

Preventing Chronic Disease Among the Aged: A Call for Evidence-Based Design Research

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Abstract

The quality of the built environment and the public health and well-being of its inhabitants are profoundly interwoven. Among all age groups, the aged are particularly susceptible to disengagement or avoidance of the built environment and the physical exercise options it affords; this can have a deleterious influence on personal health. In this discussion, concepts drawn from the fields of architecture, landscape research, urban and regional planning, and environmental gerontology are drawn together in the context of a hybrid conceptual and operative model. This model is put forth to assist in the acquisition of knowledge in the field to further understanding of how chronic diseases among the aged can be reduced through the provision and utilization of sufficiently supportive outdoor physical activity options in the everyday environment. This hybrid model, the Prospect-Refuge Competency Index (PRCI), combines key elements of prospect-refuge theory and environmental press-competency theory. It can be applied to diverse settings and user constituencies. The discussion concludes with the presentation of a set of hypotheses for the neighborhood/community level and the residential/exterior environs level of inquiry.

Key Words: *Aged, chronic disease, elderly, research, urban planning and architecture, research methods, public health*

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Introduction

Older Americans increasingly reside in a widening array of community and neighborhood contexts that range from those dominated by the automobile and suburban sprawl, where walkable amenities are few and far between, to older community and neighborhood contexts where the aged reside in traditionally planned yet deteriorated inner urban neighborhoods. In the latter contexts the fear of crime may be a major concern. By contrast, in suburban contexts the fear of crime may be only a minor concern, yet the absence of nearby amenities that foster access to the outdoors may be the primary determinant in deciding whether or not to engage in health-promoting outdoor physical activity. This trend warrants attention on the part of the planning and design professions, medical and public health specialists, and public policy makers. Elderly persons in the United States aged 65 and older numbered 37.9 million in 2006. This group represented 14.8% of the total U.S. population, about one in every eight Americans. By 2030, there will be about 70 million older persons, more than twice the number

in 1996. People older than 65 are projected to represent 20% of the American population by 2030 (American Association of Retired Persons, 2007). Meanwhile, a growing number of elderly residents of inner urban and post-World War II (WWII) suburban bedroom communities seek to live independently in these communities for as long as possible (Frumkin, Frank, & Jackson, 2004).

Because of financial constraints, many aged people must remain where they bought their first home, perhaps in the same house where they raised their families. In this sense, the familiar is most preferred, despite the tendency of social isolation to increase among those residing alone (Krause, 1993). In one empirical investigation, in racially mixed neighborhoods the perception of crime among elderly residents overrode the actual crime rate in their neighborhood. Residents were most preoccupied with how “safe it felt” (Chiricos, McEntire, & Gertz, 2001). This pattern also existed with respect to where one resided within the neighborhood (Espino, Lichtenstein, Palmer, & Hazuda, 2001).

The perception of fear among the aged is a powerful determinant in terms of their engagement with the outdoor realm (Issacs, 1983). As mentioned, prior empirical work on this topic has been linked with a significantly lower level of exercise activity for elderly persons who reside in unsafe neighborhoods (Ralston, 1999). In a study of perceived neighborhood safety and its relation to levels of physical inactivity among the aged, it was found that for persons greater than 65

years of age, 63.1% reported no outdoor activity whatsoever in the preceding month in neighborhoods rated as “not at all” safe by respondents (Verna, 1999). A study by the U.S. Centers for Disease Control and Prevention (1996) found that a higher level of outdoor physical inactivity was associated with one’s perception of his/her neighborhood. The likelihood of this occurring among the aged has also been identified, among aged men and women alike, with respect to walking to outdoor destinations (Cerin, Leslie, du Toit, Owen, & Frank, 2007) and has been linked with pedestrian-scaled neighborhood design attributes and travel options (Frank, Saelens, Powell, & Chapman, 2007). Older Americans who live in traditional neighborhoods tend to use public transit as a means to obtain physical exercise (Besser & Dannenberg, 2005). However, the aged poor often experience inequitable walking options to engage in physical exercise activity outdoors or to walk to and from existing public transit nodes (Frumkin, 2005).

Fear of crime also has been linked with whether one engages in outdoor leisure activity adjacent to one’s residence, affecting even the use or nonuse of one’s own yard (Boyce & Gutkowski, 1995; Burkhauser, Butrica, & Wasylenko, 1995). Fear has been identified as the key determinant in whether one ventures outdoors in severe climatological conditions, as was the case in Chicago during the prolonged heat wave during the summer of 1995. Excessively high temperatures for days on end caused more than 700 elderly persons to die in their homes and apartments in Chicago during a 1-week period of over 100-degree temperatures

(Klinenberg, 2002). Most of those who perished were known by their neighbors as chronic shut-ins who nearly always stayed indoors, and most died because they barred themselves behind shuttered doors and windows in fortress-like, quasi-lockdown conditions. Moreover, the effects of global climate change may be particularly harmful to the aged (Younger, Morrow-Almeida, Vindigni, & Dannenberg, 2008).

The objectives of this discussion are twofold: (1) To contribute to current knowledge on the interdependent relationship among public health, architecture, and community design; and (2) to outline a conceptual model for evidence-based research to improve the quality and efficacy of community planning, design, and revitalization from the standpoint of health promotion among the aged in the everyday milieu.

Background

It has been more than 30 years since the initial publication of the seminal text *A Pattern Language: Towns, Buildings, Construction* by Alexander and colleagues (1977). This compendium of community planning and architectural design guidelines was inclusive in its scope and level of inquiry from the region, city, neighborhoods, and transportation systems; to parks, meditative gardens and their therapeutic amenity, groupings of buildings, and individual structures; to the design of individual rooms in private dwellings. As the book traverses a broad continuum from macro to micro, a number of specific patterns addressed the critical interdependency among health promotion, outdoor physical activity, and

the design of the built environment. The New Urbanism movement, which coalesced in the past 20 years, owes a debt of gratitude to the work of Alexander and colleagues. Others have extolled the virtues of walkable, bikeable new towns based on the principles of traditional town planning, often inspired by the traditional European village (Peter & Scully, 1993). Earlier, Jacobs (1961) had extolled these virtues in her seminal book. By the 1990s, Jacobs' and others' themes were being boldly reprised. More recently, the deleterious effects of poor or nonexistent community planning and design have begun to be viewed as a serious public health threat (Duany, Plater-Zyberk & Speck, 2001). Similarly, the field of public health has embraced this movement, with a special issue of the *American Journal of Public Health* devoted to it in September 2003, and in a special issue of the *American Journal of Health Promotion* the same month. Both emphasized the deleterious consequences of a lack of access to situations and places where physical activity is promoted through environmental design. As a result, public health professionals are beginning to become acquainted with the transactional link between health and the built environment (Jackson, 2003; Malizia, 2005).

Zoning ordinances of the post-WWII period came under attack as inhumane (Newman, 1972) and their proponents' assumptions as extremely naïve (Hays, 1995). This was a central theme of Alexander and colleagues. Yet, as the Baby Boomer generation ages, perception increasingly has become equivalent to reality. A certain amount of this response has been fueled

by the sensationalized accounts of crime reported in the media and on the Internet. In an information-saturated popular culture, more and more aged individuals feel less and less secure outdoors in their neighborhoods and in the immediate environs around their place of residence. This has been a prime site and building design determinant in the thousands of assisted living facilities that have been built in recent years (Regnier, 2002). Among the aged, gated communities increasingly are viewed as safe havens from an uncertain, frightening “exterior” world. These places may provide a high level of personal safety, yet they afford little in the way of a genuine sense of community engagement for the aged or a place where one can engage in needed outdoor physical activity as a means to remain active and healthy (Wilson-Doenges, 2000).

A Conceptual Model of Health Promotion

Many aged persons experience some progressive loss in their ability to interact meaningfully with the physical environment beyond the relative safety of their residence. At times, the aged—not unlike persons of all ages—crave firsthand information about the world beyond, to extend outward. By contrast, at other times the need becomes great simply to retreat from the outside world, to draw inward. In his book *The Experience of Landscape* (1975), the British geographer Jay Appleton proposed a prospect-refuge theory of human aesthetics. The theory states that taste in art is an acquired preference for particular methods of satisfying innate predilections and that humans prefer conditions that are optimal

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for survival; that we respond to such conditions subconsciously; and that humans attracted to such conditions stand a better chance of survival in such places. The two attractors we are drawn to are opportunity (prospect) and safety (refuge). These two expressions of preference afford a means of understanding successful and enduring aesthetics, and the ability to predict their timeless manifestations. The theory predicts that humans are attracted to art and to physical settings that have broad, unoccluded vistas, visible places for easy refuge, water, plants, and a smattering of animal species. It further predicts that humans prefer spaces where one is positioned in an edge condition, i.e., with backs protected versus being in the middle of a space, where we are most exposed; and second, conditions in which we are covered or screened rather than fully exposed to the sky and the elements (Appleton, 1975). Settings characterized by prospect include uninterrupted panoramas, vistas defined by vertical or horizontal boundaries, for example under trees, a view from a cave entrance, indirect or secondary panoramas such as from a tower or mountain

lookout, and indirect secondary vistas such as a bend in a path that reveals a waterfall.

Through the work of Stephen and Rachael Kaplan (1989), interdependent behaviors associated with this theory have come to be known in environmental psychology as prospect-refuge behaviors. The two conditions, or states, represent endpoints of a single continuum. Prospect is represented by an 88-year-old widow's interest in taking evening walks in her neighborhood. She is drawn to the outdoors for the opportunity to obtain exercise, to smell freshly cut lawns and flowers, to feel and smell the evening breeze, and perhaps to socialize with her neighbors. On the other hand, she may engage in refuge-seeking behavior when she chooses to eschew social contact, physical exercise, and communality with the outdoor milieu. Human beings engage in a timeless, deep-rooted process to make sense of their surroundings in the built and natural environment, both indoors and out, as a function of the degree to which such activities threaten well-being (Herzog & Miller, 1998; Kaplan & Kaplan, 1982).

This theory has also informed studies on personal safety in relation to walking outdoors (Alfonzo, 2005); perceptions of personal safety in this context (Bolbaum & Hunecke, 2005; Ramanujam, 2006; Stamps, 2005); crime prevention protocol recommendations for increasing personal safety outdoors (Wilcox, Quisenberry, & Jones, 2003); the function of landscape design in relation to personal safety in inner city contexts (Kuo, Bacaicoa, & Sullivan, 1998; Kuo & Sullivan, 2001); children (Fischer & Shrout, 2006); personal safe-

ty while among persons with physical limitations (Stiles, Halim, & Kaplan, 2003); and appraisals of exterior areas on a college campus that varied in prospect, refuge, and hazard with regard to walking outdoors. The findings confirmed that fear of crime was highest in areas with refuge for potential offenders and low prospect of escape for potential victims (Fisher & Nasar, 1992). It was concluded that in outdoor places where people have a pronounced fear of crime, conditions that allow individuals to manipulate prospect, refuge, and escape could reduce the fear of crime and lead to a higher level of preference and hence, engagement. More recently, it was found that fear levels were highest in spaces on a college campus perceived as high in prospect and low in refuge, and that avoidance behaviors are the prime coping behavior in these situations (Petherick, 2000).

It is a push/pull dialectic. In an unpredictable, unstable setting, it is difficult to ascertain with accuracy if one will be able to meet one's objectives in order to function successfully. For the aged this is particularly serious, a challenge, because a frail individual with impaired hearing and/or eyesight is at a distinct disadvantage insofar as he or she is likely to experience a comparative loss of choice and control in interactions with the built environment. In short, unpreferred conditions tend to induce refuge seeking.

Despite this, in a world of increasing numbers of elderly and handicapped persons, more and more seek to live independently and participate to the fullest extent in the life of their community. It is also useful for this reason to examine the model

of environmental press-competency developed by Lawton and Nahemow (1973) and refined later by Lawton (1985). This dialectical model has been applied in the study of aged persons' preferences/nonpreferences for interactively designing animal exhibits in zoos (Verderber, Gardner, Islam, & Nakanishi, 1988) and in an investigation of the provision of space indoors and outdoors for the effective housing and care of personal pets (Verderber, 1991). Here, competency interacts with the difficulty, or press, inherent in a physical setting. An elderly individual possesses precise physical capabilities. In turn, the built environment exerts concrete, precise physical limitations upon the individual. The ability to adapt one's physical capability to these physical restrictions becomes the basis for what Lawton refers to as a "competency-press dialectic." Competency includes cognitive ability, psychological adjustment, physical health, and strength. Press is the sum of environmental forces that demand a response, e.g., high temperatures, heavy doors, steep stairs, being forced to walk along a busy street where sidewalks are absent, excessive sunlight, or lack of protection from the elements while outdoors.

Avoidance (refuge seeking) may consist of avoiding entirely an overtly pressing situation (as was the case in Chicago in 1995) or buying an assistive device as a means to negotiate a pressing situation. Or adaptation may be largely attitudinal, a form of learned helplessness. In this model, one's competency abilities range from low to high, while conditions posing press (pressing) range from weak (low press) to strong (high press). It

is arguable that aged persons seek a balance most of the time. But balance in this sense can be attained on a sustainable basis only if one's physical abilities and mobility level allow one to do so. This midrange, in Lawton's words, is the zone of maximum performance potential, defined by an overly challenging, highly stressful or overstimulating setting at one end of this spectrum. On the other end are environments deemed too comfortable, unchallenging, or understimulating. Negative consequences, even death, may occur when press becomes too overwhelming for the aged individual; for example, an elderly person engaged in hiking when suddenly confronted by a very steep incline may suffer a heart attack. A visit to the local zoo on a chilly, damp day may result in pneumonia if there is inadequate architectural provision for shelter during a sudden rainstorm.

The Prospect-Refuge Competency Index

The possibilities of this press-competency model, combined with the tenets of the prospect-refuge continuum, become even more intriguing when synthesized together as a Prospect-Refuge Competency Index (PRCI). A synergy occurs. One or the other when applied alone has proven successful in guiding much prior research; but new possibilities may accrue when they are synergistically fused in a single operative paradigm. Such an index can function as a useful tool for measurement and assessment in the field as a means to classify measurable phenomena (Figure 1). The orthogonal crossing of a horizontal and a vertical axis/continuum establishes four quadrants (only two of these are the focus of the present discussion). At the endpoints of each, highly pro-

nounced conditions are represented. The vertical continuum is defined at one endpoint as prospect-seeking behavior, i.e., engagement in healthful outdoor activity; refuge-seeking behavior, i.e., retreat from healthful activity outdoors, is at the other endpoint. Refuge is hereby defined as one's disengagement from outdoor activity, be it solitary or with others indoors within one's dwelling. The horizontal axis/continuum is defined at the right endpoint as possessing attributes typically

present in a supportive architectural and neighborhood milieu. The opposing endpoint denotes attributes indicative of a nonsupportive, or countertherapeutic, architectural and/or neighborhood milieu in terms of the amenities such conditions provide with regard to health-promoting outdoor activities.

The continua are diagonally bisected by two additional axes/continua (Figure 1). The first of these

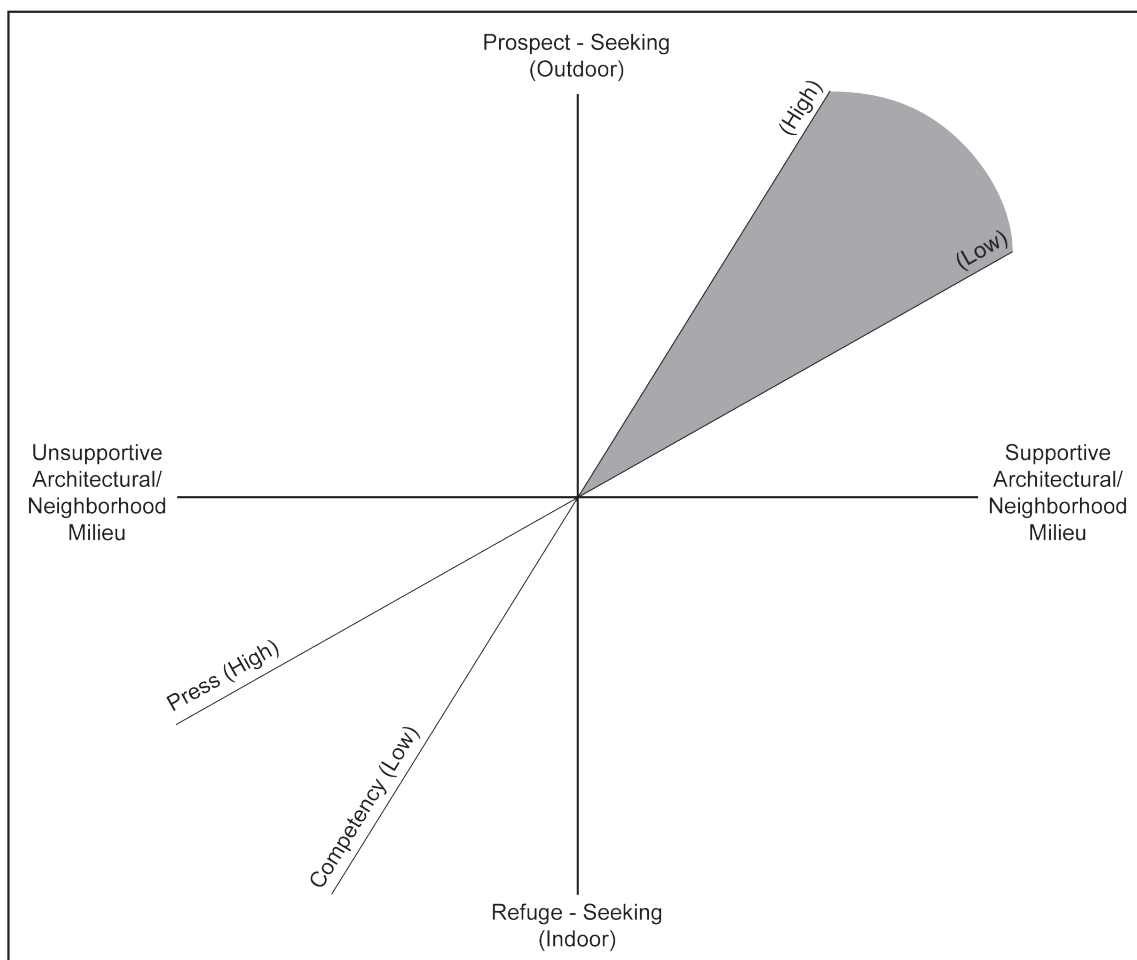


Figure 1. Conceptual model of Prospect-Refuge Competency Index (PRCI).

represents an aged individual's appraisal, or assessment, of the overall press of a given situation. Highly pressing physical conditions are associated with unsupportive settings and are equally associated with refuge-seeking avoidance coping behaviors. A second axis/continuum represents an aged individual's physical and sensory competency in relation to the perceived affordances (benefits) to be accrued through engagement in health-promoting outdoor activity. Both are based on an individual's judgement of the importance, safety, and relative risks and rewards. Behavioral outcome—what one actually opts to do—is the result of such assessment. Outcome is therefore predicated upon these two antecedent factors relative to the pair of continua. The shaded area of Figure 1 is where a balance between press and competency occurs; the individual is thereby able to engage in prospect-seeking behaviors in a supportive architectural and neighborhood milieu.

In practice, a given activity, such as successfully jogging to a local community eldercare center each day from one's house, is assessed in reality as a matter of degree, or gradation, as a positive (+) or negative (-) situation. In other words, a positive appraisal combined with an assessment of its positive affordance sets the stage for a positive outcome. In turn, a negative appraisal combined with a negative assessment of its perceived affordances would likely result in a negative outcome. In this case a negative outcome might be to elect simply to stay at home indoors. This pair of antecedent variables, combined with the resulting outcome behavior when viewed in relation to the pair of horizontal/vertical governing continua,

holds much promise for application in fieldwork investigations. Moreover, planners, architects, and public policy makers potentially can learn much from this perspective.

Translation

In its translation into a survey questionnaire instrument, the PRCI can be directly translated into Likert or similar rating scales, multiple-choice survey question formats, or behavioral observation formats, perhaps in conjunction with time-lapse videography. A logical format is to focus on individuals' frequency of use, frequency of engagement in a given activity outdoors, and assessment of individuals' level of satisfaction with their dwelling and/or neighborhood. For instance, a five-point scale ranging from low to high can record an actual outcome behavior, in this case the number of times per week one takes a walk outdoors: "How often do you walk outdoors down your favorite street in your neighborhood in a given week?" "If you walk outdoors, how valuable is your walk down this street each evening for your health?" A third question, "What outcomes do you think you derive from walking down this street?" focuses on the end result. New knowledge gleaned from this work can be helpful to public health specialists, local zoning officials, politicians, developers, architects, community advocates, eldercare product designers, civil engineers, environmental advocates, landscape architects, and social scientists.

The framework of the PRCI can be applied easily to an actual neighborhood context. A typical urban streetscape in a neighborhood with a sig-

nificant percentage of elderly residents (in this case in the Carrollton neighborhood of New Orleans) is depicted in Figure 2. Both sides of a single block are shown fully, with the horizontal space in between (shaded) denoting a narrow two-lane street with parking on both sides. Ten prospect-refuge properties are called out on this block. These consist of physical distance contact from neighbors (spatial proximity), streetscape attributes (the edge condition and its perceived coherence), primary and secondary views from within one's dwelling (window quantity, size, and orientation), landscaping (shading and screening elements), lighting (type, quantity, and its qual-

ity), circulation patterns such as the street grid (paths and nodes), the amenity afforded by the sidewalks and streets (proximity to, and their physical condition), front porch attributes (size and orientation), overall aesthetic appearance (of the buildings and the overall streetscape), and finally, the presence of mixed-use buildings (their type, quantity, and proximity to home).

To demonstrate further the direct applicability of the PRCI, a set of hypotheses is presented with the aim of further encouraging evidence-based design research on the subject of health promotion outdoors among the aged. Two levels of



Figure 2. Translation of concepts to urban streetscape.

inquiry are represented in Table 1: macroscale inquiry at the community-neighborhood level, and by comparison, microscale inquiry at the residential-adjacent outdoor environs level. For each hypothesis presented in Table 1, the implied null hypothesis may be preferable from a research gathering design standpoint. For example, "Clearly visible exterior illumination conveys the message that intruders are unwelcome in or near one's residence" may be restated as "Clearly visible exterior illumination does not convey the message that intruders are unwelcome...."

This discussion has centered on the presentation of a theory model that can capture the essence of the fluid, dynamic transactions that occur daily between aged individuals and their everyday built environment. A second goal was to apply this model to actual neighborhood settings. The purpose here was to illustrate the immediacy of the model in predicting and in turn promoting healthful physical outdoor activity among the aged, as much as illustrating plausible reasons why such behaviors may or may not occur. This said, an increasing number of healthcare providers now accept the view that the configuration and amenity of the built environment are antecedent factors in the promotion of positive health outcomes—through supportive planning and design as a means to combat public health challenges. Health-promoting physical environments can help to combat the current obesity epidemic caused by the inactivity exhibited by Americans of all ages (Gordon-Larsen, McMurray, & Popkin, 2000). Walking, jogging, canoeing, hiking, gardening, volunteering as a tour guide at the

local zoological park, swimming, birdwatching, various outdoor competitive sporting events, and so on can be promoted through effective community planning and design. With respect to multivariate research designs, as mentioned above, many possibilities exist. Outcome vis-à-vis the PRCI is definable by well-being, engagement (disengagement), frequency of engagement, satisfaction, and preference.

An earlier version of the hybrid Lawton-Appleton PRCI model mentioned previously provided a useful theory foundation for a study of how the degree of architectural press—perceived or actual—influenced whether an aged individual opted to engage in outdoor physical activity in an older, established, urban neighborhood (Verderber, 2006). More research is needed on the ways in which engagement in health-promoting outdoor activities is based on one's ability to do so safely and without fear. The PRCI can be directly incorporated in work in the emerging area of health impact assessment (HIA) in the field of community public health. HIAs are used to evaluate the impact on health of policies and projects in community design, transportation planning, and other areas outside traditional public health concerns (Dannenberg et al., 2006).

Further refinement of this model can help to identify fundamental predictors of well-being and health-promoting behaviors in the outdoor milieu. Attributes of the built environment may foster adverse physiological health outcomes among the aged. These may include hearing loss, excessive eyestrain, hypertension, heat stroke, cardiac

Table 1. Evidence-Based Hypotheses in Support of Health Promotion Activity Outdoors Among the Aged

Intervention Category	
Community/Neighborhood:	Residence/Adjacent Environs:
• A coordinated network of sidewalks, trails and walkways for non-motorized users allows for multiple route options to a given destination point. • Buildings not set back excessively from the roadway or street eliminate a "racetrack" mentality for drivers. • Streets lined with trees afford therapeutic natural screening from exposure to excessive sunlight. • Curb-cuts, ramps, redundant-cued (visual-audio-tactile) traffic signals and wayfinding graphics in accord with ADA criteria promote outdoor activity. • Shaded places encourage one to stop and rest located intermittently along travel routes. • Neighborhood traffic calming measures reduce cut-through traffic and excessive vehicular speeds. • Land use and zoning guidelines can be developed with meaningful input from citizen advocacy groups including the aged. • Parks, linear corridors, green belts, and open spaces allow aged persons to walk to and from home and other destinations. • Excessive, abrupt sources of noise pollution can easily confuse and disorient elderly users while outdoors.	• Safe, operable windows afford essential view and climatological information and can influence one's decision to engage in health-related activity outdoors. • Exterior porches and balconies perceived as safe are adjunctive outdoor activity "staging areas" functioning as catalysts for the initiation of more extensive health-related activity-seeking behavior in the community. • Clearly visible exterior illumination conveys the message that intruders are unwelcome in or near one's residence. • Close proximity of one's residence to places of work and civic points of interest in community promotes an increase in outdoor activity. • Safe, accessible places for storage and retrieval of recreational activity equipment, bicycles, etc. promote outdoor activity. • Mixed-use buildings infuse the residential milieu with pedestrian scaled storefronts, doorways, passages, and windows, in turn promoting health-related activity outdoors. • Redundant cueing, "smart" building technologies, and wayfinding measures in the home and in one's immediate neighborhood reinforce control over one's domain, providing support to venture out into the community-at-large.

arrest, hypothermia, even death. Above all, the objective is to increase health promotion and in turn prevent chronic disease by supporting citizens' needs, desires, and physical abilities. For the aged, unfortunately, planning and design professionals' outdated notion of assessing community engagement frequently does not go beyond informal anecdotes and nostalgic recollections of how things, people, events, and places in the community were many years—even decades—ago. Unfortunately, such cognitive recollections are often very much out of sync with present-day realities in the same place.

The PRCI speaks to the timeless relationship between the livability and sustainability of a community and the public health of its inhabitants. This relationship has resonated throughout history. In the 19th century industrial-age city, this relationship manifested itself in the adverse health outcomes associated with the high incidence of lung disease caused by the intensely polluted air. Perhaps the contemporary auto-dependent suburb's most chilling legacy to public health in America will be the extent to which it discouraged the elderly from obtaining the proper exercise needed to maintain a healthy, active lifestyle (Steele, 1981). The recent groundswell of interest on the part of public health professionals in creating livable communities based on principles of pedestrianism, walkability, bikeability, and access to nature signifies a promising shift in attitudes. Buildings, neighborhoods, cities, and natural environments that promote meaningful social interactivity, civic engagement, public health, and personal health will be cen-

tral to the expansion of this movement in the coming years.

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References

- Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., & Shlomo, A. (1977). *A pattern language: Towns, building, construction*. New York: Oxford University Press.
- Alfonzo, M. A. (2005). To walk or not to walk? The hierarchy of walking needs. *Environment and Behavior*, 37(6), 808–836.
- American Association of Retired Persons. (2007). *Facts on aging: 2007*. Washington, DC: AARP.
- Appleton, J. (1975). *The experience of landscape*. London: Wiley.
- Besser, L., & Dannenberg, A. (2005). Walking to public transit: Steps to help meet physical activity recommendations. *American Journal of Preventive Medicine*, 29(4), 273–280.
- Bolbaum, A., & Hunecke, M. (2005). Perceived danger in urban public space: The impacts of physical features and personal factors. *Environment and Behavior*, 37(4), 465–486.
- Boyce, P. R., & Gutkowski, J. M. (1995). The if, why and what of street lighting and street crime: A review. *Lighting Research and Technology*, 27(2), 103–112.
- Burkhauser, R. V., Butrica, B. A., & Wasylenko, M. J. (1995). Mobility patterns of older homeowners: Are older homeowners trapped in distressed neighborhoods? *Research on Aging*, 17(3), 363–385.
- Cerin, E., Leslie, E., du Toit, L., Owen, N., & Frank, L. (2007). Destinations that matter: Associations with walking for transport. *Health Place*, 13(4), 713–724.
- Chiricos, T., McEntire, M., & Gertz, M. (2001). Perceived racial and ethnic composition of neighborhood and perceived risk of crime. *Social Problems*, 48(1), 322–329.
- Dannenberg, A., Bhatia, R., Cole, B., Dora, C., Fielding, J., Kraft, K., McClymont-Peace, D., et al. (2006). Growing the field of health impact assessment in the United States: An agenda for research and practice. *American Journal of Public Health*, 96(2), 262–270.
- Duany, A., Plater-Zyberk, E., & Speck, J. (2001). *Suburban nation: The rise of sprawl and the decline of the American dream*. Boston: North Point Press.
- Espino, D., Lichtenstein, M. J., Palmer, R., & Hazuda, H. (2001). Ethnic differences in mini-mental state examination (MMSE)

- scores: Where you live makes a difference. *Journal of the American Geriatrics Society*, 49(3), 538–543.
- Fischer, M. A., & Shrout, P. E. (2006). Children's liking of landscape paintings as a function of their perceptions of prospect, refuge, and hazard. *Environment and Behavior*, 38(3), 373–393.
- Fisher, B. S., & Nasar, J. L. (1992). Fear of crime in relation to three exterior site features. *Environment and Behavior*, 24(1), 35–65.
- Frank, L., Saelens, B., Powell, K., & Chapman, J. (2007). Stepping towards causation: Do built environments or neighborhood and travel preferences explain physical activity, driving and obesity? *Journal of Social Science and Medicine*, 65(8), 1898–1914.
- Frumkin, H. (2005). Health, equity, and the built environment. *Environmental Health Perspectives*, 113(6), A290–A291.
- Frumkin, H., Frank, L., & Jackson, R. (2004). *Urban sprawl and public health: Designing, planning and building for healthy communities*. Washington, DC: Island Press.
- Gordon-Larsen, P., McMurray, R., & Popkin, B. (2000). Determinants of adolescent physical activity and inactivity patterns. *Pediatrics*, 105(3), 83–95.
- Hays, R. A. (1995). *The federal government and urban housing: Ideology and change in public policy*. Albany, NY: State University of New York Press.
- Herzog, T. R., & Miller, E. J. (1998). The role of mystery in perceived danger and environmental preference. *Environment and Behavior*, 30(4), 429–449.
- Issacs, S. (1983). A sense of belonging (establishing a sense of community). *Parents Magazine*, 58(11), 56–62.
- Jackson, R. (2003). The impact of the built environment on health: An emerging field. *American Journal of Public Health*, 93(11), 1382–1384.
- Jacobs, J. (1961). *The death and life of great American cities*. New York: Random House.
- Kaplan, S., & Kaplan, R. (1982). *Cognition and environment: Functioning in an uncertain world*. New York: Praeger.
- Kaplan, S., & Kaplan, R. (1989). *The experience of nature: A psychological perspective*. Cambridge, UK: Cambridge University Press.
- Klinenberg, E. (2002). *Heat wave: A social autopsy of disaster in Chicago*. Chicago: University of Chicago Press.
- Krause, N. (1993). Neighborhood deterioration and social isolation in later life. *International Journal of Aging and Human Development*, 36(3), 9–39.
- Kuo, F. E., Bacaicoa, M., & Sullivan, W. C. (1998). Transforming inner city landscapes: Trees, sense of safety, and preference. *Environment and Behavior*, 30(1), 28–59.
- Kuo, F. E., & Sullivan, W. C. (2001). Environment and crime in the inner city: Does vegetation reduce crime? *Environment and Behavior*, 33(3), 343–367.
- Lawton, M. P. (1985). The elderly in context: Perspectives from environmental psychology and gerontology. *Environment and Behavior*, 17(1), 501–519.
- Lawton, M. P., & Nahemow, L. (1973). Ecology and the aging process. In C. Eisendorfer & M. P. Lawton (Eds.), *Psychology of adult development and aging* (pp. 619–674). Washington, DC: American Psychological Association.
- Malizia, E. (2005). City and regional planning: A primer for public health officials. *The Art of Health Promotion*, 12(5/6), 1–13.
- Newman, O. (1972). *Defensible space: Crime prevention through urban design*. New York: Collier Books.
- Peter, K., & Scully, V. (1993). *The new urbanism: Toward architecture of community*. New York: McGraw-Hill.
- Petherick, N. (2000). Environmental design and fear: The prospect-refuge model and the University College of the Cariboo Campus. *Western Geography*, 10/11(1), 89–112.
- Ralston, B. M. (1999). Residents in unsafe neighborhoods exercise less. *The Physician and Sports Medicine*, 27(2), 80–81.
- Ramanujam, P. (2006). *Prospect-refuge theory revisited: A search for safety in dynamic public spaces with a reference to design*. Unpublished Master in Landscape Architecture Thesis, University of Texas at Arlington.
- Regnier, V. (2002). *Design for assisted living: Guidelines for housing the physically and mentally frail*. New York: Wiley and Sons.
- Stamps, A. E. (2005). Enclosure and safety in urban spaces. *Environment and Behavior*, 37(1), 102–133.
- Steele, F. (1981). *The sense of place*. Boston: CBI Publishing.
- Stiles, B. L., Halim, S., & Kaplan, H. B. (2003). Fear of crime among individuals with physical limitations. *Criminal Justice Review*, 28(2), 232–253.
- U.S. Centers for Disease Control and Prevention. (1996). *Neighborhood safety and the prevalence of physical inactivity—Selected states, 1996*. Atlanta, GA: Centers for Disease Control and Prevention.
- Verderber, S. (1991). Elderly persons' appraisal of domestic animals in the residential environment. *Anthrozoos*, 4(2), 164–173.
- Verderber, S. (2006). The role of housing in community health promotion among the aged: A case study in New Orleans. *Journal of Housing for the Elderly*, 20(4), 123–141.
- Verderber, S., Gardner, L., Islam, D., & Nakanishi, L. (1988). Elderly persons' appraisal of the zoological environment. *Environment and Behavior*, 20(2), 492–507.
- Verna, R. (1999). Neighborhood safety and physical inactivity. *American Family Physician*, 59(4), 2925.
- Wilcox, P., Quisenberry, N., & Jones, S. (2003). The built environment and community crime risk interpretation. *Journal of Research in Crime and Delinquency*, 40(3), 322–345.
- Wilson-Doenges, G. (2000). An exploration of sense of community and fear of crime in gated communities. *Environment and Behavior*, 32(4), 597–612.
- Younger, M., Morrow-Almeida, H., Vindigni, S., & Dannenberg, A. (2008). The built environment, climate change, and health: Opportunities for co-benefits. *American Journal of Preventive Medicine*, 35(5), 517–526.