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Creating sense of community: The role of public space

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ABSTRACT

A strong sense of community has been associated with improved wellbeing, increased feelings of safety and security, participation in community affairs and civic responsibility. Although interest in how the broader built environment influences sense of community is gaining momentum, there is a dearth of empirical research examining the association between sense of community and the quality of public space. This study investigates the relationship between four public spaces – Public Open Space (POS), community centres, schools and shops – and sense of community in residents of new housing developments in the Perth metropolitan area, Western Australia. Data was obtained from a cross-sectional survey (n = 911), a POS audit, and Geographical Information Systems, and analysed using linear regression. The perceived quality of neighbourhood POS and shops was significantly and positively associated with sense of community. This relationship appears to be unaffected by how frequently people use these spaces. High quality public spaces may be important settings for enhancing sense of community within residents of new housing developments.

1. Introduction

Feelings of safety and security, civic participation, voting, recycling and volunteering (Sense of Community Partners, 2004), and improved wellbeing (Davidson & Cotter, 1991), have all been associated with a strong sense of community. Sense of community is often defined as "a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together" (McMillan & Chavis, 1986, p. 9). This emphasis on affiliation and belonging has been used to distinguish sense of community from other place constructs. For example, place attachment has been identified with emotional bonding and behavioural commitment, while place dependence has been tied to available activities and quality comparisons with other communities (Pretty, Chipuer, & Bramston, 2003). Sense of place has been described as an umbrella term encompassing place attachment, place identity and place dependence (Jorgensen & Stedman, 2001). Although there is undoubtedly theoretical and phenomenological overlap between the different place constructs, there are varied, and sometimes contradictory, definitions within the published literature. Recent years have seen a number of attempts to better define and interpret these constructs (Bow & Buys, 2003; Lewicka, 2011; Mannarini, Tartaglia, Fedi, & Greganti, 2006; Pretty et al., 2003). Sense of community was chosen for this study as a particularly exhaustive measure of the people–place relationship (Mannarini et al., 2006). This reflects a focus on the social bonds within and between people and place, as well as the physical, symbolic, political and cultural implications of 'community' (Mannarini et al., 2006).

In this age of advanced technology and mobility, sense of community is not limited to a geographical region. However, the close proximity of neighbours provides unique opportunities for social interaction and support, such as collecting mail, watching children in emergencies, or surveillance of people's homes (Ife, 1995). Furthermore, resources found within the neighbourhood, including neighbours, will always serve a function for less mobile residents such as people working from home, the elderly, parents of young children, single car households and the socio-economically disadvantaged (Kweon, Sullivan, & Wiley, 1998; Maas, van Dillen, Verheij, & Groenewegen, 2009). Ironically, as our awareness of the benefits of a strong sense of community grows, there are concerns that sense of community is declining throughout the Western world (Bonaiuto, Fornara, & Bonnes, 2003; Scopelliti & Giuliani, 2004). This decline is attributed to a variety of reasons, including smaller family networks, suburbanisation, longer commutes, the prolonged independence of an ageing population, and the proliferation of leisure-time television and social media use (Freeman, 2001; House, Landis, & Umberson, 1988; Oldenburg, 1989).

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Identifying and creating the conditions that foster and strengthen sense of community within residential neighbourhoods is an important task for researchers and planners alike. In terms of the built environment, a stronger sense of community has been associated with less surface parking, higher levels of commercial floor space to land area ratios, lower levels of land use mix (Wood, Frank, & Giles-Corti, 2010), and living in neighbourhoods perceived as safe and interesting (Lund, 2002). Moreover, Mullan (2003) found vehicular traffic and car parking negatively affected perceptions of helpfulness and area friendliness and safety.

Public spaces, such as parks and piazzas, are another element of the built environment that may foster sense of community by facilitating chance encounters between neighbours (Talen, 2000). There are many definitions of public space within the published literature. 'True' public space is recognised as being accessible to all groups, providing freedom of action, temporary claim and ownership (Altman & Zube, 1989; Carr, Francis, Rivlin, & Stone, 1992). In contemporary society however, it is increasingly difficult to distinguish between public and private space (Voyce, 2006). Indeed, many definitions of public space are said to be "too narrow to be useful in an era of public–private partnerships" (Smithsimon, 1999, p. 2). Government-owned lands cannot always be accessed by the public, while privately owned and controlled land often appears to have public character (Voyce, 2006). Thus, locations that constitute public space vary along a continuum ranging from public to private, and can be categorised according to concepts of ownership, management and accessibility (Nemeth & Schmidt, 2007). Ray Oldenburg coined the term "third places" to describe "a generic designation for a great variety of public places that host the regular, voluntary, informal and happily anticipated gatherings of individuals beyond the realms of home and work" (Oldenburg, 1989, p. 16). The definition of public space adopted for this study was informed by Oldenburg's description of third places – i.e., the meeting or gathering places that exist outside the home and workplace that are generally accessible by members of the public, and which foster resident interaction and opportunities for contact and proximity. The emphasis of this definition is on public access, rather than public ownership or management, although – as exemplified above – both the uses and users are always limited (Smithsimon, 1999). Thus, public space includes parks, plazas, sidewalks, shopping malls, community centres and schoolyards (Altman & Zube, 1989; Carr et al., 1992). In particular, this study focuses on common places of interaction within the neighbourhood – parks, shops, community centres and schoolyards.

While investigations into public places and concepts are the mainstay of environmental psychology, there are few published articles within the public health literature that refer to 'public space' *per se* and not individual locations such as parks or community centres. Of the four public spaces relevant to this study, parks have been most frequently investigated, although generally in relation to physical activity rather than social interaction or sense of community. In contrast, a number of architects, urban designers, and sociologists have long investigated public space attributes that facilitate social interaction (Carr et al., 1992; Francis, 2003; Gehl, 2006; Jacobs, 1962; Lynch, 1960; Whyte, 1980). As well as physical environmental features, such as seating, food, shelter, people, and activities, urban designers and architects often refer to more subjective qualities when describing successful public spaces. For example, Carr et al. (1992) note that good public space should be supportive, democratic and meaningful, and address basic human needs, such as comfort, passive and active engagement, and discovery. Architect Jan Gehl also advocates the importance of designing public spaces for people and social interaction (Gehl, 2006). While he identifies a number of important physical elements of public space, such as traffic reduction schemes, walking paths, seating and spatial qualities, he emphasises the importance of first defining why and how people use public space (Gehl, 2006). Project for Public Spaces (PPS), an American organisation based on the work of William H. Whyte, describe successful, or high quality, spaces as those that address issues of accessibility, activity and use, comfort and image, and sociability. That is, they are easy to access and connected to the surrounding community; contain a range of activities for a variety of users; feel safe, clean, and attractive, with adequate seating; and most importantly, act as venues for people to interact socially (Project for Public Spaces, 2008). However, while these sources provide valuable insights into the design of vibrant public spaces, many of their recommendations are based on personal experiences, case studies, interviews and observations. Furthermore, data collection methods are not always described, making it difficult to generalise or reproduce findings. Frumkin (2003) suggests that in order to prompt public health action, many commonly cited recommendations for successful public places need to be supported by rigorous empirical evidence. Similarly, Ewing, Handy, Brownson, Clemente, and Winston (2006) emphasise the need to test the qualities for active street life that are often presumed to be important.

Few studies have investigated the extent to which the association between public space and sense of community is also influenced by the frequency of public space use. Given passive, face-to-face contact of repeated and increasing length is found to be one component of developing friendships (Halpern, 1995; Kuo, Sullivan, Coley, & Brunson, 1998; Leyden, 2003), the frequent use of public space is a plausible pathway through which public space influences chance encounters. Published studies have tended to examine associations between sense of community and features of public space such as proximity to the home, accessibility and surrounding land use diversity (Lund, 2002; Nasar & Julian, 1995; Plas & Lewis, 1996; Wilson & Baldassare, 1996; Wood et al., 2010). However, the mere existence of public space does not guarantee its use. Rather, well designed public spaces tend to attract more users and a greater range of activities than poor quality spaces, which tend to be used for "necessary" activities (Gehl, 2006). Although physical activity researchers have studied indicators of high quality public space (Giles-Corti et al., 2005; Sugiyama, Francis, Middleton, Owen, & Giles-Corti, 2010), fewer empirical studies have examined the design of public space for social interaction (Frumkin, 2003). Quality features of the physical environment that have been theoretically or empirically associated with influencing social interaction in public space include the presence of focal points such as public art, food outlets, connected pathways and seating (Bedimo-Rung, Mowen, & Cohen, 2005; Evans, 2003; Semenza, 2003); nature (Coley, Sullivan, & Kuo, 1997; Kuo et al., 1998); attractive buildings and landscapes (Butterworth, 2000; Lund, 2002; Nasar, 1994); and the absence of incivilities, such as graffiti and litter (Francis, 1989; Kruger, Reischl, & Gee, 2007; Perkins & Long, 2002).

In this paper, we use a socio-ecological framework to explore the association between sense of community, the presence of quality public space and frequency of use (Fig. 1). A socio-ecological framework recognises that a range of factors can impact health and wellbeing, interacting in complex ways with varying levels of causality (Commonwealth Department of Health and Aged Care, 2000). The framework has been recognised as important in health research (Sallis et al., 2006; Stokols, 1996) and in the design of health promotion and public health interventions and policy (Green & Kreuter, 1999). This paper therefore recognises the multiple levels of influence on health outcomes (i.e. individual, social, physical and socio-cultural environments) (Stokols, 1996).

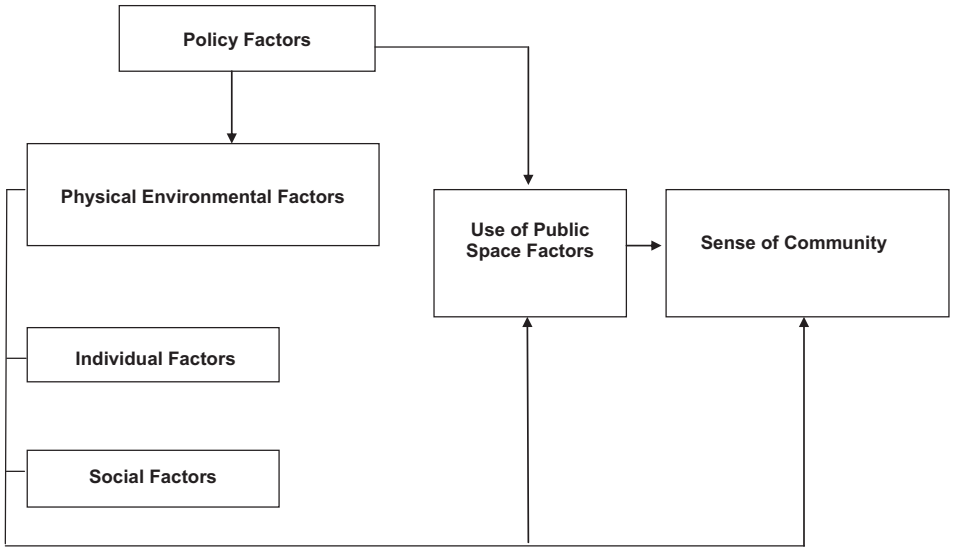

Fig. 1. Conceptual model of relationship between public space and sense of community.

2. Methods

2.1. Study context

This was a cross-sectional sub-study of the RESIDential Environments (RESIDE) Project, a longitudinal study evaluating the impact of a State-government sub-division code in Perth, Western Australia (Giles-Corti et al., 2007). All Perth residents building homes in new housing developments between July 2003 and December 2005 were invited to participate. Eligible participants were proficient in English; aged 18 years or over; planning to move into their new home by December 2005; and willing to complete a survey and wear a pedometer for seven days on three occasions over four years. Study participants completed self-administered surveys before moving into their new home (T1; $n = 1813$), and at 12 (T2; $n = 1379$) and 36 months (T3; $n = 1230$) later. The sense of community sample comprised 911 respondents who completed the T3 survey between October 2006 and June 2008. The study was approved by The University of Western Australia's Human Research Ethics Committee. A more detailed description of recruitment procedures and methodology can be found elsewhere (Giles-Corti et al., 2008).

2.2. Data collection

A mixed-method approach was adopted, with data sources including a cross-sectional survey, a Public Open Space (POS) audit and Geographic Information Systems (GIS) data. These instruments and data sources were informed by a comprehensive literature review, the opinions of an expert panel and focus groups with residents of RESIDE neighbourhoods. The expert panel comprised community developers, an urban geographer, a community psychologist, an environmental psychologist, a property developer, a local government representatives and academics.

2.2.1. Survey instrument

A detailed description of all variables, including copies of the survey instrument, can be found elsewhere (Francis, 2010). The survey instrument sought information about participants' psychosocial environment and use of public space, as well as neighbourhood and POS attributes.

2.2.1.1. Dependent variable. Sense of community was measured using the 12 item Sense of Community Index (SCI) (Chavis, Hogge, McMillan, & Wandersman, 1986). The Index is specifically designed to measure sense of community within neighbourhoods, and is the most widely used measure of the concept (Pooley, Cohen, & Pike, 2005). The Internal Consistency Reliability of the SCI is high, with studies reporting a Cronbach's alpha coefficient of 0.80 (Perkins, Florin, Rich, Wandersman, & Chavis, 1990). Participants responded true or false to 12 statements concerning their neighbourhood before responses were summed to provide an overall score ranging between 0 and 12. The distribution of the data was assessed, with low (score 0–6), medium (score 7–9) and high (score 10–12) categories assigned to ensure a sufficient number of respondents in each category.

2.2.1.2. Independent self-reported variables. The four public spaces chosen for this study were based on the results of formative focus groups, in which participants identified POS, shops, community centres and schools as the most common sites for social interaction within the neighbourhood. Of the independent self-reported variables, physical environmental variables included subjective proximity and quality of the four public spaces. Subjective quality was measured by asking participants the extent to which they agreed or disagreed with statements about their local POS, shop, community centre and school. Statements addressed the atmosphere, comfort, safety, attractiveness and maintenance, the variety of things to do, and the presence of adequate seating, public art and other people (including those known to the participant). After factor analysis, these items were summed to create an overall score, which was dichotomised into low and high quality.

Social environmental variables included whether participants agreed there was a high level of crime in the neighbourhood, and participation in neighbourhood groups or activities during the last 12 months (i.e. school or work, service, art or cultural, sport or recreation and neighbouring).

Public space 'use' variables included frequency of public space use and mode of POS use. The frequency with which participants used public space was measured by asking participants how often they used these spaces, with 'frequent' use defined as at least once a week, and 'infrequent' as less than once a week. 'Mode of POS use' was measured by asking participants if they used POS to undertake 14 activities. Factor analysis reduced the activities to five underlying dimensions (i.e., 'watch or play sport', 'attend an event', 'walk or jog', 'relax' and 'other activities').

Demographic variables included gender, age, marital status, children less than 18 years at home, education, work status, number of hours worked and area-level socio-economic status. Socio-Economic Status (SES) was measured using education as a proxy for individual SES and the 2006 Australian Bureau of Statistics' Socioeconomic Indexes for Areas (SEIFA) score (ABS, 2008a) as area-level SES. SEIFA scores were based on the combined Index of Relative Socio-economic Advantage and Disadvantage (ABS, 2008b).

2.2.1.3. Independent objective variables. Geographic Information Systems (GIS) were used to obtain POS size, the number of public spaces within a study participant's neighbourhood, and the network distances (i.e., the road or pedestrian networks) between participants' homes and their closest public space. 'Neighbourhood' was defined as a 10–15 min walk from the participants' home. For objective environmental data, a 1600 m road network buffer was used to capture the neighbourhood within a 10–15 min walk (Giles-Corti et al., 2008).

The objective quality of public space measure was based on an audit of approximately 1900 public open spaces (i.e., parks, recreational grounds, sports fields, commons, esplanades and bushland) within the Perth and Peel metropolitan areas between November 2005 and February 2006. All POS $\geq$ two acres, and within 1600 m of participants' homes, were audited by trained assessors using an adapted version of the Public Open Space Tool (POST) (Broomhall, 1996; Giles-Corti et al., 2005). The quality of POS measure was computed as a weighted mean score of ten POS attributes, including walking paths, shade, water features, irrigated lawn, birdlife, lighting, sporting facilities, playgrounds, type of surrounding roads, and presence of nearby water (Broomhall, 1996; Giles-Corti et al., 2005). These attributes and their weights were based on the opinions of an expert panel. A detailed description is reported elsewhere (Broomhall, 1996). In addition to the quality score, an incivilities score was created reflecting the presence of litter, graffiti and vandalism within POS, while an amenities score reflected the presence of amenities conducive to social interaction, such as barbecues, seating, picnic tables, rubbish bins, club rooms, toilets and public art.

2.3. Analyses

Data analyses were undertaken using SPSS Version 15. General Linear Models were used to examine the demographic, social environmental, use of public space and physical environmental factors relating to sense of community. The impact of participants clustering within residential developments was assessed using Generalised Estimating Equations (GEE) estimation, and subsequently deemed unnecessary.

Demographic factors were individually assessed in univariate models (Table 1). All other variables were initially individually assessed after adjustment for potential confounding by all demographic variables. All physical environmental variables with $p \leq 0.1$ in the single factor models were then entered into a multivariate model that also included forced entry of demographic variables. A backwards stepwise elimination procedure ($p \leq 0.05$) was used to remove the redundant variables, thereby identifying the significant and independent correlates of sense of community. This strategy was repeated for the remaining blocks of variables (i.e., social environmental and use of public space).

Finally, a series of multivariate models were fitted to examine the relationship between sense of community and the selected physical environmental factors. The first of these models included all physical environmental factors after adjustment for demographic variables only (Model 1). The second model further adjusted for the selected social environmental variables (Model 2), while the third model further adjusted for the selected use of public space variables (Model 3).

Table 1
Associations between demographic factors and sense of community ($n = 911$).

Characteristic	%	Mean (SD)	Single factor model
			p-value[a]
Gender			
Male	37.5	8.57 (2.48)	*0.80*
Female	62.5	8.61 (2.45)	
Age			
20–39 years	41.6	8.50 (2.54)	*0.63*
40–59 years	44.7	8.66 (2.37)	0.37
60–79 years	13.7	8.66 (2.48)	0.52
Married or De-facto			
Yes	86.2	8.69 (2.42)	***0.00***
No	13.8	7.97 (2.60)	
Children <18 yrs at home			
Yes	52.3	8.93 (2.39)	***0.00***
No	47.7	8.23 (2.48)	
Education			
Secondary or less	37.2	8.69 (2.36)	*0.11*
Trade/Apprentice/Certificate	38.3	8.69 (2.62)	0.99
Bachelor or higher	24.5	8.30 (2.33)	**0.06**
Work status			
Work	78.2	8.46 (2.46)	***0.00***
No work	2.6	8.13 (2.66)	0.51
Home duties	11.4	9.48 (2.15)	**0.00**
Retired	7.8	8.83 (2.54)	0.22
No. of hours worked			
Half time or less	12.4	8.26 (2.35)	***0.00***
> Half time to 38 h/week	26.2	8.74 (2.38)	**0.08**
>38 to <60 h/week	35.1	8.42 (2.54)	0.54
60+ hours/week	4.4	7.65 (2.39)	0.18
Not in workforce	21.8	9.08 (2.39)	**0.00**
Suburb SES (SEIFA)			
Lowest	21.2	8.65 (2.49)	*0.85*
Low	27.6	8.51 (2.45)	0.53
Middle	20.6	8.56 (2.46)	0.72
High	11.3	8.48 (2.47)	0.58
Highest	19.3	8.75 (2.43)	0.70

[a] Overall *p*-values are italicised. *p*-values are bolded if $p \leq 0.10$.

3. Results

The mean sense of community score for the sample of 911 participants was 8.59 (SD 2.46). Of the eight demographic factors examined, univariate analyses indicated that mean sense of community was higher in participants who were married or de-facto, had children less than 18 years at home, were employed in home duties and were not in the workforce (Table 1). Although there is suggestion of higher mean sense of community in people with a Bachelor degree or higher ($p = 0.063$), the overall *p*-value for education was not significant ($p = 0.114$). While the multivariate models forced the inclusion of the eight demographic factors, none remained significantly associated with sense of community in the multivariate models.

Of the seven physical environmental factors included in the univariate models, sense of community was significantly associated with subjective distance to closest park and school (negative associations), and with subjective quality of parks, community centres shops and schools (positive associations). As shown in Table 2 (Model 1), these remained significant in the multivariate model resulting from the variable reduction strategy (and having adjusted for demographics). Mean sense of community was higher in those who lived less than 5 min from their park ($p = 0.22$) and who reported high rather than low quality of public space ($p < 0.001$). However, only subjective distance to closest POS, and

Table 2
Final models of the association between physical environmental factors and sense of community ($n = 911$).[a]

Characteristic	%	Model 1[b]		Model 2[c]		Model 3[d]	
		β	p[e]	β	p[e]	β	p[e]
Subjective distance to closest POS							
<5 min	68.8	0.00	***0.02***	0.00	***0.04***	0.00	*0.06*
5–15 min	26.1	−0.47	**0.00**	−0.43	**0.01**	−0.40	**0.02**
>15 min/don't know	5.0	−0.43	0.25	−0.16	0.66	−0.20	0.57
Subjective quality of public space							
POS							
Low	53.3	0.00	***0.00***	0.00	***0.00***	0.00	***0.01***
High	46.7	0.91		0.55		0.44	
Community centres							
Low	71.1	0.00	***0.02***	0.00	*0.26*	0.00	*0.55*
High	28.9	0.41		0.19		0.10	
Shops							
Low	53.0	0.00	***0.00***	0.00	***0.00***	0.00	***0.00***
High	47.0	0.97		0.80		0.72	
Schools							
Low	57.4	0.00	***0.00***	0.00	*0.33*	0.00	*0.60*
High	42.6	0.66		0.23		0.13	
Incivilities in highest quality POS							
0–1	28.9	0.00	***0.02***	0.00	*0.15*	0.00	*0.13*
2–3	71.1	−0.40		−0.24		−0.26	
Distance to closest school							
84–799 m	44.5	0.00	***0.03***	0.00	*0.09*	0.00	*0.12*
800–1599 m	35.8	−0.43	**0.01**	−0.31	0.06	−0.29	0.08
1600+ m	19.8	0.02	0.94	0.07	0.74	0.11	0.69
Social factors							
High level of neighbourhood crime							
Disagree	71.4			0.00	***0.00***	0.00	***0.00***
Neutral	25.4			−1.01	**0.00**	−1.00	**0.00**
Agree	3.2			−1.58	**0.00**	−1.56	**0.00**
Neighbourhood groups or activities involved in during last 12 months							
School or work activities							
0	73.0			0.00	***0.00***	0.00	***0.05***
1+	27.0			0.64		0.45	
Service activities							
0	74.0			0.00	***0.047***	0.00	*0.156*
1	16.5			0.36	0.092	0.25	0.241
2+	9.5			0.66	**0.026**	0.54	0.069
Art or cultural activities							
0	70.4			0.00	*0.081*	0.00	*0.254*
1	20.5			0.43	**0.025**	0.32	0.107
2+	9.1			0.15	0.590	0.03	0.928
Neighbouring activities							
0	68.7			0.00	***0.000***	0.00	***0.000***
1	21.0			0.40	**0.035**	0.37	**0.048**
2+	10.3			1.10	**0.000**	1.08	**0.000**
Use of public space factors							
Frequency use public space							
Shops							
Infrequent	25.7					0.00	*0.117*
Frequent	74.3					0.29	
Child's school							
Infrequent	73.9					0.00	*0.186*
Frequent	26.1					0.32	
Usually use POS to:							
Undertake activities							
No	53.4					0.00	*0.628*
Yes	46.6					0.09	
Watch or play sport							
No	67.4					0.00	*0.484*
Yes	32.6					0.12	
Attend an event							
No	60.9					0.00	*0.162*
Yes	39.1					0.25	
Relax							
No	70.0					0.00	***0.039***
Yes	30.0					0.35	

[a] Table only displays variables that were significantly associated with sense of community in the multivariate models.
[b] Model 1: Adjusts for physical and demographic variables.
[c] Model 2: Adjusts for physical, demographic, and social variables.
[d] Model 3: Adjusts for physical, demographic, social and use of POS variables.
[e] Overall p-values are italicised. p-values are bolded if $p \leq 0.05$.

the subjective quality of a local POS and shop, remained significantly associated with sense of community in multivariate Model 2 (Table 2). The relationship between sense of community and subjective POS and shop quality attenuated in Model 3, but remained highly significant ($p < 0.01$ and $p < 0.001$ respectively). Participants who claimed to live 5–15 min from POS reported weaker sense of community than those living closer to POS, even after adjustment for POS use ($p = 0.02$). Nevertheless, this relationship attenuated in Model 3 suggesting the relationship between POS proximity and sense of community is partly explained by the fact POS is used for a variety of purposes involving social interactions.

The objective measure of POS was not significantly associated with sense of community at any stage of the analysis. Subjective and objective measures of POS quality were significantly, but only modestly, correlated ($R = 0.12$; $p < 0.001$).

Of the six social environmental factors that emerged as significant in the univariate analysis, all but involvement in sport or recreation activities remained significant in the multivariate models arising from the backward elimination process. Only perceived neighbourhood crime and involvement in school or work and neighbouring activities remained significantly associated with sense of community in Model 3, with mean sense of community scores higher in participants' who disagreed that there was a high level of crime in the neighbourhood and who were involved in one or more activities (Table 2).

All nine POS use variables appeared significantly associated with sense of community in the univariate analyses, although frequent use of parks, frequent use of community centres, and usually using parks to walk or jog were removed in the backward elimination process. Using POS to relax was the only activity to remain significantly associated with sense of community in Model 3, with participants who usually used POS to relax demonstrating a slightly higher mean score ($p < 0.05$). Frequent use of POS was not significantly associated with sense of community in the multivariate models, suggesting that it did not influence the relationship between POS quality and sense of community. It was not included in the final models (Table 2).

4. Discussion

This paper used a social-ecological framework to explore the potential correlates of sense of community in RESIDE study participants, emphasising the quality and attributes of public space. In particular, sense of community was significantly associated with the subjective quality of local shops and POS, as well as perceived distance to POS, after adjusting for a range of demographic, use of public space and social environmental factors.

4.1. Correlates of sense of community

The results support the study's premise that public space quality is an equally, if not more important, correlate of sense of community than public space size and number. Zhang and Lawson (2009) also found the size and number of public spaces outside residential buildings were not significantly associated with social interaction, concluding that the key to social interaction in public spaces was the quality of the public space provided (Zhang & Lawson, 2009). The fact that only physical environmental variables relating to shops and POS were significantly associated with sense of community in this study may suggest these public spaces were more relevant to participants' life-stage than community centres or schools.

4.1.1. Shops

Shop quality – a measure that incorporates both the presence and quality of local shops – was positively associated with sense of community, supporting the notion that shops are important meeting and gathering places within the neighbourhood, providing opportunities for proximity to others, passive social contact, and casual interactions (Coley et al., 1997; Lund, 2003). Other studies have also linked the presence of neighbourhood shops to a greater sense of community (Lund, 2002; Plas & Lewis, 1996) and casual interactions and territoriality among neighbours (Coley et al., 1997). As Joung and Miller (2002, p. 78) state, "shopping centres often provide places where people meet friends, pass time, watch people and engage in other aspects of social exchange".

While this study found a strong association between shop quality and sense of community, further studies are needed to explore the full range of features that contribute to high quality shopping environments. For example, there have been calls for measures of shop quality to include ratings of security, attractiveness of décor, courtesy of personnel, variety of services, merchandise quality, atmosphere and shop cleanliness (Bellenger, Robertson, & Greenberg, 1977). Additional aspects of quality thought to encourage social interaction in public spaces include the presence of shaded plazas with benches positioned for conversation, connected pedestrian pathways and meeting areas, and focal points such as neutral territory, visual prospect (i.e., observing a space prior to committing to it), and activity generators (e.g., food) (Carr et al., 1992; Coley et al., 1997; Evans, 2003; Whyte, 1980). Indeed, features of the built environment that contribute to 'atmosphere' are potentially more appealing to customers of grocery stores than the products available, with focus group participants describing their ideal store as a relaxing environment that was spacious, bright, and green, with a nice atmosphere and appropriate music (Geuens, Brengman, & S'Jegers, 2003). As retail environments have often been associated with stressful experiences full of distracting stimuli (Fram, 1994), Joye, Willems, Brengman, and Wolf (2010) argue that introducing greenery into the retail environment may have a restorative effect on shoppers (Joye et al., 2010). This follows research suggesting that exposure to natural environments can assist people in recovering from stress and mental fatigue (Kaplan, 1995; Ulrich et al., 1991). Furthermore, greenery within shopping centres has the potential to influence a number of outcomes related to sense of community, such as increased helpfulness and friendliness towards customers (Joye et al., 2010), and has been associated with increased interaction amongst people in the shopping centre (Buber, Ruso, Gadner, Atzwanger, & Gruber, 2007).

The impact of greenery and shop quality on sense of community may also be influenced by the purpose of a shop visit, with shop décor shown to have a greater impact on psychosocial outcomes for people visiting shops for social or recreational purposes, rather than necessary or utilitarian shopping trips (Bellenger & Korgaonkar, 1980; Pan & Zinkhan, 2006). Conversely, Joye et al. (2010) suggest that the potentially restorative impact of plants in retail environments is greater for people undertaking utilitarian shopping trips, as their need for restoration may be greater than those people shopping for more enjoyable social or recreational purposes (Joye et al., 2010).

The study setting of new residential developments may also explain the positive association found between shop quality and psychosocial outcomes. As new developments often lack a range of commercial options, and sense of community has been associated with smaller population size (Wilson & Baldassare, 1996), it is plausible that residents could form stronger attachments to existing venues and proprietors.

4.1.2. Public open space

As with shops, the positive association between POS quality and sense of community is supported by published literature stating that the presence of green space within the neighbourhood has been associated with a number of positive psychosocial outcomes, including sense of community (Kearney, 2006; Kweon et al., 1998; Lund, 2003; Mesch & Manor, 1998; Nasar & Julian, 1995; Skjaeveland & Garling, 1997; Sugiyama, Leslie, Giles-Corti, & Owen, 2008). For example, Nasar and Julian (1995) found easy access to common outdoor green space increased sense of community, while Kim and Kaplan's (2004) comparison of new urbanist and traditional developments attributed a greater sense of community in new urbanist communities to more natural features and shared spaces. Kuo et al. (1998) also found that residents living near high-nature rather than low-nature areas were more socially active, knew more neighbours, felt neighbours were more helpful and supportive, and had a greater sense of belonging. More specifically, sense of community has been directly related to views of landscaping and trails or pathways within natural areas, as well as the availability of both less developed nature areas (e.g., nature preserves and lakes) and areas containing amenities (e.g., playgrounds and ball fields) (Kearney, 2006).

As with shop quality, POS quality may be more important for those people undertaking personal recreational activities, rather than obligatory activities (e.g., exercising a dog) within the POS. Lund (2002) found that in the general neighbourhood, sense of community was positively correlated with strolling trips, and negatively correlated with destination trips.

The modest, but positive, correlation between the subjective and objective measures of POS quality in this study suggests the two items were measuring correlated, but different aspects of POS quality. It may be that emotive, subjective qualities such as perceived friendliness and safety have a stronger association with sense of community than objective attributes, such as water features, birdlife and reticulation.

4.1.3. Other sense of community correlates

This study's finding of an association between perceived level of neighbourhood crime and sense of community reflects other research linking high crime or fear of crime with a lack of neighbourhood cohesion (Conklin, 1971; Rohe & Burby, 1988) and less neighbourhood attachment (Brown, Perkins, & Brown, 2003). Ross and Jang (2000) also report that social ties with neighbours buffer the effects of neighbourhood disorder on fear and mistrust. Thus, while perceptions of crime may influence sense of community, it may also be that people with weaker sense of community perceive more crime in the neighbourhood.

Similarly, the finding that involvement in more neighbouring activities (comprised of Residents' Associations, street parties, community action groups, welcome evenings and mothers' groups) and school or work activities was significantly and positively associated with sense of community reflects research indicating leisure activities are highly social in nature and facilitate the expansion of social networks and the development of friendships (Coleman & Iso-Ahola, 1993). Involvement in the neighbourhood, such as in neighbourhood organisations, may also contribute to a greater sense of community (Chavis & Wandersman, 1990; Kingston, Mitchell, Florin, & Stevenson, 1999). Indeed, local social involvement, particularly with friends and family, has been described as "the most consistent and significant source of attachment to place" (Mesch & Manor, 1998, p. 507). Alternatively, it may be that having a larger network, and stronger sense of community increases ones likelihood of becoming involved in neighbouring activities (Warde, Tampubolon, & Savage, 2005).

4.2. Pathways between environmental correlates and sense of community

This study showed that the frequency with which people use POS and shops only explained a small portion of the relationship between POS or shop quality and sense of community. As direct associations between POS or shop quality and sense of community were observed, this study may indicate that as long as people visit public space, the frequency with which they do so does not influence their sense of community. By contrast, Kuo et al. (1998) found that the relationship between green space and social ties was mediated by the use of common space in an inner-city housing development. Using the same study setting, Kweon et al. (1998) found that use of the space predicted the strength of neighbourhood social ties and sense of community in older adults. A direct relationship has also been found between sense of community and residents' use of natural and semi-developed areas, such as playgrounds and ball fields (Kearney, 2006). However, as views of nature from the home also predicted sense of community, Kearney concluded that people may benefit from shared nature spaces without physically using them. Other studies found significant associations between green space and supportive interactions were less to do with actual contacts with neighbours than green space's ability to strengthen sense of community via place attachment and identity within its residents (Kweon et al., 1998; Maas et al., 2009). To the authors' knowledge, this is the first study to investigate the role of frequent shop visits in the relationship between shop quality and sense of community.

4.3. Study limitations

As a cross-sectional study, one cannot determine whether high quality public space strengthens sense of community, or if people with a stronger sense of community rate quality higher. People who spend more time in public spaces may also view them more favourably. Indeed, people with larger social networks have been said to visit shops more frequently as a result of their numerous social engagements, emphasis on personal appearance, and subsequent desire to purchase new clothes and beauty products (Crask & Reynolds, 1978; Hyun-Mee & Miller, 2002; Lumpkin, 1985). Longitudinal studies are also needed to clarify whether more affluent study participants have greater control over where they live. As more advantaged socio-economic suburbs have been shown to contain higher quality parks (Crawford et al., 2008), all analyses within this study adjusted for individual and area-level socio-economic status.

This study has focused on subjective measures of public space quality, although an objective measure of POS quality was also included. Given the limitations of self-administered surveys, such as the potential for recall bias, future studies would benefit from objective measures of other public spaces, such as community centres, shops and schools (Schwarz, 1999). In addition to the presence of various public space features, new measures of quality should also consider the condition of these features (Bedimo-Rung et al., 2005). Objective measures of public space quality can also help to tease out those tacit features of public space that users appreciate, but are not necessarily aware of. For example, Carmona, Heath, Oc, and Tiesdell (2010) note that an important aspect of public space quality is visual and physical permeability – that is, the ability to both move through an environment and see the routes available to them (Carmona et al., 2010). Studies into the configuration of space, i.e. space syntax, may also assist in this regard (Hillier, 1996; Hillier, Penn, Hanson, Gajewski, & Xu, 1993).

The value that different ethnic cultures place on public space and sense of community also warrants further investigation. While home ownership, length of residence and ethnicity were

potentially confounding variables of the association between physical environmental variables and sense of community, these variables could not be included in the analyses as study participants were all home owners, had been living in their homes for approximately the same amount of time, and the large majority (87%) were born in English-speaking countries.

As previously noted, while there have been a number of attempts to distinguish between the many place concepts found within the social research literature (Bow & Buys, 2003; Lewicka, 2011; Pretty et al., 2003), definitions and measures of these concepts are yet to be standardised. Collaborations between researchers and practitioners working in the fields of community psychology, environmental psychology, planning and public health may help clarify these concepts and prevent the duplication of research.

There is debate amongst researchers as to whether sense of community is best measured as a community or individual-level attribute (Chavis & Pretty, 1999). Typically it is measured at the individual level and interpreted accordingly (Brodsky, O'Campo, & Aronson, 1999; Townley & Kloos, 2009). This has been the approach adopted in this study. However, researchers have also argued that sense of community should be viewed as an ecological attribute and, as such, measured as an aggregated, community-level characteristic (Hill, 1996; Lochner, Kawachi, & Kennedy, 1999). Using multi-level statistical techniques to investigate the association between public space and sense of community at the community level may therefore be warranted. Researchers should also recognise, however, that the most valid ways of measuring collective attributes are yet to be determined (Lochner et al., 1999).

This study has intentionally focused on the positive aspects of sense of community. However, concepts such as sense of community can also be detrimental to physiological and psychological health, particularly in lower socio-economic areas (Brodsky, 1996; Caughy, O'Campo, & Muntaner, 2003; Ellis, 2006; House, 2001; Kawachi & Berkman, 2001). This is not to say that attempts to improve social outcomes in disadvantaged areas are unwarranted – high quality green spaces have been associated with fewer crimes, intra-family aggression and violence (Kuo & Sullivan, 2001a, 2001b). Rather, more research is needed into ways of creating community ties while minimising potentially negative consequences.

5. Conclusion

Perceived quality of POS and shops appears to be strongly associated with sense of community. The presence of high quality public spaces in local neighbourhoods – irrespective of whether used frequently or not – may be important for enhancing sense of community amongst residents. Nevertheless, further research is needed to explore causation. The benefits of a strong sense of community are numerous, and potentially include increased participation in community affairs and better physical and mental health. Policies that support high quality public spaces are warranted.

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