with them at 540-231-3732 or [irb@vt.edu](mailto:irb@vt.edu) if:

- You have questions about your rights as a research subject
- Your questions, concerns, or complaints are not being answered by the research team
- You cannot reach the research team
- You want to talk to someone besides the research team to provide feedback about this research

How many people will be studied?

We plan to enroll around 45 people in this research study, with a sampling of participants from each discipline area listed above.

What happens if I say yes, I want to be in this research?

- You will confirm you meet the inclusion criteria, ask questions, and review the consent form. You will also confirm your availability to take part in the study starting in September of 2019.
- You will be asked to sign a consent form online before completing the surveys.
- You will then answer a set of demographic and background questions about your career and experience. After completing background information, you will complete round one. Round one survey documents will be emailed to you and will involve working off a spreadsheet. You will be asked to modify, add, and/or comment on groupings of features in the outdoor environment.
- Two weeks later you will complete survey two. You will receive the link the survey two via email. This involves prioritizing the features. You will then have another two week break before completing survey three. Survey three will allow you to see what you prioritized as well as group averages. You can either keep or change your response. You will be able to provide an explanation if you change your answer.
- The surveys will take around 30 minutes to complete. You will have one week to complete the surveys. Your total time commitment is less than two hours.
- You will interact with researchers via email and telephone. The research activities will take place remotely. No in person meetings are required.

What happens if I say yes, but I change my mind later?

You can leave the research at any time, for any reason, and it will not be held against you.

If you decide to leave the research, contact the investigator so that the investigator can remove you from the contact list for future scheduling of research activities.

If you withdraw from the study we may ask why you have decided to withdraw. The information collected up to that point will be kept private and confidential.

Is there any way being in this study could be bad for me? (Detailed Risks)

Participating in this study has minimal risks. The potential minimal risks are described below.

- Participation poses minimal risk given the sole activity is survey completion. Participating in this study does not increase the risk of physical or emotional harm.
- Your responses to questions will not be shared with your employer. They will be kept confidential. There is minimal risk that this confidentiality will be broken.
- There is potential for personal information to be accessed, however many security measures will be taken to keep your information private such as password protected computers and locked office for study documents.

What happens to the information collected for the research?

We will make every effort to limit the use and disclosure of your personal information, including research study and medical records, only to people who have a need to review this



information. We cannot promise complete confidentiality. Organizations that may inspect and copy your information include the IRB, Human Research Protection Program, and other authorized representatives of Virginia Tech.

If identifiers are removed from your private information collected during this research, that information could be used for future research studies or distributed to another investigator for future research studies without your additional informed consent.

The results of this research study may be presented in summary form at conferences, in presentations, reports to the sponsor, academic papers, and as part of a thesis/dissertation.

What else do I need to know?

Please contact the research team if you are interested in participating or have questions about eligibility. Carlisle Shealy is the primary contact. Her email is [ecs@vt.edu](mailto:ecs@vt.edu)

Please type your name below

Please type today's date below

Do you consent to participating in this research study? Please check yes or no.

<input type="checkbox"/>	<b>Yes, I consent to participating in this study</b>
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<input type="checkbox"/>	<b>No, I decline participating in this study</b>
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## APPENDIX D: RECRUITMENT EMAILS FOR DELPHI STUDY

Protocol #19-421

Subject Line: Help Us Understand Design Priorities for Older Adult Dog Walkers

Hello,

My name is Carlisle Shealy and I'm a Ph.D. candidate at Virginia Tech. Dr. Pamela Teaster provided me with your name as a potential participant. I am working on a research study about inclusive walkable environments for older adult dog walkers. I am recruiting both academic professionals and practitioners who are involved in planning and design, management of outdoor spaces, older adults, or human-animal relationships to take a series of three online surveys. Participants will prioritize features in the outdoor environment they think are relevant to older adult dog walkers.

Each online survey will take 20-25 minutes to complete, and questions are designed to ask you how features should be grouped, followed by questions about which features you think, based on your professional opinion, are most important to older adult dog walkers. While you may only have expertise in one area, your opinions will be combined with that of other experts.

Your participation in this research will enable researchers to better understand design priorities of outdoor walkable spaces specific to the needs and wants of older adult dog walkers. Outdoor spaces that effectively integrate features for older adults and dogs have the potential to increase physical activity levels and socialization for an older demographic.

To participate, please follow the link to consent and begin Survey One. Survey One will close on January 3<sup>rd</sup>, Survey Two will begin mid- January, and Survey Three will begin mid-February.

Participation is completely voluntary and there is no compensation.

Please forward this email to colleagues you think may also be a good fit for this study.

If you have any questions, please feel free to email me. Thank you for your time!

Respectfully,

Carlisle Shealy

Virginia Tech, Ph.D. Candidate  
Environmental Design & Planning  
BioBuild Fellow<sup>[L]</sup> Myers-Lawson School of Construction  
Blacksburg, VA

## Appendix D Continued

Protocol # 19-421

Subject Line: Survey Two: Design Priorities for Older Adult Dog Walkers

Dear XXX,

Thank you again for taking the time to complete survey one. Your input was a valuable contribution to the development of Survey Two. In Survey Two, you will be asked to prioritize the features within each of the seven categories from Survey One.

Here is the link to begin Survey Two, which will close on Friday February 28th\_\_\_\_\_.

Survey link:

If you have any questions, please feel free to email me. I appreciate your continued participation.

Respectfully,

Carlisle Shealy

Virginia Tech, Ph.D. Candidate  
Environmental Design & Planning  
BioBuild Fellow<sup>[1]</sup><sub>[SEP]</sub> Myers-Lawson School of Construction  
Blacksburg, VA

## APPENDIX E: DELPHI STUDY SAMPLE SURVEYS

### Group 2: **PATH DESIGN**

For the following path design features, determine if you think the features should be kept as is, need further clarification, or need to be reworded. Drag them into the corresponding boxes. Numbers do not correspond with priority.

Items	Keep as is
connectivity/location of path	Needs further clarification
entrances/ access points	
levelness/shape/width of path (hills/gradient, slope/incline)	Needs to be reworded
path use (pedestrian only, cycling, mixed use)	
surface type (asphalt, pavement, gravel, pebble, synthetic, earth, ground cover)	

Figure E-1. Round one survey example

## PATH DESIGN

The first category of features is **Path Design**. This includes features related to the function, ease, and design of the walking path.

Here are the **8 features in Path Design** that resulted from your input in Survey One. Please use the sliders to indicate how important you think each one is. It's okay to leave the slider at zero if you think that feature isn't important at all.

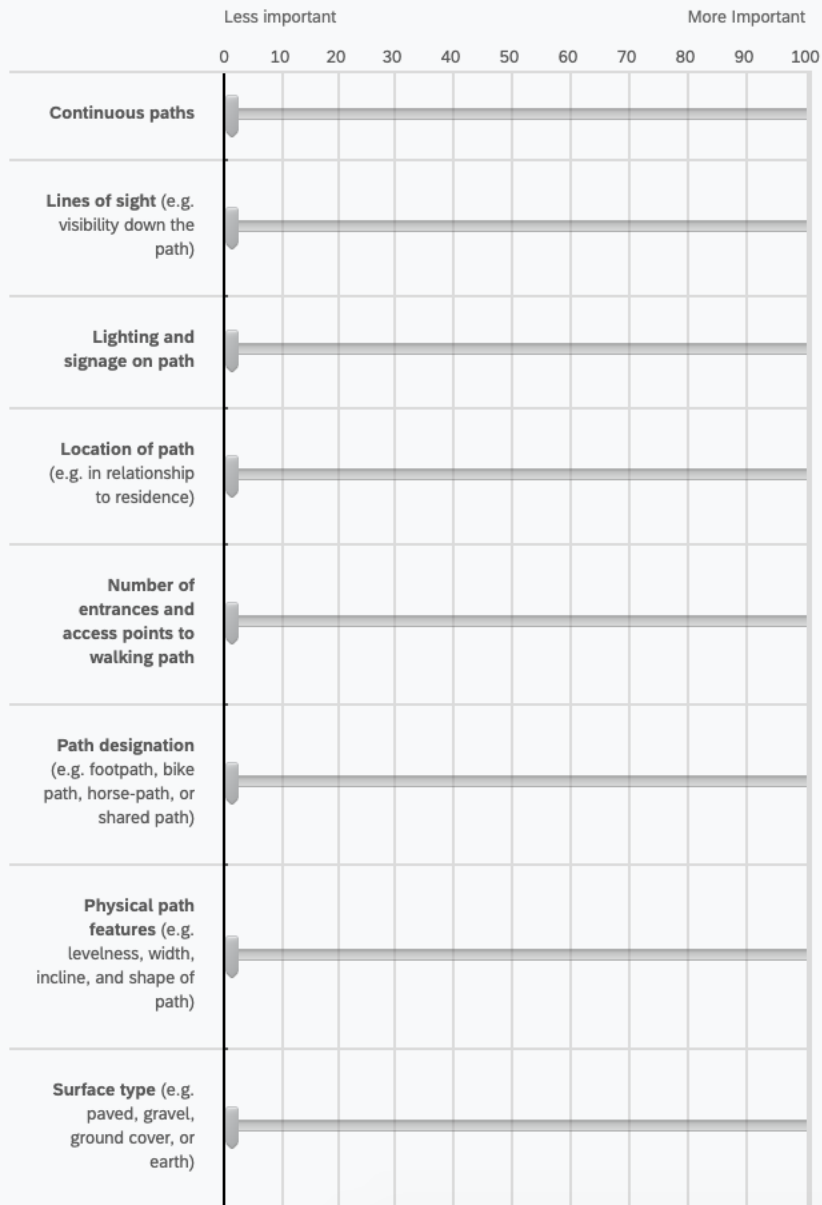


Figure E-2. Round two survey example

**PATH DESIGN**

Below are 8 features of **path design**. This includes features related to function, ease, and design of the walking path. Our goal is to understand which path design features are most relevant to older adult dog walkers.

In survey two, you provided a score of importance from 0-100, with 0 being unimportant and 100 being very important. The group median and your score are provided below. Please indicate your new score or enter your current score if you do not wish to change.

		Please indicate your new score
<b>Continuous paths</b>		
Median	Your Score	<input type="text"/>
76	\${e://Field/Q12_7}	
<b>Lines of sight (e.g. visibility down the path)</b>		
Median	Your Score	<input type="text"/>
70	\${e://Field/Q12_6}	
<b>Lighting and signage on path</b>		
Median	Your Score	<input type="text"/>
80	\${e://Field/Q12_8}	
<b>Location of path (e.g. in relationship to residence)</b>		
Median	Your Score	<input type="text"/>
82	\${e://Field/Q12_1}	
<b>Number of entrances and access points to walking path</b>		
Median	Your Score	<input type="text"/>
70	\${e://Field/Q12_2}	
<b>Path designation (e.g. footpath, bike path, horse-path, or shared path)</b>		
Median	Your Score	<input type="text"/>
75	\${e://Field/Q12_4}	
<b>Physical path features (e.g. levelness, width, incline, and shape of path)</b>		
Median	Your Score	<input type="text"/>
85	\${e://Field/Q12_3}	
<b>Surface type (e.g. paved, gravel, ground cover, or earth)</b>		
Median	Your Score	<input type="text"/>
84	\${e://Field/Q12_5}	

Figure E-3. Round three survey example

## APPENDIX F: WARM HEARTH STUDY CONSENT FORM

*Title of research study:* Exploring Walkability Needs and Wants of Older Adult Dog Walkers Through Photovoice

Principal Investigator:  
Dr. Pamela Teaster, pteaster@vt.edu

Other study contact(s):  
Carlisle Shealy, ecs@vt.edu  
Dr. Annie Pearce, apearce@vt.edu  
Virginia Buechner- Maxwell, bmax@vt.edu

Key Information: The following is a short summary of this study to help you decide whether or you would like to participate. More detailed information is listed later on in this form.

The purpose of this study is to understand the walking experience of older adult dog walkers. Participants will be asked to first complete three surveys. Then participants will schedule a time to go on a familiar walk with their dog. On this walk, participants will be asked to describe features in the outdoor environment that feel both positive and negative. A research assistant will accompany the walks to take photos of the features described by participants. After the walk, participants will participate in a short interview to talk about the photos.

To be eligible for participation, you must meet the following criteria:

1. Be 65 years of age or older
2. Own a dog which you are comfortable walking
3. Be a resident of Warm Hearth Village in either active or independent living
4. Be physically able to walk your dog for at least 20 minutes

Detailed Information: The following is more detailed information about this study in addition to the information listed above.

Who can I talk to?

If you have questions, concerns, or complaints, or think the research has hurt you, talk to the research team at 540-818-7732 or by email at ecs@vt.edu.

This research has been reviewed by the Virginia Tech Institutional Review Board (IRB). You may communicate with them at 540-231-3732 or irb@vt.edu if:

- You have questions about your rights as a research subject
- Your questions, concerns, or complaints are not being answered by the research team
- You cannot reach the research team
- You want to talk to someone besides the research team to provide feedback about this research

How many people will be studied?

We plan to enroll 15 people in this research study.

What happens if I say yes, I want to be in this research?

- You will confirm you meet the inclusion criteria, ask questions, and provide informed consent.
- You will be asked to schedule a walking time and interview time. The walk will happen first and the interview will take place within two weeks after the walk.
- You will be asked to answer three surveys about your walking habits and dog ownership, general health, and walking self-efficacy.
- The surveys will take around 20-30 minutes to complete, the walk will last around 30 minutes, and the interview will last around 30 minutes. Your total time commitment is less than two hours.
- The interview will be audio recorded
- You will interact with researchers during the consenting process, survey completion, walk, and interview.
- The research activities will take place at Warm Hearth Village. The walk will take place at Warm Hearth on a familiar walking route.
- On your walk, someone will accompany you from the research team to take photos. This person will provide you with a prompt about the environment and take photos of features you discuss.
- The photos from your walk will be printed for use during your interview. A research team member will meet with you in person to talk about the photos. With your permission the session will be recorded.

What happens if I say yes, but I change my mind later?

You can leave the research at any time, for any reason, and it will not be held against you.

If you decide to leave the research, contact the investigator so that the investigator can remove you from the contact list for future scheduling of research activities.

If you withdraw from the study we may ask why you have decided to withdraw. If you withdraw after participating in the walk, you will be asked if you want copies of the photos taken. The information collected up to that point will be kept private.

Is there any way being in this study could be bad for me? (Detailed Risks)

Participating in this study has minimal risks. The potential minimal risks are described below.

- Walking with your dog has minimal risk, however there is the potential to trip or fall by having your dog on a leash. We ask that you walk on a familiar route with your own dog to minimize this risk. If you feel unsafe walking your dog on a leash please inform a researcher. A contact person on site at Warm Hearth will be available and aware of the walks to help in the event of an emergency.
- The survey about your general health and self-efficacy on walking may cause an emotional response. Researchers will be available to answer your questions or concerns. You may skip any questions that feel uncomfortable to answer.



- There is potential for personal information to be accessed, however many security measures will be taken to keep your information private such as password protected computers and locked office for study documents.

What happens to the information collected for the research?

We will make every effort to limit the use and disclosure of your personal information, including research study and medical records, only to people who have a need to review this information. We cannot promise complete confidentiality. Organizations that may inspect and copy your information include the IRB, Human Research Protection Program, and other authorized representatives of Virginia Tech.

If identifiers are removed from your private information collected during this research, that information could be used for future research studies or distributed to another investigator for future research studies without your additional informed consent.

The results of this research study may be presented in summary form at conferences, in presentations, reports to the sponsor, academic papers, and as part of a thesis/dissertation.

What else do I need to know?

After completing this study, you will receive a \$10 Kroger gift card for participating.

Once this study is completed, we will share study results in a group presentation to both participants and residents of Warm Hearth. Identifiable photos will only be used if the participant gives permission. Participants may also indicate if they wish for their face or their dogs to be blurred. You will be asked if you wish for your photos to be shared and to what extent or excluded. There is no obligation to have your photos shared. Please indicate your preference below by placing your initials next to one of the following statements

\_\_\_\_\_ I give permission for my photos to be shared.

Do you wish for your face or dogs face to be blurred? Please explain.

\_\_\_\_\_ I do not give permission for my photos to be shared.

Signature Block for Capable Adult

Your signature documents your permission to take part in this research. We will provide you with a signed copy of this form for your records.

Signature of subject	Date
Printed name of subject	
Signature of person obtaining consent	Date
Printed name of person obtaining consent	

## APPENDIX G: WARM HEARTH STUDY RECRUITMENT INFORMATION

Warm Hearth Information Letter: Dog Walking Study

Dear \_\_\_\_\_,

Living in Warm Hearth Village, there are many options and places to walk your dog. Some may feel more appealing and dog friendly than others. We would like to understand what you think makes outdoor spaces most ideal for walking your dog.

In order to do so, Pamela B. Teaster, Ph.D., Professor and Director of the Virginia Tech Center for Gerontology and Carlisle Shealy, MPH, Doctoral Candidate, Department of Building Construction, are embarking on a study entitled *Exploring Walkability Needs and Wants of Older Adult Dog Walkers*. The **purpose** is to explore how features in the built environment promote or discourage walking among older adult dog owners.

After conducting research and analyzing the data, Dr. Teaster and Ms. Shealy will use information from residents and present the results back to the Warm Hearth Village. We also anticipate the results will better inform the design of outdoor spaces that are inclusive to older adult dog walkers.

**On behalf of the Virginia Tech research team**, we are writing to ask if you would accept the invitation of the Virginia Tech researchers to participate in the study, which involves a one-time guided walk at Warm Hearth of approximately 30 minutes followed by an interview. The interview will be audio recorded. Your participation is entirely voluntary and confidential. You will be compensated \$10 for your time.

For more information about this study, you may contact Dr. Pamela Teaster directly using her email address [pteaster@vt.edu](mailto:pteaster@vt.edu) or telephone number: 540-231-7657. You may also contact Mrs. Carlisle Shealy, co-investigator, by email at [ecs@vt.edu](mailto:ecs@vt.edu), (mention the dog walking study). After collecting and analyzing the data, Dr. Teaster and Ms. Shealy will share the results in a short presentation given at Warm Hearth. We will invite you to attend the presentation, which we anticipate will be in fall of 2019.

Many thanks for considering our request.

Sincerely,

Warm Hearth Village

## Participants needed for study about dog walking

Want to learn more?

An information session is being held at Warm Hearth Village Center.

**Location:** Warm Hearth Village Center  
Conference Room

**Address:** 2387 Warm Hearth Drive,  
Blacksburg, VA 24060

**Date:** Wednesday, November 6th

**Time:** 11:00am-1:00pm



*The purpose of this study* is to explore how features in the outdoor environment promote or discourage walking among older adult dog owners.

Background: Living in Warm Hearth Village, there are many options and places to walk your dog. Some may feel more appealing and dog friendly than others. We would like to understand what you think makes outdoor spaces most ideal for walking your dog.

Study participation involves a one-time guided walk at Warm Hearth lasting approximately 30 minutes, followed by an interview. The interview will be audio recorded. Participation is entirely voluntary and confidential. Participants will be compensated \$10 for their time.

**To be eligible for participation, participants must meet the following criteria:**

1. Be 65 years of age or older
2. Own a dog you are comfortable walking
3. Be a resident of Warm Hearth Village in either active or independent living
4. Be physically able to walk your dog for at least 20 minutes

For more information about this study, you may contact either:

Carlisle Shealy, Doctoral Candidate, by email at [ecs@vt.edu](mailto:ecs@vt.edu) or phone: 843-364-7499 or  
Dr. Pamela Teaster, Director for the Center of Gerontology, by email at [pteaster@vt.edu](mailto:pteaster@vt.edu) or  
phone: 540-231-7657

This is a Virginia Tech research study and all investigators are affiliated with Virginia Tech.

## Appendix G Continued: Warm Hearth Recruitment Session Script

Good morning/afternoon,

Thank you for taking the time to attend this information session. I am excited to tell you more about our study on older adult dog walkers. Before I do, I want to introduce myself. My name is Carlisle Shealy, and I am currently a PhD student in Environmental Design and Planning at Virginia Tech. The study investigators involve myself along with faculty from Virginia Tech. I am passionate about studying ways to make the outdoor environment more walkable for older adults.

Today I will share with you the purpose of this research study, the inclusion criteria for participating, what is involved in participating, and the timeline. I will also pass around the consent form for you to review and take home. If you meet the inclusion criteria and would like to participate you may speak with me today or reach me by phone or email.

***The purpose of this study*** is to explore how features in the built environment promote or discourage walking among older adult dog owners. Participation involves a one-time guided walk at Warm Hearth of approximately 30 minutes followed by an interview. Photos will be taken during the walk and printed before the interview. The interview will be audio recorded and will last about 30 minutes.

To be eligible for participation, participants must meet the following criteria:

1. Be 65 years of age or older
2. Own a dog which you are comfortable walking
3. Be a resident of Warm Hearth Village in either active or independent living
4. Be physically able to walk your dog for at least 20 minutes

Your participation is entirely voluntary and confidential. You will be compensated \$10 for your time. The study is set to take place this fall.

I am happy to answer any questions you may have about this study.

## APPENDIX H: WARM HEARTH STUDY SCRIPTS

### Instructions for Guided Walk

Details about your upcoming walk:

#### Purpose

The purpose of your participation is to understand what features in the built environment influence your walk with your dog. The built environment refers to the physical characteristics of a space such as sidewalks and roads as well as the appearance. As you walk, the researcher will capture photos you feel are important. These can be features that are positive and negative.

#### How to prepare for your walk

- 1) A research team member will contact you the day before your scheduled walk to confirm the time and location.
- 2) Wear comfortable clothes for walking.
- 3) Be sure you bring your dog and a leash.
- 4) After completing your walk, you will confirm your interview time.

#### How will we capture the walk through photos?

When you see, feel, or hear something in the environment that impacts your walk, talk about it with the researcher on the walk. Be specific about the feature you are referencing. For example, when I walk, having wide sidewalks with no obstructions makes it easier for me to walk my dog.

#### As you think about features consider the following:

- What makes your walk enjoyable or unenjoyable?
- What provides you comfort or discomfort?
- What serves as a barrier or enabler to walking?
- What makes you feel safe or unsafe?
- What provides ease or creates frustration?
- What motivates you to keep walking?
- Are there places you can or can't walk to?
- What do you like or dislike about the landscape?
- Does the outdoor space meet your dog's needs?

#### Questions

Please contact me if you have questions about your upcoming walk.

Carlisle Shealy, MPH

## **Appendix H: Design Goal Prompts Used on the Walk**

- access/ accessibility/ availability of destinations
- aesthetics/ attractiveness
- cleanliness
- comfort/ thermal comfort
- connectivity of routes
- convenience/ directness of routes
- diversity/ mix/ variety of destinations
- dog friendliness
- enjoyable/ pleasurable/ peaceful/ purposeful
- family friendliness
- inclusiveness of routes, streets, and destinations
- maintained/ kept amenities
- maintained/ kept paths
- personal safety
- proximity/ distance to amenities
- proximity/ distance to destinations
- traffic safety
- visual interest/ scenery/ views

## Appendix H Continued: Warm Hearth Study Interview Prompts

### Pre-Interview Verbal Script

Thank you for your willingness to participate in the interview portion of this study about older adult dog walkers. Since we met last, I have prepared the photos from our walk. We will review these photos together and discuss specific aspects within the photos. Our session will be audio reordered so they can be reviewed at a later time.

Do I have your permission to record this session?

First, take a moment to review the printed photos. Here is a notepad if you want to take any notes about the photos. We will discuss them together after you have had a chance to look at them. Take a few minutes now to look at the photos. When you are done please let me know and we can begin the questions I have prepared.

The following questions and prompts will help guide the semi structured interviews.

1. In general when you look at these photos what features served as a barrier or enabler to your walk? What about to your dog?
2. What features in these photos made your walk enjoyable or unenjoyable?
3. What features in the photos provided you comfort or discomfort?
4. What features made you feel safe or unsafe? Where they personal or traffic related?
5. Were there features that motivated you to keep walking?
6. What features in these photos did you consider dog friendly?
7. Did you find the walk to be aesthetically pleasing? Which features in the photos made the walk pleasing or unpleasing?
8. What features made the walk convenient or inconvenient?
9. What features provided visual interest? Was there a lack of visual interest?
10. What features made the walking path feel accessible or inaccessible?
11. Are there features you encountered on your walk that aren't represented in the photos you want to discuss?

## APPENDIX I: WARM HEARTH STUDY DEMOGRAPHIC SURVEY

### Demographic Survey

Study Participant:

Date of walk:

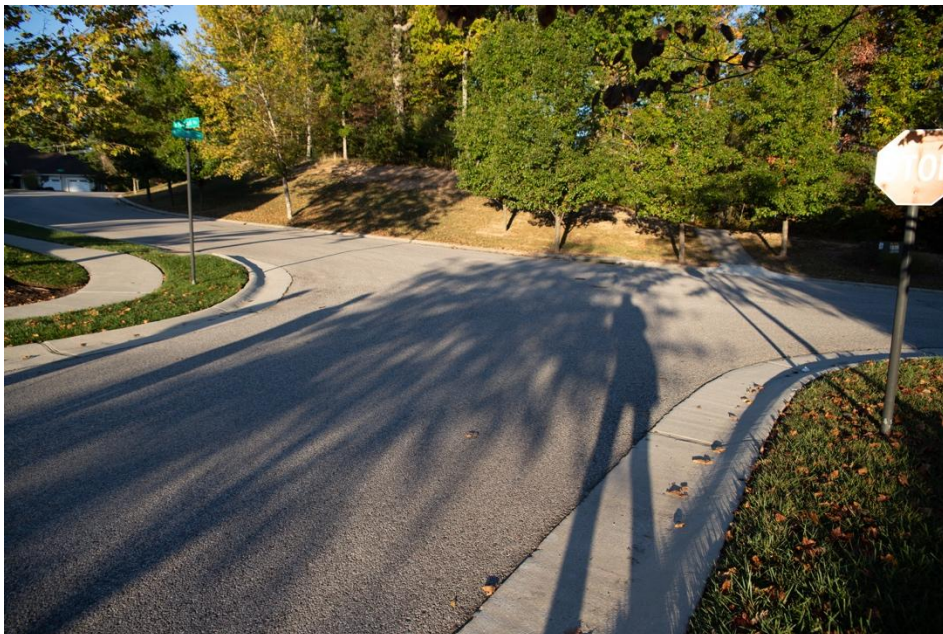
<b>Demographic questions</b>		
1.	Are you male or female?	
2.	What is your age range? Circle one	65-69   70-74   75-79 80-84   85+
3.	What is your highest level of education?	
4.	How would you describe your race or ethnicity?	
5.	Do you have any health conditions that impact walking?	
<b>Dog specific questions</b>		
6.	How old is your dog(s)?	
7.	What is your dog's breed and size?	
<b>Walking Questions</b>		
8.	What time of day are you walking?	
9.	How long do you plan to walk?	
10.	Who is joining you on your walk?	
11.	Where do you plan to walk?	
12.	What is the weather like the day of your walk? (rain, sun, hot, cold)	
13.	Typically how many days a week do you walk?	
14.	Of those walks, how often do you bring your dog?	
15.	On average how many minutes do your walks last?	



**APPENDIX J: WARM HEARTH STUDY PHOTOGRAPHS FROM WALKS**

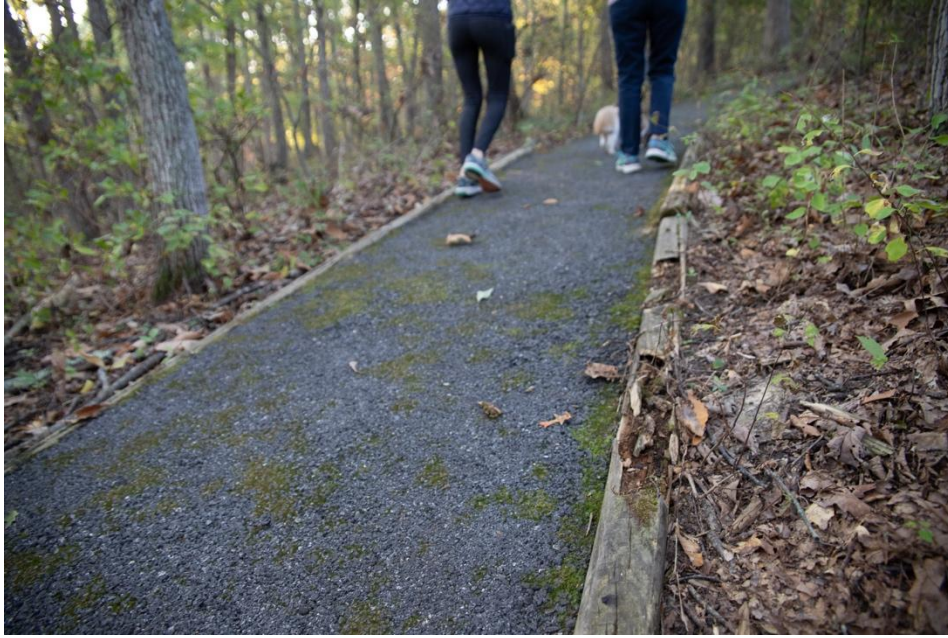


**Figure H-1. Woods Edge neighborhood**



**Figure H-2. Crossing in Woods Edge**





**Figure H-3. Paved walking trail in Warm Hearth Village**



**Figure H-4. Dog waste station in Woods Edge**



**Figure H- 5. Lighting in Woods Edge**



**Figure H-6. Driveway modification in Woods Edge**





**Figure H-7. Wooded dirt trail with down tree**



**Figure H-8. Leaves and nuts on paved trail**





**Figure H-9. Exposed railroads ties on paved walking trail**



**Figure H-10. Dog Park at Warm Hearth Village**