Neighborhood Design and Neighborliness

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CERTIFICATE OF APPROVAL

This is to certify that the Master's thesis of
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ABSTRACT

Context: Social ties between neighbors and neighborhood-based social capital are beneficial to health. Neighborliness is the degree to which people know their neighbors, trust their neighbors, speak to their neighbors, exchange favors with their neighbors, and believe their neighborhood is a place where people look out for one another. Neighborliness is a resource for individuals but is also a marker of social capital, a resource of the collective. Neighborhood design, or the built environment of our neighborhoods, plays a distinct role in encouraging or discouraging neighborliness.

Objective: To determine whether features of the neighborhood built environment, such as front porches, traffic calming devices, yard maintenance, building condition, bars on windows or doors, litter or graffiti, and neighborhood sidewalk connectivity were associated with neighborliness in our study population.

Study Design: This study was a cross-sectional analysis of three existing data sets, which we linked together for the purposes of this study to examine the relationship between neighborliness and the built environment. Data used in this analysis were assessed for eight selected neighborhoods in Portland, OR and included: (1) a systematic neighborhood observation tool that constitutes an objective assessment of the built environment; (2) a survey of social capital administered to 128 individuals within eight neighborhoods; and (3) publicly accessible demographic data.

Methods: Multinomial logistic regression models were created to model the odds of low, moderate, and high neighborliness given the above listed features of the built environment and covariates including race, self-reported health, perception of safety, number of years individuals had lived in their neighborhood, age of the house, market value of the house, and proportion of homeowners in the neighborhood.

Conclusion: The odds of neighborliness were significantly higher among individuals who reported excellent or very good health, had lived in the neighborhood longer than the median of the study population, lived in houses built before 1950, and lived in houses valued above the median house value in Portland during the year of study. In the univariate analysis, the odds of high compared to moderate neighborliness among those living on streets with more front porches were almost three times that of people living on street segments with fewer front porches (OR = 2.94, 95% CI 1.29, 6.69). In the multivariable analysis, the covariates litter and graffiti and neighborhood sidewalk connectivity reached statistical significance. The odds of high compared to moderate neighborliness among people living on street segments with no litter or graffiti were almost seven times higher than those living on street segments where some litter or graffiti was present (OR = 6.90, 95% CI 1.92, 27.80). The odds of high compared to moderate neighborliness among those living in neighborhoods with a more complete system of sidewalks was almost seven times greater than among those living in neighborhoods with a less complete system of sidewalks (OR = 6.71, 95% CI 1.21, 37.00). This study implies that modifiable features of the built environment may be one avenue whereby we can create social capital.

BACKGROUND

Introduction

The importance of neighboring has long been a question of interest (Mann, 1954). Mann (1954) defined neighborliness as the form of behavior undertaken in the interactions between neighbors, a small number of people who live very near to us. It is well established that social support between neighbors offers not only health benefits but also supports individuals as they rear children, seek professional success, and mobilize political resources (Cohen & Syme, 1985).

Studies on the health benefits of individual-level social support are abundant (see for example a review article by Berkman, 1995). Neighborliness is a more specific form of social support that benefits individuals, but also serves as a marker of social capital, a resource of the collective that individuals may utilize (Kawachi & Berkman, 2000; Kawachi, Kennedy, Lochner & Prowith-Stith, 1997; Putnam, 1993). Public health scholars have only recently begun studying the health benefits of social capital (Kawachi & Berkman, 2000). Research has been promising in showing that increased social capital benefits health beyond the benefits of social support at the individual level. For example, social capital has been linked with lower levels of all-cause mortality (Kawachi, Kennedy, Lochner & Prowith-Stith, 1997; Putnam, 2000) and decreased risk of coronary heart disease (Sundquist, Johansson, Yang & Sundquist, 2006). Neighborhood-based social capital has been linked to better mental health (Araya et al., 2006) and better self-reported health (Poortinga, 2006). Despite promising research linking both individual- and group-level social resources to health, the forces that destroy social capital are better understood than the forces which can build social capital (Kawachi & Berkman, 2000).

Health effects of place are a result of both the 'material infrastructure and collective social functioning' – that is, places make people and people make places (Macintyre, Ellaway, & Cummins, 2002). The physical design of neighborhoods, also referred to as the built environment (Leyden, 2003), is thought to play a distinct role in encouraging or discouraging neighborly interactions and is being studied in a variety of ways by public health professionals (Corburn, 2004), urban planners (Forrest & Kearns, 2001), sociologists (Sampson & Raudenbush, 1999), psychologists (Fried, 2000), and architects (Evans & McCoy, 1998). A better understanding of the role of neighborhood design on neighborliness may suggest unique opportunities for public health interventions that can build social capital and lead to improved health.

Features of the Built Environment Hypothesized to Influence Neighborliness

Existing literature suggests that neighborliness is influenced by the neighborhood built environment. This section first describes two previously proposed theories of the mechanisms whereby the built environment may impact neighborliness. It then presents the conceptual framework used for this study, which was derived from the existing theoretical discussion. Lastly, this section presents a focused review of the pertinent literature involving specific features of the built environment that will be studied in this project.

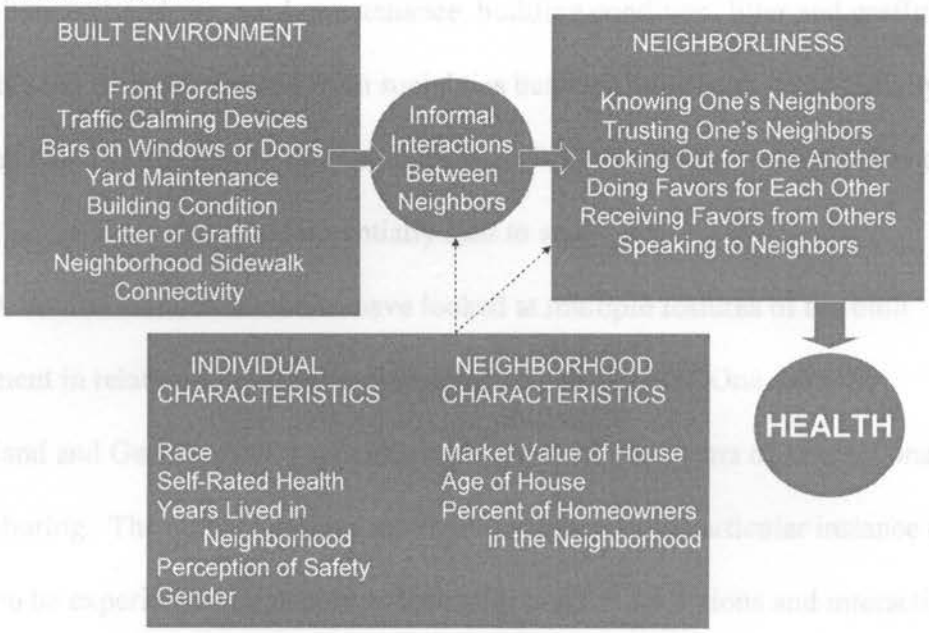
Theoretical Discussion. While a variety of mechanisms have been proposed to suggest how social ties between neighbors form, two are specifically applicable to the conceptual framework of this study. One often-cited essay, written by Granovetter in 1973, argues for the importance of the 'weak ties' between neighbors. By 'weak ties,'

Granovetter referred to informal relationships that stem from everyday interactions that in turn facilitate neighborliness. Skjaeveland & Garling (1997) proposed that opportunities for passive contact, closer proximity to others, and appropriate spaces to interact are factors that contribute to the formation of weak ties between neighbors.

The concept of weak ties as an important feature of neighborhoods was also examined in a series of longitudinal and cross-sectional studies by Henning and Lieberg (1996). Survey respondents from Swedish neighborhoods identified weak ties as important contributors to feelings of home, security, and social support. Henning and Lieberg also examined the total numbers of contacts in the neighborhood and found 'weak' interactions, such as hand waving or passively greeting neighbors, occurred three times more frequently than 'strong' interactions such as planned gatherings. The latter occurred more frequently outside of the neighborhood setting. Overall, social ties with neighbors were more important for certain groups, such as blue collar workers and the elderly, a finding that was corroborated by a study conducted in the United States (Guest & Wierzbicki, 1999).

The second pertinent theoretical construct was proposed by Gehl in 1986. Gehl coined the phrase 'soft edges' to describe indistinct boundaries between public and private spaces, also called semiprivate zones. The importance of these semiprivate spaces is in keeping people out-of-doors for a longer duration than a purely public or purely private space. For example, a front garden or yard constitutes a 'soft edge' where neighbors might interact if one were out maintaining the yard. Both of these theoretical constructs, informal interactions and semiprivate spaces, inform the theoretical basis through which the built environment may influence neighborliness.

Figure 1: Conceptual model used for Neighborhood Design and Neighborliness Study, Portland, OR, 2003.



Conceptual Framework. Existing theoretical work suggests a model through which the built environment influences neighborliness, namely that semiprivate spaces facilitate informal interactions which in turn lead to neighborliness. Figure 1 illustrates our conceptual model, which is built around these theories. The premise of this study is that features of the built environment, including front porches, traffic calming devices, a lack of bars on windows or doors, well-maintained yards and buildings, the absence of litter and graffiti, and a connected system of sidewalks within a neighborhood facilitate informal interactions between neighbors. This, in turn, leads to neighborliness, which leads to better health. Additional characteristics of individuals and neighborhoods may also be related to neighborliness and are discussed in greater detail below.

Review of Relevant Literature. The above conceptual model is supported by existing studies. A review of literature focused on studies that researched the specific

elements of the built environment included in this study (front porches, traffic calming devices, bars on windows, yard maintenance, building condition, litter and graffiti, and sidewalks) and their relationship with social ties between neighbors. Additionally, some studies included in this review did not focus specifically on social ties but rather on informal interactions that could potentially lead to social ties.

A limited number of studies have looked at multiple features of the built environment in relation to specific measures of neighborliness. One study by Skjaeveland and Garling (1997) specifically focused on the effects of interactional spaces on neighboring. The authors defined interactional space as 'a particular instance of place... to be experienced by people as the major context for actions and interactions.' They collected objective measurements of physical characteristics of neighborhoods in Sweden and surveyed residents regarding various dimensions of neighboring. They found that both functional components (such as porches and sidewalks) and aesthetic components (such as yards and overall cleanliness) were important for neighborly interaction, even after considering the respondents' marital status, age, gender, whether respondents had children, and income.

Other research has shown that the appearance dimension of a neighborhood has important implications for social interaction. Greenbaum and Greenbaum (1981) report on a neighborhood intervention project by Bush-Brown (1969) where the Garden Club of Philadelphia placed garden boxes in physically deteriorated neighborhoods. They observed an increase in the frequency of casual visiting and pedestrian traffic after the placement of the boxes (Bush-Brown, 1969). Although this study took place many years ago, the interventional component is not typically found in more recent studies and

underscores an important point, namely that a specific environmental intervention led to increased interactions among neighbors rather than the opposite.

Better aesthetics also increase peoples' perceptions of safety and increase social contact in spite of the actual amount of crime that occurs in the area (Taylor, 1997; Perkins, Meeks & Taylor, 1992). Brown, Perkins, and Brown (2003) examined objective measures of incivilities such as litter and dilapidated buildings, and found that the absence of these markers of incivilities fostered place attachment - 'positive bonds to physical and social settings that support identity and provide other psychological benefits.' Taylor and colleagues (1984) found that features of defensible space (i.e. either symbolic or real barriers to crime, such as bars on windows) staked territoriality of an area and were associated with decreased crime and fear. Social connections between neighbors are increased where people feel safer (Taylor, 1997).

Functional aspects of spaces, including features such as front porches or sidewalks, have also been found to influence interactions among neighbors (Skjaeveland & Garling 1997). Front porches are one example of a structural element that serves as both a meeting place and as a place where people can observe street activity (Brown, Burton & Sweaney, 1998; Skjaeveland & Garling, 1997). While there are few empiric studies that have looked at front porch use, Wilson-Doenges (2001) found that factors associated with decreased front porch use included smaller sizes of porches, more attractive back yards, and busy lifestyles not compatible with the leisure time spent on the front porch. A qualitative study by Brown and colleagues (1998) found that while front porch use has declined over time, front porches still constituted a place where people enjoyed spending time alone or with neighbors.

While studies have not examined the relationship between connected sidewalks and social interaction, sidewalks have been given attention particularly with regard to physical activity. The relevance of sidewalk use to this study is based on the increased probability that neighbors will meet and interact if they are walking for pleasure or transportation. Studies involving sidewalk use have focused on the features of sidewalks that increase walking. For example, Hess and colleagues (1999) mapped out urban and suburban neighborhoods in Seattle, WA and compared the street connectivity to sidewalk connectivity. The ratio of street length to sidewalk length was measured and considered in relation to pedestrian activity in neighborhoods. A greater degree of street connectivity, i.e. where the ratio was closer to one, was associated with more pedestrian activity. Based on these findings, the authors concluded that the most important feature of sidewalks in promoting pedestrian activity was their degree of connectivity between the residence and a particular destination. Other studies have found similar results, including some by Susan Handy and colleagues (Handy, Boarnet, Ewing & Killingsworth, 2002; Pikora et al., 2003; Cao, Handy, & Mokhtarian, 2006).

Pedestrian activity has also been found to be greater in areas where traffic volume is less, though again this feature of the built environment has not been examined specifically with regard to neighborliness. Cao and colleagues (2006) found that increased traffic volumes in Austin, TX were negatively associated with walking to the store. Based on these findings, the authors suggested that traffic calming programs designed to reduce traffic speed in residential areas might help encourage pedestrian activity. Conversely, a qualitative study by Michael and colleagues (2006) in Portland, OR found that traffic calming devices, such as street bumps, signs, and roundabouts,

were perceived by some residents as undesirable for walking because pedestrians were less visible to drivers and walking was more dangerous. Overall, settings which encourage neighbors to walk increase the chances for casual meetings between neighbors.

In summary, multiple studies suggest that specific features of the built environment may influence aspects of neighborliness in certain populations. This may be facilitated by the presence of suitable spaces that allow for informal interactions. While empiric testing has been undertaken with regard to some features, others, such as sidewalks and traffic calming devices, still lack quantitative research into the nature of their relationship with neighborliness. Furthermore, applying the conceptual framework to a unique population in Portland, OR will add to the existing body of literature by testing these hypotheses in a new geographical setting.

Other Factors Associated with Neighborliness

While the above studies illustrate that features of the built environment are associated with social interactions, studies have suggested that other social factors also influence neighborliness. This section presents a brief review of other potentially relevant social factors.

One factor that likely influences neighborliness is a person's life stage. The contextual effects of the neighborhood are likely to change during the course of a person's lifetime, with people in different life stages needing neighborliness in different forms and varying amounts (Ziersch, Baum, MacDougall & Putland, 2005; Forrest & Kearns, 2001). For example, couples with children may rely more heavily on neighbors for help with child-rearing, as may the elderly (Ziersch, Baum, MacDougall & Putland,

2005; Unger & Wandersman, 1982), and therefore report more neighborliness. Occupational status may also dictate a greater need for neighborliness, particularly among the unemployed or manual laborers (Coulthard, Walker & Morgan, 2002). Homeownership and longer length of residence in an area have been found to be related to strengthened local ties (Ziersch, Baum, MacDougall & Putland, 2005) and place attachment (Brown, Perkins & Brown, 2003). Homeownership has also been found to contribute to improved property maintenance and longer duration of residence in neighborhoods (Rohe & Stewart, 1996). Finally, it is well known that gender plays a role in social interaction (Unger & Wandersman, 1982), but it is less clear what role gender plays in neighborly interactions. For example, one study found that women feel less safe in their neighborhoods compared to men, but gender was not associated with other measures of neighborliness such as reciprocating favors or trusting neighbors (Ziersch, Baum, MacDougall & Putland, 2005). In summary, a variety of social factors may impact neighborliness, but studies have inconsistently taken these factors into account.

Perceived v. Objective Measures of the Built Environment

Previous studies have measured the built environment in a variety of ways. For example, one can measure peoples' perceptions of their surroundings, or one can engage in a systematic observation of the presence or absence of certain conditions. A debate exists about whether peoples' perceptions of their neighborhood environment or objective measures are more important predictors of social interaction (see for example Perkins & Taylor, 1997), and some have advocated for measuring both (Sallis et al., 1997). Studies have shown that subjective assessments differ from objective assessments of the built

environment, with regard to how much physical activity a person undertakes (Troped et al., 2001; Beard, 2004) and how safe a person views his or her environment (Eyles, Taylor,Johnson & Baxter, 1993). Systematic observations are regarded by some as the preferred method for measuring the frequency and duration of use of structures such as front porches, as well as the physical characteristics of such structures (Brown, Burton & Sweaney, 1998) because systematic observations capture features that are actually present as opposed to relying on a person's perceptions. We found it more important to use objective measures in this study because we were interested in measuring characteristics of the built environment that were actually present as opposed to respondents' perceptions of their environments.

Specific Aims

The overall purpose of this study was to assess whether neighborhood design was associated with neighborliness. The primary hypothesis was that objective measures of the built environment were associated with increased neighborliness. We proposed that features of the built environment facilitated interactions, created weak ties among neighbors (Granovetter, 1973), and thus increased neighborliness.

In this regard, our specific aim was to determine whether features of the built environment, such as front porches, traffic calming devices, yard maintenance, building condition, bars on windows or doors, litter or graffiti, and neighborhood sidewalk connectivity were associated with greater neighborliness in our study population. We hypothesized that greater numbers of front porches and traffic calming devices in the immediate vicinity of a person's home were associated with greater neighborliness, as

were well-maintained yards and buildings. We hypothesized that having fewer bars on windows and doors and less graffiti and litter were associated with greater neighborliness. Finally, we proposed that a more connected system of sidewalks within a neighborhood was associated with greater neighborliness. Using unique data, including an objective measure of the built environment and a survey of social capital that captured many potentially relevant social factors, we assessed these hypotheses in a population of residents in Portland, OR.

METHODS

Overview

This study was a cross-sectional analysis of three existing data sets, which we linked together for the purposes of this study to examine the relationship between neighborliness and the built environment. Data used in this analysis were assessed for eight selected neighborhoods in Portland, OR and included: (1) a systematic neighborhood observation tool that constitutes an objective assessment of the built environment; (2) a survey of social capital administered to individuals within neighborhoods; and (3) publicly accessible demographic data.

Data Collection

Neighborhoods and street segments. Eight out of ten urban Portland neighborhoods with corresponding built environment data were selected for inclusion in this study, based on data available from the "Neighborhood Social Capital, Health, and Ageing" study (R03 AG022240, PI: Yvonne L. Michael). A neighborhood was defined as a specific geographic location recognized by the Portland Office of Neighborhood Involvement. The neighborhoods are situated in north, northeast, and southeast Portland, all considered urban as opposed to suburban.

Within each neighborhood, all street segments were enumerated using geographic information system (GIS) mapping. The total number of street segments from the original 10 neighborhoods was 5384. Segments representing industrial blocks or freeways were excluded (16%, n=862). A random sample of 457 segments was chosen, representing approximately a 10 percent sample. After removal of duplicate entries and those street

segments from two neighborhoods not included in this study, there were 359 unique segments from the eight neighborhoods. When duplicate entries existed, as was the case for a reliability analysis (Cunningham, Michael, Farquhar & Lapidus, 2005), the first observation was kept in the dataset.

From a total of 359 segments, social capital data were collected from residents on 65 randomly sampled street segments. The median number of individuals per segment was one, with a range of 1 to 7.

Systematic Neighborhood Observation Tool. Each of the street segments sampled was assessed for built characteristics. A total of nine observers were trained in four-hour training sessions (Cunningham, 2005). Trained observers surveyed the street segments using a structured audit tool (Cunningham, Michael, Farquhar & Lapidus, 2005) and recorded their data on paper forms. The data from the paper forms were entered into an Access database by a single researcher. Data were hand-checked for errors. The items surveyed were generally related to the functional, aesthetic, safety, or connectivity aspects of the street segment (Cunningham, Michael, Farquhar & Lapidus, 2005; Pikora et al., 2003). The specific items selected for this study were front porches, bars on windows or doors, yard maintenance, building condition, litter or graffiti, sidewalks, and traffic-calming devices. These items will be discussed in greater detail in the Independent Variables section below. Inter-rater reliability of the audit instrument was tested on randomly selected segments (Cunningham, Michael, Farquhar & Lapidus, 2005). The inter-rater reliability statistics for the characteristics included in the study are displayed in Table 1. Additional direction is provided within the systematic neighborhood observation tool (Appendix A).

Table 1
Inter-rater reliability of built environment characteristics used in the Neighborhood Design and Neighborliness study, Portland, OR, 2003.

Variable	Inter-Rater Agreement	
	Side 1	Side 2
Buildings with front porches	0.07[a]	0.43[a]
Bars	0.88[c]	0.89[c]
Yard maintenance	0.45[b]	NA[d]
Building condition	0.19[b]	NA[d]
Litter / graffiti	0.60[b]	NA[d]
Sidewalk continuity	0.86[b]	0.86[b]
Traffic-calming device	0.60[b]	NA[d]

Source: Developing a reliable senior walking environmental assessment tool (Cunningham et al., 2005)
[a]P-value for t-test reported
[b]Kappa statistic reported
[c]Intraclass correlation coefficient reported
[d]NA refers to no computation due to lack of observations or variability

Social Capital Survey. Within the eight neighborhoods, 128 individuals were recruited to complete a survey administered by trained interviewers. 7 interviewers were trained with all surveys conducted during the summer months of 2003. Households were enumerated using a taxlots scheme, where all taxlots within 50 feet of a previously sampled street segment were eligible for selection. The taxlot was required to be on or directly adjacent to the street but was not required to have an address along that segment. For each neighborhood, one of the sampled street segments was selected as the starting place to begin the survey process. Seven interviewers attempted to interview the first adult to answer the door at each taxlot on that segment before moving on to the next closest sampled segment. In the event that an individual refused an interview, the interviewers encouraged them to participate using an approach taught to them during their training. Houses where no one answered the door at the first attempt were attempted a second time. This process continued until 20 households in a neighborhood were interviewed or until every household on all the selected segments of a neighborhood had been attempted. The vast majority of interviews were conducted between 3pm and 7pm. These data were linked to the systematic neighborhood observation data via street

segment ID. The survey response rate was 32 percent among houses where someone answered the door. See Appendix B for a copy of the social capital survey used.

Publicly Accessible Data. Data on the market value and age of each respondent's house, as well as the proportion of homeowners in each neighborhood, were gathered using a publicly available database (www.portlandmaps.com) provided by the City of Portland. These data were linked by Taxlot ID to data from the systematic observation prior to the initiation of the current study.

Dependent Variable: Neighborliness

The social capital questions used in the door-to-door survey were adopted from the Social Capital Module of the General Household Survey (Coulthard, Walker & Morgan, 2002) of 2000-2001 used in Great Britain. The module was designed by the Office for National Statistics with the goal of better understanding the meaning of social capital as well as its measurement and relationship to health. The social capital measure of interest for this study is neighborliness, which was defined by the GHS as the extent of interaction, trust, and reciprocity between neighbors (Coulthard, Walker & Morgan, 2002). Neighborliness was highly correlated with the other social capital indicators, such as civic engagement or networks of friends and relatives. Our method of calculating neighborliness differed slightly from the GHS method.[1] Overall, the construction of the scale for the current study yielded very similar results to the GHS scale, as described in the Results section.

[1] The GHS scale was developed using factor analysis. It was constructed slightly differently than the method described above: the GHS scale coded for a middle position in the responses, yielding a score of 0, 0.5, or 1 for certain variables. They then divided the overall neighborliness score into thirds, with the top third representing individuals with "high neighborliness" and the bottom two categories collapsed.

The key items used in the neighborliness index were identified in the GHS as the following: knowing people in the neighborhood, trusting the people in the neighborhood, looking out for one another, doing favors for neighbors, having favors done for you, and frequency of speaking with neighbors. For the purposes of these questions, 'neighborhood' was defined to the survey respondents as the survey participant's street or block. Table 2 describes how the questions were worded and dichotomized. The final score was created by summing the unweighted scores from the six questions, yielding a total of six possible points with more points indicating a greater degree of neighborliness.

Table 2
Survey questions and scoring used to create the Neighborliness index, the outcome variable of the Neighborhood Design and Social Capital study, Portland, OR, 2003.

Question/Variable	Possible Responses	Point Value for Given Response
Would you say that you **know**...	1. Most people in your neighborhood*	1.00
	2. Many people in your neighborhood	1.00
Would you say that you **trust**...	3. A few people in your neighborhood	0.00
	4. Or that you do not know people in your neighborhood?	0.00
Would you agree this neighborhood is a place where **neighbors look out for each other**?	1. Yes	1.00
	2. No	0.00
	3. Don't know	0.00
In the past 6 months, have **you done a favor for a neighbor**?	1. Yes	1.00
	2. No	0.00
In the past 6 months, have any of your **neighbors done a favor for you**?	3. Just moved into the area	0.00
How often do you **speak** to neighbors?	1. Every day	1.00
	2. 5 or 6 days a week	1.00
	3. 3 or 4 days a week	1.00
	4. Once or twice a week	1.00
	5. Once every couple of months	0.00
	6. Once or twice a year	0.00
	7. Not at all in the last 12 months	0.00

* Neighborhood was defined as the survey participant's street or block.

The neighborliness index was split into three categories based on data-driven cutpoints. The variable was categorized to facilitate comparison with the outcomes of the GHS study. The decision to create three categories, as opposed to two, was data driven and based on the examination of crude odds ratios which suggested differences between the three categories in relation to built environment characteristics. Those scoring at the highest level possible, having answered positively to each of the above questions and therefore receiving a score of 6, were defined as having "high" neighborliness when compared to the others. Those with "moderate" neighborliness received a score of 4 or 5, and those with "low" neighborliness scored 3 or under.

Independent Variables: The Built Environment

Measures of the neighborhood built environment, collected systematically through trained observers as previously discussed, constituted the exposure of interest. Measures were chosen *a priori* as features of the environment that potentially maximized the number of informal interactions occurring between neighbors: sidewalks (Hess, Moudon, Snyder & Stanilov, 1999); front porches (Brown, Burton & Sweaney, 1998); yard maintenance and building condition (Skjaeveland & Garling 1997); traffic calming devices (Cao, Handy & Mokhtarian, 2006); bars on windows or doors and the presence of litter or graffiti (Taylor, 1997). All but one independent variable under consideration (sidewalks) was measured at the street segment level. The street block has been considered an ideal unit of measurement for neighborhood behavior because it constitutes the 'everyday environment with a recurring pattern of behaviors and a surrounding and supporting physical milieu' (Taylor, 1997). Sidewalk connectivity was measured at the

neighborhood level, rather than the segment level, for reasons described below. For further details on the actual observation tool see Appendix A.

Front porches. This survey item was defined as porches, balconies, or stoops where residents can overlook and interact with pedestrians and were required to be wide enough to comfortably place a chair and still open the door. This variable was measured by counting the total number of buildings with front porches and dividing by the number of buildings on the segment. It was dichotomized at the median.

Traffic calming devices. This item was defined by the presence of a traffic circle, cross walk, speed bump, planter, or pedestrian sign on a given street segment or in the intersection between the segment under study and the adjacent segment. The variable was dichotomized based on the presence versus absence.

Bars on windows or doors. This variable was defined by the presence of any visible bars over windows or doors on any of the buildings on a street segment. It was dichotomized by presence versus absence of bars.

Yard maintenance. The trained observer collected data on yard maintenance by estimating the percentage of well-maintained yards, i.e. well-trimmed and debris-free, on the street segment as greater than 75 percent of the yards, 50-74 percent of the yards, or less than 50 percent of the yards. This variable was dichotomized based on whether greater than 75 percent were well-maintained or less than 75 percent were well-maintained. This cutpoint maximized the numbers of cases in each group, as the majority of yards sampled were very well-maintained (i.e. a cutpoint at 50-74 percent would have yielded a very small group with poorly maintained yards).

Building condition. This variable required the observer to assess the quality and upkeep of the buildings based on evidence of broken windows, graffiti on buildings, other damage or need of repair. The proportion of buildings with damage or in need of repair was recorded as less than 5 percent, 5-25 percent, or greater than 25 percent. The variable was dichotomized based on segments with less than 5 percent needing repair versus greater than 5 percent needing repair. As with Yard Maintenance, this cutpoint maximized the amount of variability between the groups, as the majority of buildings were in good repair.

Litter or graffiti. This variable required the observer to assess the quality of the cleanliness of the segment as a whole, including streets, sidewalks, properties and buildings. The presence of litter, graffiti, or broken glass was recorded as none or almost none, yes (but not dominant feature), or yes (dominant feature). This variable was dichotomized based on the presence versus absence of litter or graffiti.

Sidewalks. Sidewalks were assessed on the basis of continuity within *neighborhoods* rather than on street segments, as the rest of the built environment variables were analyzed. As discussed in the background section, studies have shown that when networks of streets within a neighborhood have corresponding sidewalks, i.e. the sidewalk-to-street ratio approaches one, the likelihood of pedestrian activity increases (Hess, Moudon, Snyder & Stanilov, 1999), increasing the possibility of informal interactions between neighbors. In the current study, all street segments originally sampled in the neighborhood (n=359) were evaluated for the proportion of sidewalks continuous on at least one side. Those neighborhoods with between 90-100 percent of sidewalks continuous on at least one side were given a score of 2. Those with between

80-89 percent of sidewalks continuous on at least one side received a score of 1. Those with less than 80 percent of neighborhood sidewalks received a score of 0. Thus, every respondent living in a given neighborhood received the same sidewalk score.

Confounders

Relevant individual-level variables that had the potential, based on prior research, to confound the relationship between neighborhood design and neighborliness were considered in the analysis. Relevant sources are cited with each variable below. Those variables collected from the social capital survey included race (Subramanian, Lochner & Kawachi, 2003), self-rated health (Veenstra, 2005), years of residence in the neighborhood (Ziersch, Baum, MacDougall & Putland, 2005; Taylor, 1997), and feelings of safety (Perkins, Meeks & Taylor, 1992). Those collected from publicly available data included age of the house in which the person resides (Brown, Burton & Sweaney, 1998) and market value. Market value was used as a proxy for socioeconomic status, as income and education measures which are typically used for socioeconomic status were not collected or available publicly. Income has been found to be positively associated with place attachment and social ties (Brown, Perkins & Brown, 2004). Also collected from publicly available data but at the neighborhood level was the proportion of homeowners in the neighborhood (Ziersch, Baum, MacDougall & Putland, 2005; Rohe & Stewart, 1996). Gender was available only for a subset of the population (n=60), because the original intent of the social capital data was for comparison at the neighborhood level rather than the individual level as in this study. The decision was made later in the data collection process to begin collecting data on gender. The role of gender as a

confounding factor in this study was assessed in a subanalysis for the subset of subjects with data on gender.

Race. Information on race was dichotomized into white v. other race due to small numbers of races other than white.

Health. Self-rated health was based on a question in the social capital survey that asked if respondents would in general rate their health as excellent, very good, good, fair, or poor. This variable was dichotomized based on those who felt their health was excellent or very good versus all others.

Years lived in the neighborhood. Survey respondents were asked how many years they had lived in this area, meaning within a 15-20 minute walk or a 5-10 minute drive from where they were currently living. In the event that they had been living in the area less than one year, they were asked how many months they had lived in the area. The months were then converted into a decimal representing the fraction of the year they had lived in the area. If they had just moved to the area (n=5), they were considered to have lived in the area zero years. This variable was dichotomized based on values above and below the median number of years respondents had lived in their respective neighborhoods.

Perception of Safety. Studies have indicated that a person who is fearful of crime report more crime in his or her neighborhood than a resident who experiences less fear, even though they live in the same neighborhood (e.g. Perkins, Meeks & Taylor, 1992). To this end, respondents were asked how safe they felt walking alone in the area after dark: very safe, fairly safe, a bit unsafe, very unsafe, or they never go out alone

after dark. This variable was dichotomized based on those who felt very or fairly safe and those who felt otherwise.

Market value of the house. The market value of the home in which the person currently resides was determined based on publicly available data, linked by the home address of the survey respondent. This variable was dichotomized based on those with houses below the median house value in Portland in the year 2000 and those above the median ($154,900).

Age of the house. The age of the house in which the survey respondent resides was determined based on publicly available data. There were 13 missing values in the data set. A three-category designer variable was created: houses before 1950 and missing cases were compared to the referent category of houses built after 1950. The age of house in which a person lives has been found to be associated with neighborly interaction, presumably because the era of development generally determines the basic characteristics of the neighborhood (Cao, Handy & Mokhtarian, 2006). Brown and colleagues (2001) state that the building styles and neighborhood layout of the earlier 20th century is vastly different than the modern era, which began in 1986; the authors therefore suggest a mid-century marker to distinguish these two eras. Based on these theoretical discussions, we chose a cutpoint of 1950 to compare eras.

Percentage of homeowners in the neighborhood. The percentage of homeowners for each of the eight neighborhoods was gathered from publicly available data. This variable was dichotomized based on whether greater or fewer than 50 percent of people in the neighborhood owned their own homes.

Data Analysis

A total of 128 survey respondents and corresponding street segments were considered in the data analysis. SPSS version 13.0 was used for data management and analysis. Internal consistency of the neighborliness composite measure was assessed using Cronbach's coefficient alpha. The built environment characteristics of those segments included in the study (n=128) was compared to the excluded segments (n=294), using a contingency table analysis with Pearson's chi-square test statistics.

Summary statistics were calculated using frequency tables. Distributions were visually checked with histograms, to get a sense of the relationship between neighborliness and the built environment characteristics and determine if sufficient variability existed to continue with the analysis. Those variables with values fewer than five observations in the contingency tables with neighborliness were not included in the regression analysis. Correlations among the built characteristics (front porches, traffic calming devices, bars on windows, litter, and sidewalks) as well as among the individual-level characteristics were assessed for strength, direction, and significance. This was done to get a sense of which variables tended to exist together. Crude associations with neighborliness were examined between each built environment measure and each covariate using contingency tables and chi-square statistics.

Multinomial Logistic Regression. The odds of low versus moderate, low versus high, and moderate versus high neighborliness were modeled using multinomial logistic regression. Univariate associations between each built environment variable and neighborliness were first assessed. The univariate relationship between each covariate (potential confounders) and neighborliness was also assessed. Models were then created

between one built environment characteristic and neighborliness, controlling for race, self-reported health, perception of safety, number of years lived in the neighborhood, age of the house, market value of the house, and neighborhood-level homeownership. These were called the 'individual models.'

Simple multinomial logistic regression models with p-values <0.26 were combined into a multivariable model to consider how the built environment characteristics work together in relation to neighborliness. Factors with p-values >0.10 were removed one at a time until all p-values were <0.10. The covariates that were removed from the model were then added back into the model individually, and remained in the model if the effect estimate for the primary exposure of interest changed by at least 10 percent.

Because the majority of street segments had only one individual sampled, we assumed that there was very little clustering by street segment and did not account for clustering in the analysis. We did not take into account spatial correlations at the neighborhood level because we were primarily concerned with differences in environmental characteristics at the street segment level.

RESULTS

Characteristics of the Respondents

Of the 128 respondents, the majority (78 percent) were white and 48 percent reported excellent or very good health. The mean number of years the survey respondents had lived in the area was 13.9 years, while the median was 6.5 years. Average market value of the homes was $196,804, while the median home price in the city of Portland during 2000 was $154,900. A majority of respondents (64.8 percent) reported feeling very or fairly safe walking alone in their neighborhoods after dark. 63 percent of respondents' homes were built prior to 1950 (excluding the 13 with missing values). Gender data were available for 60 respondents (47 percent of the sample); of those, 63.3 percent were female.

Characteristics of the Neighborhoods

Table 3 displays selected characteristics of the eight neighborhoods. The majority of neighborhoods were primarily made up of single-family and some multi-family housing, while a smaller number had more of an industrial presence. The proportion of people per neighborhood who refused interviews ranged from 52 percent to 74 percent; this was not significantly different by neighborhood (X^2= 5.97, p=0.54). The percentage of homeowners within a neighborhood ranged from 16 percent to 66 percent. The median property value ranged from $109,525 to $224,780.

Comparisons between the built environment characteristics of the original 359 street segments, stratified by neighborhood, revealed significant differences between the neighborhoods regarding built environment characteristics, as shown in Table 4. Between-neighborhood differences were significant for all seven built environment

characteristics; marginal significance was achieved with yard maintenance (X^2=12.70, p=0.08), demonstrating that this variable had the least amount of variability between neighborhoods, as most yards were very well-maintained.

Table 3
Selected characteristics of study neighborhoods[a], Neighborhood Design and Neighborliness study, Portland, OR, 2003.

Neighborhood	Overall % street segments per NH (n=359)	% Survey Respondents from given NH (n=128)	Population	Median Property Value	%Home-owners	% Refused Interviews (X^2= 5.97, p=0.54)	Description of NH from land use maps
Buckman	11.7%	11.7%	7923	$181,475	16%	65%	Good mix of land uses from employment to open spaces to retail/commercial to single- and multi-family residential
Cathedral Park	6.7%	14.8%	3033	$120,600	52%	64%	Primarily residential, single-family dwellings, commercial zone is not embedded w/in the dwelling area
Creston-Kenilworth	9.2%	14.1%	8234	$139,150	38%	63%	Single- and multi-family dwelling. Commercial area along principal artery. Some open spaces.
Montavilla	26.2%	14.8%	15987	$125,150	61%	72%	Majority single-family zoning, with some multi-family zoning. Open spaces are limited.
Richmond	16.7%	8.6%	11320	$128,790	60%	65%	Majority is single-family zoning, with some commercial space.
St. John's	16.2%	16.4%	11346	$109,525	56%	74%	Majority is industrial, with some areas of open space and a concentrated area of single-family dwelling zone.
Sullivan's Gulch	4.2%	10.2%	3043	$224,780	26%	65%	Mix of commercial and employment uses. Single- and multi-family residence. Very limited open space.
Woodlawn	9.2%	9.4%	4889	$112,000	66%	52%	Mostly single-family zoning, with some multi-family. Industrial area is rather large. Some open space.

[a]Table adapted from: Neighborhood design and active aging (Michael et al., 2006).
Source: Data from June 2002 RLIS, taxlots dataset (Data Resource Center, Metro); US Census 2000; Office of Neighborhood Involvement, www.myportlandneighborhood.org.

Table 4
Comparisons of the built environment of the eight neighborhoods represented in the Neighborhood Design and Neighborliness study, Portland, OR, 2003. (n=359 street segments)[a]

	Buckman	Cathedral Park	Creston Kenilworth	Montavilla	Richmond	St. John's	Sullivan's Gulch	Wood-lawn	Pearson's Chi-square (p-value)
Front Porches[b]									
Below Median	61%	65%	74%	77%	46%	76%	50%	48%	$\chi^2 = 24.10$ p=0.001
Above Median	39%	35%	26%	23%	54%	24%	50%	52%	
Traffic Calming Devices									
None	64%	96%	64%	86%	75%	66%	73%	79%	$\chi^2 = 20.00$
Some	36%	4%	36%	14%	25%	34%	27%	21%	p=0.006
Bars on Windows									
Some	60%	74%	42%	54%	53%	53%	73%	30%	$\chi^2 = 15.60$
None	40%	26%	58%	46%	47%	47%	27%	70%	p=0.029
Yard Maintenance									
<75% well-maintained	22%	25%	22%	24%	4%	23%	23%	13%	$\chi^2 = 12.70$ p=0.08
≥75% well-maintained	78%	75%	78%	76%	96%	77%	77%	87%	
Building Condition									
≥5%damaged	20%	11%	23%	14%	0%	7%	0%	13%	$\chi^2 = 17.70$
<5%damaged	80%	89%	77%	86%	100%	93%	100%	87%	p=0.013
Litter or Graffiti									
Some	45%	30%	27%	30%	20%	55%	33%	30%	$\chi^2 = 21.10$
None	55%	71%	73%	70%	80%	45%	67%	70%	p=0.004
Neighborhood Sidewalk Continuity[c]	≥90%	<80%	≥90%	<80%	≥90%	80 to 89%	80 to 89%	80 to 89%	n/a

[a]The entire population of street segments, without repeats (n=359), was used for this comparison, to get an overall sense of neighborhood differences.
[b]Front porches median was defined as the total number of FP's on the street segment divided by the number of buildings on the segment and was dichotomized at the 50th percentile of the analytic population.
[c]'Continuity' was measured as having continuous sidewalks on at least one side. Neighborhoods were categorized as those with <80% continuous on at least one side, 80-89%, or ≥90%.

Characteristics of the built environment did not differ significantly between those street segments included in the study (n=128) and those not included (n=294), except for Front Porches and Bars (see Table 5). With regard to front porches, the median of those segments included in the study was used as the cut point; 32 percent of the street segments not included in the analysis fell above the median cut point of the analytic sample. This was significantly different between the two samples (X^2=7.87, p=0.01). With regard to bars on windows and doors, 38 percent of those segments included in our

Table 5
Comparison of street segments included in study and those not included; Neighborhood Design and Neighborliness study, Portland, OR, 2003.

	Segments included in study (n=128)	Segments not included (n=294)	Pearson's Chi-square (p-value)
Front Porches[a]			
Below Median	49.2%	68.0%	$\chi^2 = 7.87$
Above Median	50.8%	32.0%	(p=0.01)
Traffic Calming Devices			
None	74.6%	76.0%	$\chi^2 = 0.06$
Some	25.4%	24.0%	(p=0.81)
Bars on Windows			
Some	37.7%	43.7%	$\chi^2 = 7.02$
None	62.3%	56.3%	(p=0.01)
Yard Maintenance			
<75% well-maintained	14.5%	19.8%	$\chi^2 = 0.92$
≥75% well-maintained	85.5%	80.2%	(p=0.34)
Building Condition			
≥5%damaged	10.2%	11.4%	$\chi^2 = 0.07$
<5%damaged	89.9%	88.6%	(p=0.79)
Litter or Graffiti			
Some	27.0%	35.5%	$\chi^2 = 1.67$
None	73.0%	64.5%	(p=0.20)
NH Sidewalk Continuity[b]			
<80% continuous in NH	31.7%	33.1%	$\chi^2 = 1.15$
80-89% cont. in NH	34.9%	28.4%	(p=0.56)
≥90% continuous in NH	33.3%	38.5%	

[a]Front porches median was defined as the total number of FP's on the street segment divided by the number of buildings on the segment and was dichotomized at the 50th percentile of the analytic population (n=128).
[b]'Continuity' was measured as having continuous sidewalks on at least one side. Neighborhoods were categorized as those with <80% continuous on at least one side, 80-89%, or ≥90%.

analytic sample had some bars on the windows, whereas 44 percent of those segments not included had bars on the windows (X^2=7.02, p=0.01). The remaining variables did not vary significantly between segments included compared with those excluded.

Dependent Variable: Neighborliness

The Cronbach's alpha for the subscales used to create the neighborliness score was acceptable at 0.65 and close to the reliability of the UK's General Household Survey (GHS) scale, which was 0.70. The mean neighborliness score was 4.5; see Figure 2 for distribution of frequencies. Overall, 34 percent of survey respondents were categorized as having high neighborliness, meaning they scored 6 out of 6 on the neighborliness scale. 45 percent were categorized as having moderate neighborliness, and 21 percent

were categorized as having low neighborliness. 56 percent of respondents reported knowing most or many of the people on their street segment or block, and 66 percent reported trusting most or many. While overall proportions were higher among the neighborhoods of this survey when compared to the results of the much larger GHS survey, the trends are similar (see Table 6). For example, in both studies a higher percentage report *trusting* most or many than *knowing* most or many, possibly indicating a 'generalized trust' people have of each other even if they are not considered acquaintances (Coulthard, Walker & Morgan, 2002). Furthermore, 84 percent of individuals in this study reported looking out for one another, 80 percent having done a favor and received a favor, and 88 percent spoke to their neighbors on at least a weekly basis.

Figure 2
Distribution of Neighborliness, Neighborhood Design and Neighborliness study, Portland, OR, 2003

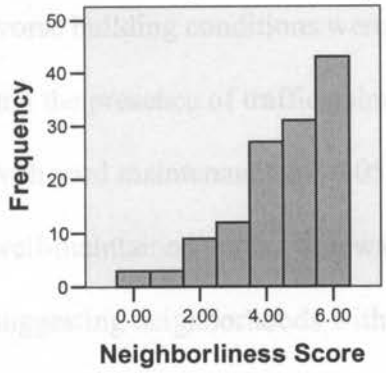


Table 6
Neighborliness score distributions of Neighborhood Design and Neighborliness study, Portland, OR, 2003, compared to General Household Survey[a], UK, 2000.

	Current Study, 2003	GHS, 2000
Cronbach's alpha	0.65	0.70
Overall High neighborliness	34%	34%
Knowing most or many	56%	46%
Trusting most or many	66%	58%
Look out for each other	84%	73%
Done a favor	80%	74%
Received a favor	80%	72%
Speak weekly	88%	81%

[a]The GHS is a large-scale survey conducted on a regular basis throughout the UK (Coulthard, Walker & Morgan, 2002).

Correlations between Main Effects Variables and between Covariates

Significant correlations were found between number of years lived in a neighborhood and self-rated health in the negative direction ($p=0.02$). This may reflect the possibility that the longer the person has lived in a neighborhood, the older the respondent, and the lower the respondent rates his or her health. Perception of safety was also found to be positively correlated with market value of the house ($0=0.01$) but unexpectedly negatively correlated with neighborhood homeownership ($p<0.01$). Between built environment characteristics, front porches were correlated with sidewalk connectivity ($p<0.05$) and traffic calming devices ($p<0.01$) in a positive direction, suggesting that front porches commonly coexist with traffic calming devices and with more complete systems of sidewalks. Building condition was correlated in a negative direction with traffic calming devices ($p<0.05$) and sidewalk connectivity, suggesting worse building conditions were found in neighborhoods with more connected sidewalks and the presence of traffic calming devices. Building condition was positively associated with yard maintenance ($p<0.05$), suggesting well-maintained buildings coexisting with well-maintained yards. Sidewalks were negatively correlated with bars ($p<0.01$), suggesting neighborhoods with more complete sidewalks also had more bars on windows and doors (given the direction of our hypothesis). A table showing correlations among covariates and correlations among built environment variables is provided in Appendix C.

Associations between Neighborliness and the Covariates

Distribution of neighborliness by covariates is shown in Table 7. The direction of association for all covariates was in the direction expected except homeownership, which

showed data distributed fairly evenly across all neighborliness categories. Significant trends were found between neighborliness and the age of the house (p=0.03), and marginally between neighborliness and self-reported health (p=0.08), years lived in the neighborhood (p=0.09), and market value (p=0.06). Race, perception of safety, and homeownership did not reach statistical significance. Living in a house built before 1950 was associated with greater neighborliness: 78 percent of those with high neighborliness lived in houses built before 1950, compared with 73 percent of those with moderate neighborliness and 48 percent of those with low neighborliness. With respect to self-rated health, 60 percent of those with high neighborliness reported excellent or very good health compared to 38 percent of those with moderate neighborliness and 48 percent of those with low neighborliness. Those who had lived in the neighborhood longer were more likely to be neighborly: 60 percent of those with high neighborliness had lived in

Table 7
Distribution of neighborliness by covariate (n=128). NH Design and Neighborliness, Portland, OR, 2003.

	Neighborliness			Pearson's Chi-Square (p-value)
	Low	Moderate	High	
Race				
Other	26%	26%	14%	χ^2=2.40
White	74%	74%	86%	p=0.31
Self-Reported Health				
Good, Fair, or Poor	52%	62%	40%	χ^2=5.00
Excellent or Very Good	48%	38%	60%	p=0.08
Perception of Safety after Dark				
Less safe	41%	38%	28%	χ^2=1.6
Very / fairly safe	59%	62%	72%	p=0.46
Years Lived in NH[a]				
Below median	67%	50%	40%	χ^2=4.90
Above median	33%	50%	60%	p=0.09
Year House was Built[b]				
1950 or After	52%	27%	22%	χ^2=7.20
Before 1950	48%	73%	78%	p=0.03
Market Value of House[c]				
Below median	63%	52%	35%	χ^2=5.70
Above median	37%	48%	65%	p=0.06
Homeownership[d]				
<50% of neighborhood	30%	41%	33%	χ^2=1.40
≥50% of neighborhood	70%	59%	67%	p=0.49

[a]Missing values (n=13) were excluded from the 2x2 contingency table analysis for Year House was Built.
[b]Years lived in neighborhood is dichotomized based on the median of our sample population.
[c]Market value of house is dichotomized based on the median value in Portland the year the data were collected.
[d]Homeownership is based on the proportion of residents of a given neighborhood who own homes. It is measured at the neighborhood level.

the neighborhood for greater than the median length of time, compared with 50 percent of those with moderate neighborliness and 33 percent of those with low neighborliness. Greater market value of the house was also marginally associated with greater neighborliness: 65 percent of those with high neighborliness lived in houses above the median Portland value during the study year, compared with 48 percent of those with moderate neighborliness and 37 percent of those with low neighborliness.

Table 8 provides similar information to Table 7, but using logistic regression to display the odds ratios relating neighborliness to each of the covariates. The odds of high neighborliness compared to moderate was two and a half times greater for those who reported excellent or very good health (OR = 2.50, 95% CI 1.11, 5.62). The odds of high neighborliness compared to low neighborliness was three times higher among those who

Table 8
Univariate analyses: Odds of neighborliness for each covariate. Neighborhood Design and Neighborliness study, Portland, OR, 2003 (n=128).

	Univariate Analysis OR (95% CI)			
	Odds of Moderate v. Low	Odds of High v. Low	Odds of High v. Moderate	p-value*
Race				
Other	1.00	1.00	1.00	0.28
White	1.00 (0.35, 2.85)	2.16 (0.64, 7.30)	2.15 (0.76, 6.11)	
Self-Reported Health				
Good, Fair, or Poor	1.00	1.00	1.00	0.08
Excellent or Very Good	0.66 (0.26, 1.66)	1.65 (0.62, 4.35)	**2.50 (1.11, 5.62)**	
Perception of Safety				
Less safe	1.00	1.00	1.00	0.45
Very / fairly safe	1.13 (0.44, 2.86)	1.78 (0.64, 4.91)	1.58 (0.67, 3.70)	
Years Lived in NH[a]				
Below median	1.00	1.00	1.00	0.08
Above median	2.00 (0.77, 5.18)	**3.06 (1.12, 8.37)**	1.53 (0.69, 3.40)	
Year Built				
1950 or After	1.00	1.00	1.00	0.03
Before 1950	**3.00 (1.09, 8.23)**	**3.90 (1.31, 11.32)**	1.28 (0.49, 3.40)	
Missing	4.50 (0.81, 24.99)	1.44 (0.17, 12.23)	0.32 (0.06, 1.85)	
Market Value of House[b]				
Below median	1.00	1.00	1.00	0.06
Above median	1.59 (0.62, 4.04)	**3.17 (1.17, 8.64)**	2.00 (0.89, 4.50)	
Homeownership[c]				
<50% of neighborhood	1.00	1.00	1.00	0.49
≥50% of neighborhood	0.60 (0.22, 1.59)	0.87 (0.31, 2.48)	1.46 (0.64, 3.34)	

*P-value from Likelihood Ratio Test chi-square statistic
[a]Years lived in neighborhood is dichotomized based on the median of our sample population
[b]Market value of house is dichotomized based on the median value in Portland the year data were collected.
[c]Homeownership is based on the proportion of residents of a given neighborhood who own homes. It is measured at the neighborhood level.

had lived in the neighborhood longer than the median number of years of all respondents (OR = 3.06, 95% CI 1.12, 8.37) and who lived in houses more expensive than the median house price in Portland (OR = 3.17, 95% CI 1.17, 8.64), and almost four times higher among those living in houses built before 1950 (OR = 3.90, 95% CI 1.31, 11.32). Age of the house was also significant when comparing moderate to low neighborliness; the odds of moderate compared to low neighborliness was three times greater among those living in older houses compared with those living in houses built more recently (OR = 3.00, 95% CI 1.09, 8.23).

In summary, the covariates that reached statistical significance at least marginally when examining their association with neighborliness in univariate analyses included self-reported health, years lived in the neighborhood, year house was built, and market value of the house. Race, perception of safety, and proportion of homeownership in the neighborhood did not reach statistical significance.

Association between the Built Environment and Neighborliness

This section reviews the results of the contingency table analysis (Table 9) and the multinomial logistic regression analyses (Table 10) with regard to the relationships between neighborliness and the built environment characteristics. The multivariable model is then discussed at the end of this section.

Table 9
Distribution of neighborliness by built environment characteristic (n=128); Neighborhood Design and Neighborliness study, Portland, OR, 2003.

	Neighborliness			Pearson's Chi-Square (p-value)
	Low	Moderate	High	
Front Porches[a]				
Below median	52%	59%	33%	χ^2=6.90
Above median	48%	41%	67%	p=0.03
Traffic Calm Devices				
None	78%	72%	86%	χ^2=2.70
Some	22%	28%	14%	p=0.26
Bars on Windows				
Some	63%	60%	67%	χ^2=0.54
None	37%	40%	33%	p=0.77
Litter/Graffiti				
Some	19%	29%	13%	χ^2=2.70
None	81%	71%	84%	p=0.26
Neighborhood Sidewalk Connectivity[b]				
<80% Cont.	37%	31%	23%	χ^2=5.02
80-89% Cont.	44%	34.5%	33%	p=0.29
≥90% Cont.	19%	34.5%	44%	
Yard Maintenance				
<75% well-maint.	4%	14%	0%	χ^2=7.70
≥75% well-maint.	96%	86%	100%	p=0.02
Building Condition				
≥5%damaged	7%	24%	12%	χ^2=4.80
<5%damaged	93%	76%	88%	p=0.09

[a]Front porches median was defined as the total number of FP's on the street segment divided by the number of buildings on the segment and was dichotomized at the 50th percentile of the study population (n=128).
[b]'Continuity' was measured as having continuous sidewalks on at least one side. Neighborhoods were categorized as those with <80% continuous on at least one side, 80-89%, or ≥90%.

Overall, the distribution of neighborliness across built environment characteristics, as shown in Table 9, suggested significant associations between neighborliness and front porches and yard maintenance, and marginal significance with building condition. However, because of small cell sizes associated with two variables, Yard Maintenance and Building Condition, these variables were not included in the logistic regression analysis. In particular, all of the individuals with high neighborliness lived on street segments where greater than 75 percent of yards were well-maintained (p=0.02) and 88 percent of those with high neighborliness compared with 76 percent with moderate and 93 percent with low neighborliness lived on segments where less than 5 percent of the buildings on the segments were in need of repair.

Front Porches. 67 percent of those with high neighborliness compared to 41 percent of those with moderate and 48 percent of those with low neighborliness lived on street segments where there were a greater number of buildings with front porches (p=0.03). In the univariate analysis, the odds of high neighborliness compared to moderate neighborliness were almost three times higher among those living on street segments with more front porches per building than those with fewer front porches (OR = 2.94, 95% CI 1.29, 6.69). Results were similar when comparing high to low neighborliness (OR 2.23, 95% CI 0.83, 5.99). In the Independent Models, which controlled for confounders, the effect estimates were reduced and the front porches variable became insignificant. The confounders that most significantly weakened the effect estimate were the year the house was built (decreasing the odds ratio by approximately 27 percent) and the market value of the house (decreasing the odds ratio by about 26 percent).

Traffic Calming Devices. The direction of the association between traffic calming devices and neighborliness was in the opposite direction from what was hypothesized. The odds ratios in the univariate and independent models failed to reach statistical significance. In the independent models, controlling for confounders, the odds of high versus moderate neighborliness was 61 percent less among those with some traffic calming devices compared with those with no traffic calming devices on their street segments. The high versus low comparison showed a 64 percent reduction of odds, whereas the moderate versus low showed an 8 percent reduction of odds.

Bars on Windows and Doors. As with the traffic calming devices, the direction of the association between bars and neighborliness was in the opposite direction from

what was hypothesized. The odds ratios failed to reach statistical significance in both the univariate analysis and the independent model. The effect estimates in the independent models ranged from a 23 percent to a 42 percent reduction in the odds of neighborliness among those people living on street segments where there were some bars on buildings compared to those living on segments where there were none.

Litter/Graffiti. Though this variable failed to reach statistical significance in the univariate or independent model, the direction of the effect was as hypothesized and became stronger after controlling for confounding variables. In the independent models, the odds of high compared to moderate neighborliness was 2.63 times greater among those living on street segments with no litter or graffiti compared with those living on segments with some (95% CI 0.88, 7.83), and the odds of high compared to low neighborliness was 1.48 times greater again among those with no litter or graffiti (95% CI 0.37, 5.94).

Neighborhood Sidewalk Connectivity. Though sidewalk connectivity did not reach statistical significance in either the univariate or independent models, the trends in the data are noteworthy: 44 percent of those with high neighborliness compared to 35 percent with moderate and 19 percent with low neighborliness lived in neighborhoods where greater than 90 percent of the sampled segments were continuous. In the independent models, the effect estimates after controlling for confounders were stronger than those of the univariate analyses. The odds of high versus moderate neighborliness was almost 3 times greater among those living in neighborhoods with greater than 90 percent of sidewalk connectivity compared with those living in neighborhoods with less than 80 percent connectivity (OR = 2.96, 95% CI 0.69, 12.70). The odds of high versus

low neighborliness was seven times greater among those living in neighborhoods with greater than 90 percent of sidewalk connectivity compared with those living in neighborhoods with less than 80 percent connectivity (OR = 7.04, 95% CI 0.87, 56.64). The confounding variable that strengthened the effect estimate the most was proportion of homeowners in the neighborhood, which strengthened the odds ratio by 113 percent.

Multivariable Model Results

In the multivariable model shown in Table 10, we considered how the built environment characteristics work together in relation to neighborliness. The p-value represents the level of significance reached by the Likelihood Ratio Test chi-square statistic for the main effect variable in the multinomial logistic regression model. We considered front porches, traffic calming devices, litter/graffiti, and neighborhood sidewalk connectivity. Bars were not included in the model based on the results of the univariate analysis. Front porches and traffic calming devices were not significant in the multivariable model, while litter and sidewalks remained very significant. Specifically, the odds of high neighborliness compared to moderate neighborliness among people living on street segments with greater than 90 percent sidewalk continuity were almost 7 times greater than those living in neighborhoods with less than 80 percent connectivity (OR 6.70, 95% CI 1.21, 37.0). The odds of high neighborliness compared to low neighborliness among people living on street segments with greater than 90 percent sidewalk continuity were almost eight times greater than those living in neighborhoods with less than 80 percent connectivity (OR 7.90, 95% CI 0.86, 72.46). The odds of high neighborliness compared to moderate neighborliness among those living on street segments with no litter or graffiti were also almost seven times greater than individuals

living on street segments with no litter or graffiti (OR 6.90, 95% CI 1.92, 27.80), where the odds comparing high to low neighborliness were almost two times greater among those with no litter or graffiti (OR = 1.95, 95% CI 0.34, 11.00).

All of the covariates considered in the multivariable model changed the effect estimate of at least one main effects variable by greater than 10 percent, including race, self-reported health, perception of safety, years lived in the neighborhood, age of the house, market value of the house, and proportion of neighborhood homeowners. The odds of high neighborliness compared to moderate or low neighborliness was greater among those who report better health, those who have lived in the neighborhood longer, those who live in more expensive houses, those who live in older houses, those who live in neighborhoods with a higher percentage of homeowners, those who feel safer walking alone after dark in their neighborhoods, and whites compared to people of other races.

Table 10

Odds of neighborliness, given characteristics of the built environment and various levels of confounding. Neighborhood Design and Neighborliness study, Portland, OR, 2003 (n=128).

	Univariate Analyses				Independent Models[c,d,e]				Multivariable Model[f]			
	OR (95% CI)				OR (95% CI)				OR (95% CI)			
	Odds of Moderate v. Low	Odds of High v. Low	Odds of High v. Moderate	p-value*	Odds of Moderate v. Low	Odds of High v. Low	Odds of High v. Moderate	p-value*	Odds of Moderate v. Low	Odds of High v. Low	Odds of High v. Moderate	p-value*
Front Porches[a]												
Below median	1.00	1.00	1.00		1.00	1.00	1.00					
Above median	0.76 (0.30, 1.90)	2.23 (0.83, 5.99)	**2.94 (1.29,6.69)**	**0.03**	0.53 (0.18, 1.56)	1.08 (0.34, 3.53)	2.06 (0.78, 5.41)	0.26	ns	ns	ns	--
Traffic Calm Devices												
None	1.00	1.00	1.00	0.25	1.00	1.00	1.00	0.20	ns	ns	ns	--
Some	1.33 (0.46, 3.91)	0.57 (0.16, 1.99)	0.43 (0.15, 1.20)		0.92 (0.27, 3.19)	0.36 (0.09, 1.50)	0.39 (0.12, 1.23)					
Bars on Windows												
Some	1.00	1.00	1.00	0.76	1.00	1.00	1.00	0.64	(not included in model)	--	--	--
None	1.12 (0.44, 2.87)	0.82 (0.30, 2.25)	0.74 (0.32, 1.68)		0.77 (0.27, 2.26)	0.58 (0.18,1.85)	0.75 (0.29, 1.91)					
Litter/Graffiti												
Some	1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	
None	0.55 (0.18, 1.69)	1.17 (0.33, 4.14)	2.13 (0.79, 5.72)	0.26	0.56 (0.16, 1.94)	1.48 (0.37, 5.94)	2.63 (0.88, 7.83)	0.19	0.32 (0.07, 1.49)	1.95 (0.34, 11.00)	**6.90 (1.92, 27.8)**	**0.01**
Neighborhood Sidewalk Connectivity[b]												
<80% Cont.	1.00	1.00	1.00	0.26	1.00	1.00	1.00	0.14	1.00	1.00	1.00	**0.03**
80-89% Cont.	0.93 (0.32, 2.66)	1.17 (0.36, 3.75)	1.26 (0.45, 3.53)		0.62 (0.17, 2.19)	0.90 (0.22, 3.69)	1.46 (0.44, 4.78)		0.46 (0.10, 2.07)	1.28 (0.25, 6.46)	**4.56 (1.02, 20.40)**	
≥90% Cont.	2.22 (0.64, 7.74)	**3.80 (1.01, 14.20)**	1.71 (0.63, 4.63)		2.38 (0.33, 17.15)	7.04 (0.87, 56.64)	2.96 (0.69, 12.70)		1.57 (0.18, 13.56)	7.90 (0.86, 72.46)	**6.71 (1.21, 37.00)**	

[a]Front Porches per were dichotomized based on the median number of front porches per building of our study sample (n=128).

[b]Neighborhood Sidewalk Connectivity was defined as the proportion of continuous sidewalks in a neighborhood, measured from all street segments in the parent study population (n=359).

[c]In the independent models, significant confounders for Front Porches, Traffic Calming Devices, and Bars were Health, Years in Neighborhood, Market Value, and Year House was Built.

[d]In the independent model for Litter/Graffiti, significant confounders were Health, Years in Neighborhood, Market Value, Year House was Built, Race, and Safety.

[e]In the independent model for Sidewalk Connectivity model, significant confounders were Health, Yrs in NH, Market Value, Year House was Built, and Homeownership.

[f]In the Multivariable model, all of the confounders considered contributed to the model.

*The p-value is from the Likelihood Ratio Test chi-square statistic for the main effect variable in the multinomial logistic regression model.

Sub-Analysis including Gender

An analysis of the sub-population in which gender could be assessed as a potential confounder was carried out among the 60 survey participants with corresponding gender data. Due to the presence of small cell sizes, we were only able to evaluate gender alone as a potentially confounding variable for the univariate relationships between each built environment variable and neighborliness, not when added to the multivariable model. The results are shown in Table 11.

When controlling for gender, most main effects variables reached statistical significance and Neighborhood Sidewalk Connectivity reached marginal significance ($p=0.10$). The majority of the effect estimates became stronger when controlling for gender compared to the univariate effect estimates. The odds of neighborliness among women was greater than that among men in all comparisons, and ranged from 1.4 to 29 times greater odds of neighborliness among women than among men, depending on which built environment characteristic was being evaluated. The degree of confounding was greatest with the front porches variable comparing high to moderate neighborliness, where adding gender to the model strengthened the odds ratio by almost 200 percent. When controlling for gender, the odds of high compared to moderate neighborliness among those living on street segments with more front porches per building was 8.76 times greater than the odds among those with fewer front porches (95% CI 2.27, 33.80). In summary, gender does appear to confound the relationship between neighborliness and the built environment characteristics, but primarily strengthens the relationships when included in the models.

Table 11

Odds of neighborliness given characteristics of the built environment and gender. Neighborhood Design and Neighborliness Study, Portland, OR, 2003.

	Univariate Analyses (n=128)				Univariate plus Gender (n=60)			
	OR (95% CI)				OR (95% CI)			
	Odds of Moderate v. Low	Odds of High v. Low	Odds of High v. Moderate	p-value*	Odds of Moderate v. Low	Odds of High v. Low	Odds of High v. Moderate	p-value*
Front Porches[a]								
Below median	1.00	1.00	1.00		1.00	1.00	1.00	
Above median	0.76	2.23	**2.94**	0.03	0.16	1.39	**8.76**	<0.001
	(0.30, 1.90)	(0.83, 5.99)	**(1.29,6.69)**		(0.03, 0.84)	(0.22, 8.68)	**(2.27, 33.80)**	
Male					1.00	1.00	1.00	
Female					6.30	8.87	1.41	
					(1.19, 33.30)	(1.68, 46.83)	(0.34, 5.86)	
Traffic Calm Devices								
None	1.00	1.00	1.00	0.25	1.00	1.00	1.00	0.07
Some	1.33	0.57	0.43		1.37	0.84	0.61	
	(0.46, 3.91)	(0.16, 1.99)	(0.15, 1.20)		(0.27, 6.91)	(0.15, 4.81)	(0.18, 2.10)	
Male					1.00	1.00	1.00	
Female					5.21	9.17	1.76	
					(1.10, 24.65)	(1.73, 48.52)	(0.49, 6.39)	
Bars on Windows								
Some	1.00	1.00	1.00	0.76	1.00	1.00	1.00	0.02
None	1.12	0.82	0.74		5.64	1.83	0.33	
	(0.44, 2.87)	(0.30, 2.25)	(0.32, 1.68)		(0.58, 55.20)	(0.15, 22.10)	(0.08, 1.41)	
Male					1.00	1.00	1.00	
Female					5.76	9.23	1.60	
					(1.17, 28.41)	(1.75, 48.80)	(0.43, 5.94)	
Litter/Graffiti								
Some	1.00	1.00	1.00		1.00	1.00	1.00	0.04
None	0.55	1.17	2.13	0.26	0..48	1.51	3.13	
	(0.18, 1.69)	(0.33, 4.14)	(0.79, 5.72)		(0.05, 5.02)	(0.11, 21.45)	(0.55, 17.73)	
Male					1.00	1.00	1.00	
Female					4.94	9.32	1.89	
					(1.03, 23.64)	(1.75, 49.70)	(0.51, 6.93)	
Neighborhood Sidewalk Connectivity[b]								
<80% Cont.	1.00	1.00	1.00	0.26	1.00	1.00	1.00	0.10
80-89% Cont.	0.93	1.17	1.26		0.26	0.21	0.78	
	(0.32, 2.66)	(0.36, 3.75)	(0.45, 3.53)		(0.02, 4.71)	(0.01, 4.87)	(0.08,8.00)	
≥90% Cont.	2.22	**3.80**	1.71		3.31	4.74	1.43	
	(0.64, 7.74)	**(1.01, 14.20)**	(0.63, 4.63)		(0.32, 34.1)	(0.36, 63.31)	(0.21, 9.80)	
Male					1.00	1.00	1.00	
Female					15.13	29.14	1.93	
					(1.58, 145.1)	(2.71, 313.9)	(0.50, 7.20)	

[a]Front Porches per were dichotomized based on the median number of front porches per building of our study sample (n=128).

[b]Neighborhood Sidewalk Connectivity was defined as the proportion of continuous sidewalks in a neighborhood, measured from all street segments in the parent study population (n=359).

*The p-value is from the Likelihood Ratio Test chi-square statistic for the main effect variable in the multinomial logistic regression model.

DISCUSSION

This study suggests that modifiable features of the built environment are associated with neighborliness, even after adjusting for characteristics of individuals and other neighborhood qualities. In particular, this study suggests that it is not merely the presence of individual elements of the built environment that are associated with neighborliness but rather that the environment and individual characteristics confound one another in this relationship. These results offer promising directions for potential interventions that may increase social capital and in turn benefit health. This discussion will relate our findings to the existing literature, address the limitations of our study, and finally propose ways in which our findings guide future public health research.

Comparison of our Findings to the Existing Literature

This study found that neighborhood sidewalk connectivity and the absence of litter and graffiti were associated with neighborliness in the expected directions, increasing the odds of neighborliness almost 7-fold. The presence of front porches was significant only in the univariate analysis, increasing the odds of neighborliness 3-fold, but failed to reach significance in the final model. Contrary to our expectations, the presence of traffic calming devices and the absence of bars were associated with a decreased likelihood of neighborliness, although these did not reach statistical significance in the full model.

Sidewalks. Our finding that a continuous system of sidewalks within a neighborhood is associated with neighborliness supports the weak ties theory of Granovetter (1973), whereby informal interactions lead to increased familiarity and trust

between neighbors. This finding is also corroborated by several existing studies. Leyden (2003) developed a measure of 'Walkability' in a city in Ireland and found that a greater number of types of destinations such as restaurants or pubs a person reports being able to walk to from his or her home, the greater the odds of several measures of social capital, such as trusting and knowing one's neighbors. While he did not measure sidewalk connectivity outright, the neighborhoods with higher Walkability scores were older and had better developed networks of sidewalks than other neighborhoods in the study.

These findings are also supported by studies in the Transportation literature, which have found that the connectivity and continuity of sidewalks between a person's residence and the destination is the feature most highly predictive of pedestrian activity (Hess, Moudon, Snyder & Stanilov, 1999; Cao, Handy & Mokhtarian, 2006; Handy, Boarnet, Ewing & Killingsworth, 2002; Pikora et al., 2003). While this is not overtly related to neighborliness, the theoretical assumptions underlying our conceptual framework suggest that increased pedestrian activity increases the probability that informal interactions occur, thereby leading to neighborliness. From a public health standpoint, having connected systems of sidewalks may therefore be beneficial in multiple ways – by increasing physical activity and leading to increased social support and social capital. Further research should be undertaken to determine whether there is a synergistic effect between increased physical activity and increased social support in the presence of connected sidewalks.

Litter and Graffiti. Our findings also strongly support the relationship demonstrated in previous studies that the presence of litter and graffiti negatively affects social interactions (Taylor, 1997; Perkins, Meeks & Taylor, 1992; Perkins, Wandersman,

Rich & Taylor, 1993). The presence of graffiti has been found to be a marker of social disruption (Araya et al., 2006; Cohen et al., 2000), and related to perceived safety from crime (Day, Boarnet, Alfonzo & Forsyth, 2006; Taylor, 1997). Some researchers have explicitly not included litter or graffiti in their assessment of the built environment, arguing that the feature is too labile and misclassification highly likely, though they do consider it a very important characteristic of the neighborhood (Pikora et al., 2003). While a misclassification bias cannot be ruled out, the strength of the association between the absence of graffiti or litter and neighborliness is such that people with high neighborliness would have to be misclassified as living on street blocks without litter seven times more frequently than people with low neighborliness to account for this bias, which is highly unlikely.

Front Porches. Although the presence of front porches was not significant in the multivariable models, the fact that it was significant in the univariate analysis suggests that in some settings they may contribute to neighborliness. Theoretical and qualitative considerations strongly support the role for front porches in facilitating social cohesion (Brown, Burton & Sweaney, 1998; Wilsom-Doenges, 2001). The degree to which front porches may influence neighborliness is dependent on how frequently they are used and the extent to which their use results in interactions between neighbors. While we only counted front porches that could comfortably seat a chair, we did not measure their actual use. Existing studies have found that qualities such as porch size or the presence of furniture are related to increased front porch use, and that more recently-built houses tend to have smaller, less functional front porches (Wilson & Doenges, 2001).

When the presence of front porches was included in a model with the covariates, the relationship between neighborliness and front porches was confounded primarily by two factors: the age and the market value of the house. In addition, when the presence of a system of sidewalks was included in the multivariable model, the odds ratio for front porches was further attenuated. These findings suggest that the variability in neighborliness thought to be explained by front porches was actually better explained by sidewalk connectivity and other covariates. This may indicate that front porches and sidewalks influence neighborliness by a similar mechanism, such as providing semi-private space for interaction. Perhaps urban neighborhood settings with older house styles and connected sidewalks are particularly conducive to neighborly interactions in ways that render porches less important. Of relevance to this, street segments in our study with a greater number of houses built before 1950 were associated with more buildings with front porches ($p=0.05$), suggesting that the front porches surveyed in our study were attached to older houses.

There are multiple measurement tools designed to objectively survey the built environment that include an assessment of front porches (Day, Boarnet, Alfonzo & Forsyth, 2006; Cunningham, Michael, Farquhar & Lapidus, 2005), and future studies should continue to evaluate their role in neighborliness. In particular, the actual frequency and duration of use of front porches should be assessed in the setting of other built environment characteristics such as sidewalk connectivity. Future studies should also consider the potential for an interaction between sidewalk connectivity and front porches, as they may act synergistically to influence neighborliness.

Traffic Calming Devices. Our observed relationship between neighborliness and traffic calming devices was in the opposite direction to that hypothesized (i.e. the presence of traffic calming devices was associated with lower odds of neighborliness), though it did not reach statistical significance.

The literature is inconclusive as to the importance of traffic calming devices for the purpose of activity such as walking. An Australian study by Pikora et al. (2003) found that traffic calming devices were not perceived by experts to be the most important factors influencing walking in a neighborhood, while personal safety, attractiveness of the surroundings, and the presence of destinations were highly important. Another Australian-based study, by Leslie and colleagues (2005), found that neighborhoods that were classified as 'highly walkable' or 'less walkable' (based on an intersection density, dwelling density, and land-use mix) did not differ by residents' perceptions of traffic safety measures. Michael and colleagues. (2006) also found mixed results in a qualitative study among senior residents of the same Portland neighborhoods as in this study. The participants of that study were decidedly mixed as to whether traffic calming devices served to increase safety by slowing traffic, or to make walking less safe by obscuring visibility of drivers to pedestrians.

While these studies suggest the inconclusive nature of the relationship between traffic calming devices and physical activity, they do not speak to the relationship with neighborliness. We hypothesized that traffic calming devices would allow people to feel safe being outdoors (e.g. conversing with neighbors), as the traffic would be slower and more predictable. Perhaps traffic calming devices are either unimportant, or the street segments with these devices had other unmeasured features that discourage interaction,

such as prior high traffic flow. To understand this, we would need to consider confounding by factors such as traffic flow patterns in our study sample.

Bars on Windows or Doors. As with traffic calming devices, the bars variable failed to reach statistical significance and was in the opposite direction as hypothesized (i.e. the presence of bars was associated with a greater degree of neighborliness). Literature reviewed after the development of our hypotheses (see for example Criminology literature by Taylor, 1997) indicates that bars actually provide a barrier to crime and are associated with decreased crime in neighborhoods. The direction of our findings is consistent with the work of Taylor (1997) to the extent that decreased crime either represents stronger existing social capital or facilitates neighborly interactions.

Yard Maintenance and Building Condition. These two variables could not be evaluated in the regression analyses because of small cell sizes. However, the bivariate contingency table analysis suggested that a relationship existed in the expected direction. No respondents living on street segments with less than 75 percent of yards well-maintained had high neighborliness (X^2=7.77, p=0.02). Similarly, only 4 percent of respondents living on segments with buildings in need of repair had high neighborliness, whereas 30 percent of those living on segments with fewer buildings in need of repair had high neighborliness (X^2=4.84, p=0.09). This suggests that well-maintained buildings and yards may indeed be associated with neighborliness. Larger sample sizes would allow a more robust assessment of these variables and their relation to neighborliness and other aspects of the built environment.

Neighborliness Categories and the Built Environment Characteristics

One additional point of discussion involves what happens to the relationship between built environment variables and neighborliness when comparing moderate vs. low, high vs. low, and high vs. moderate neighborliness categories. The relationship between neighborliness and the built environment characteristics did not increase progressively from low to moderate to high neighborliness. For example, people living on street segments with less litter and graffiti were actually more likely to be classified as having low neighborliness than moderate neighborliness in the independent models in Table 10. Although none of these relationships reached statistical significance, the trend was the same among front porches, traffic calming devices, and bars in the independent models. This trend suggests that people were more likely to have low neighborliness than moderate neighborliness, though they were still more likely to have high compared with moderate or low neighborliness when living on segments with more favorable built environment characteristics. This suggests a level of complexity in our data and we can only speculate why this is occurring.

One possible explanation that has been suggested in the literature involves socioeconomic status (typically measured by income and education), which plays a complex role in neighborliness. A study by Ziersch and colleagues (2005) found that neighborhood connections (knowing neighbors, socializing with neighbors, noticing if neighbors had moved, and being friends with neighbors) was not associated with either education or income, and that neighborhood trust was positively associated with education but not income. Another study found higher income to be associated with greater place attachment and more social ties (Brown, Perkins & Brown, 2004), while a

study by Subramanian found lower income to be associated with greater mistrust (2004). Income and education were found by Subramanian and colleagues (2003) to interact with one another in their relationship with neighborly trust, but this interaction was not corroborated by a subsequent study (Veenstra, 2005). Overall, these studies indicate that the relationship between SES, neighborliness, and the built environment are complex and still under study.

These studies provide a potential explanation for our neighborliness category findings – specifically, that a threshold effect may exist in the relationship between the built environment and neighborliness across the socioeconomic spectrum. It is possible that neighborliness increases with SES up to a certain point after which individuals rely less heavily and therefore interact less with neighbors, and neighborliness begins to decrease. This may be because of greater networks of social support outside of neighborhoods, a dimension we did not examine in this study. If this were the case, some individuals living in neighborhoods with more favorable built environment characteristics may have had low neighborliness scores, leading to findings such as those we observed. Unfortunately we did not ask survey respondents to report their income or education levels. Our closest measure to income was market value of the house in which the person lives, which increased when moving from low to moderate to high neighborliness. To the extent that market value is representative of SES, this does not lend support to the threshold effect discussed above.

It is possible that market value of the house is an inadequate measure for SES and that more thoroughly addressing SES in this study would explain why we found a greater odds ratio for a number of the built environment variables and neighborliness when using

low vs. moderate comparisons. The significance of this discussion is particularly important when considering the potential public health interventions suggested by this study. What it may indicate is the importance of considering social connectedness needs that are being met outside the neighborhood. Interventions should then be targeted to neighborhoods where greater proportions of people lack social support in general. It is these individuals who would most benefit, from a health promotion standpoint, from relationships with neighbors.

Strengths and Limitations

This study contributes new knowledge about the nature of the relationship between the built environment and neighborliness in the context of a public health perspective that has the potential to improve health by building social capital. It substantiates and strengthens existing literature by empirically testing theories in a different population with unique data and many covariates. The weaknesses of this study involve limitations of the study sample and design, potentially uncontrolled confounding, potential biases, and issues of generalizability.

Study Sample and Design. The cross-sectional nature of this study limits our understanding of the direction of causation. It is certainly possible that individuals with certain tendencies gravitate toward certain neighborhood types, rather than neighborhood features facilitating social traits. While one author commented that 'it seems reasonable to assume that the causal link goes from attributes of the physical environment to neighboring,' (Skjaeveland & Garling 1997), this cannot be assumed. Other authors

propose that the relationship is bi-directional (Greenbaum & Greenbaum, 1981; Brown & Werner, 1985).

The size of our study sample limited our ability to perform certain analyses. In particular, we were not able to assess a number of potential interactions or provide a more detailed analysis of the confounding by gender. We were also not able to fully assess the yard and building maintenance variables due to our sample size and lack of variability in those variables. We observed wide confidence intervals around most of our effect estimates, indicating a lack of precision that may be corrected with a larger sample size.

Our small sample size of both individuals and neighborhoods also limited our ability to look deeper into the within- and between-neighborhood variability. For example, we were not able to consider nesting of individuals within neighborhoods through multi-level modeling techniques. Such an analysis would have allowed us to better understand how much of the variability in neighborliness in our population was due to characteristics of individuals as compared to characteristics of neighborhoods.

An alternative approach to multi-level modeling is to adjust for individual neighborhoods by including neighborhood code as a covariate in the statistical modeling. Doing so would allow us to evaluate the influence of overall neighborhood environment on neighborliness, as opposed to breaking the neighborhood into components as we have done. A preliminary analysis that included neighborhood code in a model with neighborliness revealed that neighborhood code was significantly associated with neighborliness (Likelihood Ratio Test $p=0.02$). When neighborhood code was included in a model with sidewalks, the effect estimates of sidewalks could not be estimated due to small cell sizes. When it was included in a model with litter and graffiti, the effect

estimates of litter and graffiti were strengthened by about 50 percent. When included in a model with front porches, the effect estimates of front porches were attenuated compared to the univariate analysis and did not reach statistical significance. These findings not only verify that the variability in neighborliness that front porches contributed is better explained by other characteristics of neighborhoods, but also suggests that there are additional elements of the neighborhood that are important predictors of neighborliness that were not captured in our analyses.

Confounding. One potential source of uncontrolled confounding that has already been discussed is SES. Other social factors that were not considered include marital status, the presence of children, and occupational status. In addition, uncontrolled confounding by age and gender was a limitation of this study. We may have indirectly controlled for age to some degree by controlling for the number of years lived in the neighborhood and self-rated health. These to covariates were highly correlated in a negative direction, that is as the number of years lived in the neighborhood increases, self-rated health decreases ($p=0.02$).

It is well-known that gender plays a role in social interaction (Unger & Wandersman, 1982). In our analysis of the sub-population for which we had gender data ($n=60$), gender did confound the relationship. In most of the sub-analyses (traffic calming devices being one exception), the effect estimates were actually stronger after adjusting for gender, suggesting that our effect estimates in Table 10 may be underestimated.

Additional features of the built environment, such as traffic volume or access to services and amenities, may present additional confounders and should be considered in

future studies. By considering the potential of such factors to act as confounders, however, they may also act to provide a more comprehensive assessment of the built environment – that is to fill out the construct of built environment by adding in missing components.

Bias. Further limitations of this study include the potential for biases. Selection bias of survey respondents cannot be ruled out. This would mean that respondents more likely to report high neighborliness agreed to participate compared with those with lower neighborliness. Only to the extent that participating in the study is related to both neighborliness and characteristics of the built environment would this affect our results. Given a response proportion of 32 percent, selection bias is a possibility.

One possible source for selection bias would be if we captured a population of people who are less healthy, such as a non-working population. If poorer health is related to both neighborliness and the built environment exposure of interest, selection bias would occur. For example, if poorer health were positively related to neighborliness and related to less desirable built environment characteristics, selection bias would act to underestimate the true odds of neighborliness. While our study was subject to this kind of bias, factors that argue against such bias include steps that were taken in the study design as well as data that show comparability of our study population with the populations of other studies. Our surveys were initiated between 3 and 7pm, the latter portion being times that would not have excluded a working population from participating. While 48 percent of our respondents reported excellent or very good health, this proportion is comparable to what other studies have reported. Other studies have found between 52 percent (Veenstra, 2005) and 58 percent (Veenstra et al., 2005) of people report excellent

or very good health. Poortinga (2006) found 74 percent of respondents rate their health as good or very good, though the categories were not identical to those used in this study and did not include an excellent category. In our study, 84 percent reported excellent, very good, or good health. Sooman & Macintyre (1995) found that between 11-28 percent of survey respondents rated their health excellent, where in our population 19 percent of survey respondents reported excellent health. These comparisons suggest that our study subjects may not be that much different from survey respondents of other studies, and argue against selection bias resulting from capturing a non-working population. Furthermore, selection bias of the street segments is a possibility. Our analysis of the built environment characteristics of those segments included in the analysis to those excluded (Table 5) argues against such a selection bias, as the majority of built environment characteristics under study were not significantly different between the two groups.

Another potential bias is a measurement bias. Measurement error in our exposure (built environment characteristics) was minimized by formal training of the observers. They would not, however, have captured any changes in the built environment over time, such as transient changes in litter and graffiti or yard maintenance. Any variations in the environment that might result in misclassification would most likely be nondifferential, as those with high, moderate, or low neighborliness would be equally affected, and would bias our results toward the null.

Lastly, we cannot rule out the possibility of a measurement error in the outcome (neighborliness), particularly if less neighborly individuals were more likely to report higher neighborliness. If this occurred on street segments with more desirable qualities to

a different degree than it occurred on street segments with less desirable qualities, it would result in a differential misclassification that would bias the results away from the null value. Though the interviewers were trained, they could not be blinded to the built environment characteristics around them and may conceivably have contributed to such an error in measurement. However, those interviewers of the social capital respondents did not conduct the built environment assessments.

Generalizability. The social capital tool used in this study was developed and validated for the United Kingdom and has not been formally validated in the United States. Although this raises questions about the applicability of the results of our study, conducted in Portland, Oregon, to the built environments of other settings, we believe that the survey has face validity. Questions used for this study are not specific to the UK and are appropriate questions to ask of people living in the US.

As shown in Table 6, there are close similarities in the proportion of people who reported certain answers that constituted the neighborliness score when comparing the respondents of our survey to those of the large British survey. Other results of the two studies are similar, such as the association between longer length of residence in an area as well as white race being associated with increased neighborliness. Race, however, reached statistical significance in the GHS study but did not in our study. Finally, the GHS survey found statistically significant associations between region and neighborliness, further suggesting that characteristics of places are associated with neighborliness. The similarities between our survey and that of the GHS suggest that it would be reasonable to generalize this survey with caution.

Future studies

This study suggests many directions for a research agenda. Future observational studies of the relationship between the built environment and neighborliness should consider confounding by socioeconomic status, gender, and age, as well as others such as occupational status, marital status, and presence of children. Larger sample sizes would also help assess variables such as yard maintenance and building condition, as well as allow for better enunciation of within- and between-neighborhood variability. The potential for interactions should be assessed in future studies, for example between front porches and sidewalks as well as interactions between individual characteristics such as income and education.

This study also suggests that other features of the built environment are important in influencing neighborliness and should therefore be researched. Characteristics of neighborhoods such as street width, the presence of back-alley garages as opposed to garages that face the street, and shallow setbacks as opposed to houses that sit further back on the lot should be assessed. Observational studies should assess microphysical qualities of front porches that might promote neighborliness, such as size and proximity to the street, while also assessing the extent to which front porches are being used. Video cameras might be used capture the number and length of interactions between neighbors on a given street segment and their degree of neighborliness, while assessing the specific places where neighbors are interacting, be it the sidewalk, front porch, or yard.

Longitudinal studies should look at changes in the built environment and changes in neighborliness. A more diverse system of neighborhoods should be studied over time to determine whether characteristics of the built environment operate the same way in

differing neighborhoods and whether changes to the built environment affect neighborhoods in similar ways. Newer suburbs that attempt to incorporate characteristics such as sidewalk systems, front porches, and shallow setbacks should be compared with newer suburbs where these characteristics are not incorporated into the neighborhood design, as well as with older neighborhoods that exhibit similar characteristics. This will help to tease out whether newer neighborhoods can incorporate some of the qualities of older neighborhoods (such as those built before 1950) and achieve the same levels of neighborliness.

Interventional studies should be undertaken to determine whether characteristics such as connected sidewalks lead to increased neighborliness. People living in areas where sidewalk systems are not complete should first be assessed for neighborliness, after which the sidewalk networks could be completed and neighborliness re-assessed. The presence of walkable destinations should also be assessed in such a study, as this can impact the use of sidewalks. Neighborliness measures should also be assessed in areas with prominent litter and graffiti before and after neighborhood clean-up measures are taken.

Finally, a research agenda should include health outcome measures. One possibility would be to include measures of health outcomes, such as a mental health assessment, to studies. Mental health could then be evaluated across various levels of neighborliness categories as features of the built environment change. This step is a necessary component of linking such studies to public health outcomes.

Conclusions and Implications

The Neighborhood Design and Neighborliness study supports prior research that certain features of the built environment are related to neighborliness. People are more likely to be neighborly if their neighborhoods have continuous systems of sidewalks and if there is less litter and graffiti. People are also more likely to be neighborly if they report better health, live in neighborhoods longer, and live in more valuable houses. Characteristics such as a person's perception of safety, living in older houses (presumably because of what it implies about the neighborhood environment), and homeownership are also associated with increased neighborliness in conjunction with other factors.

This study represents a unique approach to improving health by impacting social connectedness through the built environment. Intervening in the built environment to increase social connectedness and social capital has the potential to improve both physical and mental health. The implications of this study for public health strongly support actions such as neighborhood cleanup projects and mandates for continuous sidewalks to be built into neighborhoods. The absence of litter and graffiti may not only be associated with better neighboring practices but also may encourage people to keep yards and buildings better maintained, providing further opportunities for interacting with neighbors. In addition, this study supports helping people live in their own houses for longer periods of time. One way this may happen is through controlling property tax increases for the elderly or those with lower incomes in order to maintain affordability for residents.

Social ties are important for health and this research supports a role for the built environment in shaping these ties. While further research in this area will elucidate the intricacies of these relationships, this study provides further support that where we live affects our relationships with our neighbors and offers a glimpse into some unique approaches to improving the health of individuals and their neighbors.

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Appendix A – Systematic Neighborhood Observation Tool

Neighborhood ID _____
Segment ID _____
Primary observer ID _____
Secondary observer ID _____

Date_____ **(Mo/Day/Yr)**
Start time _____
Temp in Fahrenheit _____
Is it raining? **Yes** _____ **No** _____

Please provide street and cross streets of block you are observing
Street: _____
Cross1: _____
Cross2: _____
Record in notes names of bldgs other than residential.

1. Count buildings *(count number, 0 or greater)*

	Side 1	Side 2
Single Family		
Apts/Condos		
Row/town homes		
Duplexes		
Institutional		
Retail		
Commercial		
Public		
Religious		
Mixed Use		
Total		

Describe mixed use (note vertical, horizontal attached or horizontal detached):

2. Record number of buildings with the following stories: (count number, 0 or greater)

	Side 1	Side 2	Total
1			
2			
3			
4			
5+			

3. Number of buildings on the block with front porches or areas where residents can overlook the street and/or interact with other pedestrians or street users. *(Count number, 0 or greater)*

Side 1	Side 2	Total

4. Count residential or commercial buildings that have noticeable bars. *Count number, 0 or greater*

Side 1	Side 2	Total

5. Yard maintenance: (well-maintained = looks trim & clean)
>75% well maintained ☐ 1
50-74% well maintained ☐ 2
<50% well maintained ☐ 3

6. Condition of the buildings: (can you see broken windows, graffiti, litter or other signs of damage)
5% or less have damaged/need repair ☐ 1
5-25% have damage/need repair ☐ 2
>25% have damage/need repair ☐ 3

7. Height of trees- *(count number, 0 or greater, with the following heights)*:

	Side 1	Side 2	Total
≤15ft	_____	_____	_____
>15ft	_____	_____	_____

8. Are there benches for individuals to rest on, if necessary, along the street of this block?

	Side 1	Side 2
No	☐ 0	☐ 0
Yes	☐ 1	☐ 1
If yes, count (1 or greater):	_____	_____

9. Conditions of benches:

Clean and not damaged	☐ 1
Some are dirty & damaged	☐ 2
All in poor condition	☐ 3

10. Are there other places (e.g. ledges or retaining walls) for pedestrians to rest on or gather around?

	Side 1	Side 2
No	☐ 0	☐ 0
Yes	☐ 1	☐ 1
If yes, count	_____	_____

Describe: _____

_____

11. Can you see any litter, graffiti, broken glass, etc.?

None or almost none	☐ 0
Yes, but not dominant feature	☐ 1
Yes, dominant feature	☐ 2

12. Are there publicly accessible restrooms on this block?

No	☐ 0
Yes	☐ 1

13. Count streetlights *(0 or greater)*:

	Side 1	Side 2
At crossing areas	_____	_____
Other locations on street	_____	_____

14. Are public streetlights positioned at transit stops? *(if transit stops are present)*

No	☐ 0
Yes	☐ 1
No transit stops	☐ 98

15. Commercial parking (check all that apply):

	Side 1	Side 2
Curbside parking	☐ 1	☐ 1
Behind buildings or underground	☐ 2	☐ 2
Between building front and street	☐ 3	☐ 3
Parking Lot independent of building	☐ 4	☐ 4
No commercial/retail	☐ 98	☐ 98

16. Are sidewalks continuous?

	Side 1	Side 2
No	☐ 0	☐ 0
Yes	☐ 1	☐ 1
No sidewalks	☐ 98	☐ 98

17. Sidewalk Slope:

	Side 1	Side 2
Flat/gentle	☐ 1	☐ 1
Steep slope	☐ 2	☐ 2

18. Sidewalk material *(check all that are present)*:

	Side 1	Side 2
Asphalt	☐ 1	☐ 1
Concrete	☐ 2	☐ 2
Bricks/Tile	☐ 3	☐ 3
Gravel	☐ 4	☐ 4
Dirt	☐ 5	☐ 5
Grass	☐ 6	☐ 6
Under repair	☐ 7	☐ 7
Private lawn	☐ 8	☐ 8
Other	☐ 9	☐ 9

List _____

19. Sidewalk condition & smoothness:

	Side 1	Side 2
Good (<10%has bumps, cracks, holes, weeds)	☐ 1	☐ 1
Moderate (10-50% has bumps, cracks, holes, weeds)	☐ 2	☐ 2
Poor (>50% has bumps, cracks, grates, holes, weeds)	☐ 3	☐ 3
Under repair	☐ 4	☐ 4

20. Sidewalk obstructions(mark all that create considerable obstruction/danger to pedestrian traffic):

	Side 1	Side 2
None	☐ 0	☐ 0
Bump/crack/hole	☐ 1	☐ 1
Weeds/leaves	☐ 2	☐ 2
Standing water/ice	☐ 3	☐ 3
Poles/signs	☐ 4	☐ 4
Tables/Chairs	☐ 5	☐ 5
Trees/shrubs	☐ 6	☐ 6
Parked Cars	☐ 7	☐ 7
Other	☐ 8	☐ 8

*Describe:*_____

_____

21. Permanent items in the buffer zone (mark all that are present).

	Side 1	Side 2
None	☐ 0	☐ 0
Bike Racks	☐ 1	☐ 1
Controller boxes	☐ 2	☐ 2
Fire hydrants	☐ 3	☐ 3
Grate/hatch cover	☐ 4	☐ 4
Mailboxes	☐ 5	☐ 5
Newspaper boxes	☐ 6	☐ 6
Parking meter	☐ 7	☐ 7
Planter or flowers	☐ 8	☐ 8
Public Garbage Cans	☐ 9	☐ 9
Signal poles	☐ 10	☐ 10
Signs	☐ 11	☐ 11
Street light	☐ 12	☐ 12
Street furniture	☐ 13	☐ 13
Telephone booth	☐ 14	☐ 14
Trees or Shrubs	☐ 15	☐ 15
Utility poles	☐ 16	☐ 16

Wall	☐ 17	☐ 17
Water fountains	☐ 18	☐ 18
Other	☐ 19	☐ 19

Please describe

22. Are signs (including directional signs for pedestrians and signs in front of retail, commercial stores) on this street clear and large?

>50% are clear & large	☐ 1
10-50%are clear & large	☐ 2
<10% are clear & large	☐ 3

23. Does this segment end in a cul-de-sac or dead end?

No	☐ 0
Dead end w/o pedestrian thruway	☐ 1
Dead end with pedestrian thruway	☐ 2
Cul-de-sac	☐ 3

24. How many lanes of traffic are there in this block?

1 ☐ 2 ☐ 3 ☐ 4+ ☐

*If any lane(s) is/are designated for other purposes at specific times, please describe*_____

25. Is there a designated bike lane in the street?

Yes	☐ 1
No	☐ 0

26. What is the posted speed limit?

_____ **mph**

If none posted, enter 98.

27. Is there a traffic circle, roundabout or other traffic-calming device (e.g. signs, bumps, marked crosswalk)?

Yes	☐ 1
No	☐ 0

If yes, list:

_____

_____

28. Do intersections and crosswalks <u>WITH TRAFFIC SIGNALS</u> have pedestrian signals?

	Int 1	Int2
No pedestrian signals	☐ 0	☐ 0
Ped signals but not controllable	☐ 1	☐ 1
Ped signals & controllable	☐ 2	☐ 2

29. Time traffic signal (Green) or pedestrian signal if present (Walk):

	Int 1	Int2
Green/WALK	_____ sec	_____sec

Please circle what signal you observed.

30. If traffic signals exist, measure length of crosswalks *(in normal paces)*

Int 1	Int 2
_____ paces	_____paces

31. Width of *paved* sidewalk (in):

	Side 1	Side 2
Max	_____	_____
Min	_____	_____

32. Do crossing areas have ramps or curb cuts?

	Side 1	Side 2
None	☐ 0	☐ 0
Yes, at some crossing areas	☐ 1	☐ 1
Yes, at all crossing areas	☐ 2	☐ 2

33. Measure height of curbs on this street (in.).

	Side 1	Side 2
1 crossing area	_____	_____
2 crossing area	_____	_____
3 crossing area	_____	_____

Enter 98 if not applicable (fewer than 3 crossing areas without ramps/curb cuts on either side)

34. Width of buffer zone (in):
See picture below for ONE example of a buffer zone.

Side 1	Side 2
_____	_____

35. Count cars going in one direction for 2 minutes. *Repeat for other direction.*

Dir 1	Dir2
_____	_____

Enter end time_____
Segment Difficulty on a scale of 1(easiest) – 5 (most difficult) (please describe any specific difficulties you had in assessing this street in the notes section.):

Appendix B – Social Capital Survey Tool

Start time: _____

The questions on social capital

Questions 1-17 examine 'view of local area'

This topic looks at the physical environment in which people live, the facilities in their area, and whether they feel safe in the area. People's feelings about their physical environment can relate to each of the other aspects of social capital.

Now I would like to ask you some questions about your local area. By area I mean within a 15-20 minute walk or a 5-10 minute drive from your home.

1. How many years have you lived in this area?
RECORD YEARS_____
IF LESS THAN 1, CODE AS 0 and go to 2.
IF 1 or greater, skip to 3.
0..97 Round up or down to nearest whole number

Q1 is designed to find out how long the respondent has lived in the area, as defined in the preamble. So if someone has lived at their current address for 5 years, but previously lived two streets away for 3 years, they are coded as 8 years. If the answer is less than 1year, than they are coded as 0.

2. How many months have you lived in this area?

_____
0..11

Q2 is only asked of those who have lived in the area for less than a year.

3. Would you say this is an area you enjoy living in?
Yes..... 1
No..... 2
Don't know..... 3

The following questions (Q4-14) ask about the facilities in the local area. The answer categories shown on the card include 'don't know or have no experience', which is usually excluded as an explicit response. It was felt it was important to include as some respondents would genuinely have no idea.

Now I'd like you to refer to Show Card A, the red card.
[*] Thinking generally about what you expect of local services and built environment, how would you rate the following:

4. [*] Leisure facilities for people like yourself
SHOW CARD A
1 2 3 4 5 6

In Q4 the emphasis is on the social and leisure services the respondent wishes to use. Examples would include publicly and privately provided services, such as, community centers, pools, senior centers, parks, Eagle's lodge. Boys and Girls club. etc.

5. [*] Garbage removal
SHOW CARD A
1 2 3 4 5 6

6. [*] Local health services (a clinic or local hospital, for example)
SHOW CARD A
1 2 3 4 5 6

A hospital should be considered local if it serves the local area, even if it is not physically within a 15-20 minute walk or a 5-10 minute drive.

7. [*] Local public schools
SHOW CARD A
1 2 3 4 5 6

8. [*] Community colleges and adult education
SHOW CARD A
1 2 3 4 5 6

9. [*] Local police service
SHOW CARD A
1 2 3 4 5 6

10. [*] Existence and upkeep of sidewalks
SHOW CARD A
1 2 3 4 5 6

11. [*] Ease of travel between your house and local market, shopping
SHOW CARD A
1 2 3 4 5 6

12. [*] Attractiveness of local area
SHOW CARD A
1 2 3 4 5 6

Now we're done with Show Card A.

13. What form of transportation do you use to get where you need to go? (Allow for spontaneous answer, only read options if respondent offers no answer. May include up to 3 responses.)

1. Car/motorcycle/moped
2. Public transport (buses/max)

3. Bicycle
4. Walking
5. Other
6. Never goes out

This question is trying to obtain the main form of transportation used by the respondent. If respondents ask for a reference period, suggest 'in a typical week.' If respondent spontaneously indicates more than one "main form" of transportation, up to 3 may be coded.

The code 'car/motorcycle/moped' includes lifts from other people, including ride share. The code 'public transport' includes the lift and street car.

14. [*] Would you say this area has good public transportation for where you want to go?

1. Yes
2. No
3. Don't know

15. [*] How safe do you feel walking alone in this area during daytime? (Read running prompt)
Do you feel...
RUNNING PROMPT

1. Very safe
2. Fairly safe
3. A bit unsafe
4. Very unsafe
5. Or do you never go out alone during daytime

16. [*] How safe do you feel walking alone in this area after dark?
Do you feel...
RUNNING PROMPT

1. Very safe
2. Fairly safe
3. A bit unsafe
4. Very unsafe
5. Or do you never go out alone after dark

Questions 17-23 examine 'civic engagement'

Indicators of civic engagement and trust of civic institutions and process are central to Putnam's understanding of social capital. Cognitive research in UK found that these concepts were the most difficult to operationalize in the form of survey questions. This difficultly stemmed from 2 issues: (i) trying to measure a community-level resource by means of individual-level questions; and (ii) the rarity of civic engagement, or knowledge of such processes.
Q17 and 18 are intended to capture how the R feels overall about most issues and most of the time. If R indicates "sometimes," "it depends", etc. ask "What would you say ***overall*** about whether you are well informed..." or "What would you say ***overall*** about whether you can influence decisions..."

These will be yes/no questions.

17. [*] Thinking of the same local area...
Would you say you are well informed about local issues? (Probe if necessary: such as education, health, housing...)

1. Yes
2. No
3. Don't know

18. [*] Would you say you can influence decisions that affect your area?

1. Yes
2. No
3. Don't know

19. Please refer to Show Card B, the orange card.
To what extent do you agree or disagree with the following statements?
[*] By working together, people in my neighborhood can influence decisions that affect the neighborhood.
SHOW CARD B

1 2 3 4 5 6

20. [*] Newspapers are a reliable source of information about local issues.
SHOW CARD B

1 2 3 4 5 6

Now we're done with Show Card B.

21. Have you been involved in any local organizations over the past 3 years (while living in this area)?

1. Yes
2. No

IF no, go to Q24.

Local organizations could include:

- parent/teacher associations
- school associations
- religious organizations such as churches, mosques or temples
- neighborhood or tenants' associations
- neighborhood watch
- support groups
- local branches of national organizations

However, it would exclude just being a member of a sport or social club which is included in Q24

22. How many local organizations have you been involved with over the past 3 years?

_____

23. In the past 3 years (while living in this area), have you had any responsibilities in this (these)
organization(s), such as being a committee member, raising funds, organizing events or doing administrative or clerical work?

1. Yes
2. No

Active involvement would include responsibilities such as:

- taking minutes
- being a committee member
- organizing events
- raising funds by collecting money
- delivering and picking up donations envelopes
- working in a charity shop

However, it would exclude just attending meetings.

24. Have you been involved in any team sports or social groups over the past 3 years (while living in this area)?

1. Yes
2. No

If no, go to question 26.

Team sports or social group would include hobby clubs (gardening, cards), soccer, softball, bowling team etc. but not simply membership in a gym or athletic club.

25. How many team sports or social groups have you been involved with over the past 3 years?

_____

Questions 26-36 examine 'view of local area'

Please refer to Show Card C, the yellow card.

[*]Still thinking about the same area, I mean within a 15-20 minute walk or a 5-10 minute drive from your home, can you tell me how much of a problem these things are.

26. [*] The speed or amount of road traffic
SHOW CARD C
1 2 3 4 5 6

27. [*] Vehicles not stopping for pedestrians in crosswalk
SHOW CARD C
1 2 3 4 5 6

28. [*] Parking in residential streets (availability)
SHOW CARD C
1 2 3 4 5 6

29. [*] Property Crime (Probe if necessary: Breaking car window, for example)
SHOW CARD C
1 2 3 4 5 6

30. [*] Trash and litter lying around
SHOW CARD C
1 2 3 4 5 6

31. [*] Owners not picking up after their dogs
SHOW CARD C
1 2 3 4 5 6

32. [*] Graffiti or vandalism
SHOW CARD C
1 2 3 4 5 6

33. [*] Level of noise
SHOW CARD C
1 2 3 4 5 6

34. [*] Homeless people or vagrants hanging around on the streets
SHOW CARD C
1 2 3 4 5 6

35. [*] Alcohol or drug use
SHOW CARD C
1 2 3 4 5 6

Problems associated with alcohol and drug use (Q35) could include people hanging around the streets drunk or affected by drugs, syringes littering the streets, or people openly buying or selling drugs.

36. [*] Increasing housing costs forcing out long-term neighborhood residents.
SHOW CARD C
1 2 3 4 5 6
Now we're done with Show Card C.

Question 37 examines 'civic engagement'
Please refer to Show Card D, the green card.
37. In the past 3 years, have you taken any of the following actions in attempt to solve a local problem?
CODE ALL THAT APPLY
SHOW CARD D
1 2 3 4 5 6 7 8

The emphasis in this question is taking action about a local issue. For example, 'contacted a local representative' would include writing to a representative about a local issue such as plans to close the accident and emergency unit of the local hospital, but excludes writing to rep about a national issue.

Question 38 examines 'view of local area'
We're done with that card, please refer to Show Card E, the light blue card.
38. Have you personally been a victim of any of the following crimes in the past 12 months?
CODE ALL THAT APPLY
SHOW CARD E
1 2 3 4 5 6

Now we're done with Show Card E.

As this question might be sensitive for some respondents, a show card is used, so the respondent only has to read out a number.

Questions 39-42 examine 'reciprocity and local trust'

Trust of strangers is a central dimension of Putnam's conception of social capital. It was found in testing in UK that respondents were unable or unwilling to answer questions concerning trust of others in relation to an a area that extended beyond their immediate neighborhood, or when applied to people the respondent did not know personally. Therefore, the next set of questions asks respondents to think about their neighborhood: that is, the street or the respondent's part of the street, the block of apartments, or whatever the respondent thinks of as their immediate area.

[*]Now I would like to ask you a few questions about your more immediate neighborhood by which I mean your street or block.

39. [*] Would you say that you know...
RUNNING PROMPT

1. Most of the people in your neighborhood
2. Many of the people in your neighborhood
3. A few of the people in your neighborhood
4. Or that you do not know people in your neighborhood?

Cognitive testing in UK found that the term 'know' was consistently understood as applying to neighbors whom the respondent knew by sight, which apartment or house they lived in, and well enough to have something of a conversation with. Knowing the neighbor's name was not a necessary requirement of knowing the person.

40. [*] Would you say that you trust...
RUNNING PROMPT

1. Most of the people in your neighborhood
2. Many of the people in your neighborhood
3. A few of the people in your neighborhood
4. Or that you do not trust people in your neighborhood?

41. [*] Would you agree this neighborhood is a place where neighbors look out for each other?

1. Yes
2. No
3. Don't know

42. In the past 6 months, have you done a favor for a neighbor?

1. **Yes**
2. **No**
3. Just moved into the area

Examples of favors are:

- taking in mail
- watering plants
- lending tools or garden equipment
- *carrying things up stairs*
- feeding pets when neighbors go away
- shopping

If people have just moved into area, interviewers can probe to see if the respondent has done or received a favor since they moved into the area. It may be that neighbors have helped them when they were actually moving in.

43. And, in the past 6 months, have any of your neighbors done a favor for you?

1. Yes
2. No
3. Just moved into the area

The following 2 sections on 'social networks' and 'social support' investigate measures of social capital relating to individuals.

The section on social networks attempts to address the quality of contact (closeness) as well as frequency.

Questions 44-52 examine 'social networks'

Please refer to Show Card F, the pink card. The next few questions are not limited to your local area, and are about how often you see or speak to your relatives and friends. Not counting the people you live with, how often do you do any of the following?

44. Speak to relatives on the phone...
SHOW CARD F
1 2 3 4 5 6 7 8

45. See relatives
SHOW CARD F
1 2 3 4 5 6 7 8

46. Email relatives
SHOW CARD F
1 2 3 4 5 6 7 8

47. Speak to friends on the phone...
SHOW CARD F
1 2 3 4 5 6 7 8

48. See friends...
SHOW CARD F
1 2 3 4 5 6 7 8

49. Email friends
SHOW CARD F
1 2 3 4 5 6 7 8

50. Speak to neighbors...
SHOW CARD F
1 2 3 4 5 6 7 8

Now we're done with Show Card F.

Q44-52- are about relatives or friends living outside the respondents household. Interviewers may need to probe to ensure that respondents are not counting the same people twice; someone may be a friend and a neighbor, but should only be coded once.

Work colleagues should be counted as friends only if the respondent sees them outside working hours and outside the working premises. Similarly, if a student sees other students only at classes or lectures, they should not be included as friends.

51. Apart from the people you live with, how many relatives that you feel close to live within a 15-20 minute walk or 5-10 minute drive, if any?
RECORD NUMBER 0..15 _____
IF MORE THAN 15 CODE AS 15.

52. How many close friends live within a 15-20 minute walk or 5-10 minute drive, if any?
RECORD NUMBER 0..15 _____
IF MORE THAN 15 CODE AS 15

Questions 53-60 examine 'social support'

Hypothetical scenarios are used to explore individuals' social support. Cognitive testing in UK found that the strongly preferred response from some respondents was not to ask anyone for help. The questions were revised to ask first if respondents 'could' ask for help and, if so, who 'would' they ask. Answers are chosen from a card which includes 'would prefer not to ask for help' as an option.

The interviewer may need to probe to ensure that respondents are not counting the same people twice; someone may be a friend and a neighbor, but should only be coded once. If the respondent mentions only one person, the interviewer should probe by asking 'anyone else?'

I am going to read a list of situations where people might need help. For each one, could you tell me if you would ask anyone for help?

53. You urgently need a ride to be somewhere. Could you ask someone for help?

1. Yes
2. No
3. Don't know

IF Yes or Don't know, go to 54.
IF No, go to 55.

54. Can you look at Show Card G, the purple card, and tell me who you would ask for help? (Please choose the three most important to you.)
CODE UP TO 3 ANSWERS
SHOW CARD G

1 2 3 4 5 6 7 8 9

In Q54 the category 'voluntary or other organization' would include voluntary or community organizations that transport people, such as Tri-Met The Lift.

55. *You are ill in bed and need help at home. Could you ask someone for help?*

1. Yes
2. No
3. Don't know

'Help at home' means help with domestic tasks such as cooking and cleaning.

IF Yes or Don't know, go to 56.
IF No, go to 57.

56. Can you look at the card and tell me who you would ask for help? (Please choose the three most important to you.)
CODE UP TO 3 ANSWERS
SHOW CARD G
1 2 3 4 5 6 7 8 9

57. You are in financial difficulty and need to borrow $100. Could you ask someone for help?
1. Yes
2. No
3. Don't know

Loans from banks or other financial institutions should be excluded.

IF Yes or Don't know, go to 58.
IF No, go to 59.

58. Can you look at the card and tell me who you would ask for help? (Please choose the three most important to you.)
CODE UP TO 3 ANSWERS
SHOW CARD G
1 2 3 4 5 6 7 8 9

Now we're done with Show Card G.

59. If you had a serious personal crisis, how many people, if any, do you feel you could turn to for comfort and support?
RECORD NUMBER 0..15 _____
IF MORE THAN 15 CODE AS 15.

This question needs to be dealt with sensitively, as it can be upsetting for people who are socially isolated.

Examples of personal crises include bereavement or a partner leaving.

If respondents have difficulty in giving a number for this and the following question (Q60), the interviewer should ask them to give an estimate

60. How many of these people (Does this person) live within a 15-20 minute walk or 5-10 minute drive, if any?
RECORD NUMER 0..15 _____
IF MORE THAN 15 CODE AS 15

Questions 61-64 examine 'walking for exercise' and 'health'
Please refer to Show Card H, the dark blue card.
On average, how often in a typical week do you:

61. Walk for exercise in your neighborhood.

SHOW CARD H

1 2 3 4 5

62. Walk for exercise outside your neighborhood.

SHOW CARD H

1 2 3 4 5

63. Exercise for 20 minutes or more at a level that increases your breathing rate enough to raise a sweat?

SHOW CARD H

1 2 3 4 5

Now we're done with Show Card H.

64. In general, would you say your health is...

RUNNING PROMPT

1. Excellent
2. Very good
3. Good
4. Fair
5. Poor

65. How do you find out about what's going on in your neighborhood? (record response verbatim)

66. For what age group or groups would you say this neighborhood is best suited? You may choose more than one answer.

RUNNING PROMPT

1. Children
2. Teenagers
3. Young Adults
4. Middle Age
5. Seniors

67. What changes to the built environment (if any) would need to happen to make your neighborhood more suitable for people of all ages? (record response verbatim)
(By built environment we mean the features of your neighborhood that are not part of the natural environment, for example buildings, sidewalks, roads.)

Ask race/ethnicity question on cover sheet.

End time: _____

Notes:

Appendix C: Correlations among main effects variables (A) and covariates (B).

A. Correlations among Main Effects Variables

		Front Porches	Traffic Calming Device	Bars on Windows or Doors	Litter or Graffiti	Completeness of Neighborhood Sidewalks	Yard Maintenance	Building Condition
Front Porches	Pearson Correlation	1	.248**	-.137	-.114	.193*	.039	-.049
	Sig. (2-tailed)		.005	.122	.201	.029	.661	.579
	N	128	128	128	128	128	128	128
Traffic Calming Device	Pearson Correlation	.248**	1	.067	.016	.166	-.002	-.225*
	Sig. (2-tailed)	.005		.450	.862	.062	.979	.011
	N	128	128	128	128	128	128	128
Bars on Windows or Doors	Pearson Correlation	-.137	.067	1	.025	-.272**	-.171	-.144
	Sig. (2-tailed)	.122	.450		.778	.002	.054	.105
	N	128	128	128	128	128	128	128
Litter or Graffiti	Pearson Correlation	-.114	.016	.025	1	-.013	.362**	.163
	Sig. (2-tailed)	.201	.862	.778		.887	.000	.065
	N	128	128	128	128	128	128	128
Completeness of Neighborhood Sidewalks	Pearson Correlation	.193*	.166	-.272**	-.013	1	.054	-.249**
	Sig. (2-tailed)	.029	.062	.002	.887		.548	.005
	N	128	128	128	128	128	128	128
Yard Maintenance	Pearson Correlation	.039	-.002	-.171	.362**	.054	1	.208*
	Sig. (2-tailed)	.661	.979	.054	.000	.548		.018
	N	128	128	128	128	128	128	128
Building Condition	Pearson Correlation	-.049	-.225*	-.144	.163	-.249**	.208*	1
	Sig. (2-tailed)	.579	.011	.105	.065	.005	.018	
	N	128	128	128	128	128	128	128

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

B. Correlations among Covariates

		Race	Self-rated Health	Feels Safe Walking Alone after Dark	Years Lived in NH	Year House was Built (before v after 1950)	Market Value of House, Dichotomized at Median	Proportion of Homeowners in NH (greater or less than 50%)
Race	Pearson Correlation	1	-.101	.046	.113	.135	.092	-.002
	Sig. (2-tailed)		.259	.608	.203	.130	.301	.978
	N	128	128	128	128	128	128	128
Self-rated Health	Pearson Correlation	-.101	1	-.084	-.203*	.066	.111	.030
	Sig. (2-tailed)	.259		.348	.021	.458	.212	.736
	N	128	128	128	128	128	128	128
Feels Safe Walking Alone after Dark	Pearson Correlation	.046	-.084	1	-.115	.147	.236**	-.279**
	Sig. (2-tailed)	.608	.348		.198	.099	.007	.001
	N	128	128	128	128	128	128	128
Years Lived in NH	Pearson Correlation	.113	-.203*	-.115	1	.053	-.063	.098
	Sig. (2-tailed)	.203	.021	.198		.551	.483	.273
	N	128	128	128	128	128	128	128
Year House was Built (before v after 1950)	Pearson Correlation	.135	.066	.147	.053	1	.169	-.247**
	Sig. (2-tailed)	.130	.458	.099	.551		.057	.005
	N	128	128	128	128	128	128	128
Market Value of House, Dichotomized at Median	Pearson Correlation	.092	.111	.236**	-.063	.169	1	-.270**
	Sig. (2-tailed)	.301	.212	.007	.483	.057		.002
	N	128	128	128	128	128	128	128
Proportion of Homeowners in NH (greater or less than 50%)	Pearson Correlation	-.002	.030	-.279**	.098	-.247**	-.270**	1
	Sig. (2-tailed)	.978	.736	.001	.273	.005	.002	
	N	128	128	128	128	128	128	128

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).