



Perceptions of safety in suburban neighbourhoods: exploring the influence of the physical environment.

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Abstract

Among public health practitioners, there is growing recognition of the need to build supportive environments that encourage people to be physically active. One necessary component of a supportive environment is neighbourhood safety. While we intuitively expect that neighbourhoods perceived to be unsafe will constrain local physical activity and affect health, the evidence of such a link is inconclusive.

This paper presents a theoretical model investigating the relationships between the physical environment, perceived neighbourhood safety and local walking. The central theme is the moderating influence that urban design and neighbourhood presentation have on resident perceptions. The model will be applied to investigate whether neighbourhoods designed to promote safety through activity and surveillance (i.e. Liveable Neighbourhoods) improve residents' feelings of safety, and consequently affect walking behaviour.

The Safety and Walking Study is part of the RESIDENTIAL Environment project (RESIDE), a longitudinal study of people building homes in new housing estates designed to examine the impact of urban design on walking, cycling, and sense of community. RESIDE will evaluate the impact of Liveable Neighbourhood sub-division design codes that aim to increase walking. The Safety and Walking Study will combine survey data and objective environmental assessments to offer insights into which, if any, aspects of suburban design correlate with increased perceived safety among residents.

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1 Introduction

In the sphere of public health, there is increasing awareness of the role the built environment plays in encouraging people to be physically active. One necessary component of a supportive physical environment is the safety of the local neighbourhood. Few studies adequately address the relationship between real or perceived neighbourhood safety and walking, and there are several limitations with the research that does identify a connection.

This paper introduces the Safety and Walking Study, and describes the theorised relationships and project methodology. The research will expand on existing work and take a more comprehensive approach, integrating the affect of neighbourhood planning, the social environment and individual factors on perceived safety, and its subsequent influence, if any, on neighbourhood walking.

To achieve health benefits, Australians are encouraged to participate in moderate-intensity physical activity for thirty minutes, most days of the week (Commonwealth Department of Health and Aged Care, 1999). However evidence suggests that while Australians have become more aware of the benefits of physical activity, activity levels are actually decreasing (Armstrong et al., 2000). Physical inactivity is responsible for about 8% of the total burden of disease in Australia, and ranks second only to tobacco. Consequently, interventions that increase physical activity levels could produce considerable public health improvements (Mathers et al., 1999), and environmental interventions are of particular interest as they have the potential to affect greater numbers of people (Sallis et al., 1998).

Recently, there has been growing interest in the relationship between neighbourhood design and walking. For example, research suggests residents living in neighbourhoods with more mixed-use development are also more likely to walk and less likely to be obese (Frank et al., 2004). In 1998, the Western Australian Planning Commission (WAPC) introduced an alternative planning strategy for new development which promotes sustainable communities. Based on new urbanism, the Liveable Neighbourhoods Design Guidelines facilitate the creation of mixed-use, mixed-density, walkable communities that aim to foster a strong sense of community and local identity. Moreover, one of the objectives of liveable neighbourhoods is to increase neighbourhood safety through activity and surveillance (Western Australian Planning Commission, 2000). To explore this objective, the research will draw on participants from conventionally planned and liveable neighbourhoods.

2 The research problem

Individuals that are anxious about crime may change their behaviour to reduce their apparent vulnerability (Skogan and Maxfield, 1981). Typically, two typical patterns can be employed: 1) constrained behaviour, where people minimise their exposure to potentially dangerous situations by avoiding certain places and altering behaviour, and 2) protective behaviour, which involves the upgrading of security measures (Skogan and Maxfield, 1981, Liska et al., 1988). Women typically respond to fear of crime by constraining their behaviour. When Skogan and Maxfield (1981) questioned women about how they would deal with the threat of sexual assault, most women recommended 'not going out alone' or 'not talking to strangers' rather than 'fighting back against their attackers' or 'carrying a weapon for protection'. However Liska and colleagues (1988) suggest restricting activities does not necessarily alleviate fears. Rather, fear of crime and constrained behaviour function in an 'escalating loop' where fear restricts behaviour, which increases, rather than decreases fear.

A number of public health researchers have investigated the link between safety and neighbourhood walking or physical activity. While it seems commonsense that resident concerns about safety might constrain local physical activity, to date the evidence is inconclusive. The term, 'neighbourhood safety', as used in the public health literature, spans numerous local concerns, including unattended or barking dogs, traffic volume and speed, footpath condition, street lighting, crime and disorder. The aspect of safety most commonly

examined is crime related, but traffic and dogs are also frequently addressed in the research. Neighbourhood conditions that can promote or discourage feelings of safety, such as disorder (incivilities), neighbourhood or garden maintenance and street lighting are less commonly investigated, and natural surveillance is rarely assessed. Most research focuses on the neighbourhood correlates of walking, and safety is analysed with numerous environmental, social and personal variables. Neighbourhood safety itself is rarely the focus for the research.

Of the research specifically addressing crime, the term 'neighbourhood safety' may encompass a number of related constructs, such as fear of crime, anxiety or worry about crime, and perceived risk. Ferraro (1995) defines fear of crime as an emotional reaction of dread or anxiety to crime of the symbols that one associates with crime. It is distinct from perceived risk, which refers to people's assessments of crime rates and the likelihood that an event will occur. Within the criminological field, how to best measure 'fear of crime' continues to generate debate. Despite calls for more qualitative investigations into the subject, most research is based on quantitative survey instruments, and it has been suggested that many of these generate inaccurate estimates of fear about crime (Farrall et al., 1997). Hale (1996) presents a comprehensive review of the fear of crime literature, and makes a number of recommendations for researchers applying quantitative measures: 1) questions should refer explicitly to 'fear' rather than worry or concern about crime; 2) measures should specifically mention crime, rather than make 'vague or implicit references to crime' and 3) questions should not be hypothetical. Public health researchers have been slow to incorporate these recommendations.

The existing research has a number of limitations associated with the measurement of perceived safety. Many studies are reliant on global measures of fear, which do not explicitly mention the source of insecurity, and may be interpreted in various ways by respondents. In examples such as, 'how safe do you feel walking in your neighbourhood at night' (Piro et al., 2006), or 'do you feel safe returning to your home when it is dark?' (Shenassa et al., 2006), the threat is implied but the source of insecurity is not clearly mentioned (i.e. does crime, dogs, or traffic cause the respondent to feel unsafe). Moreover, respondents who feel unsafe may not actually be fearful, but may judge the risk of victimisation to be high (Ferraro and LaGrange, 1992). Some researchers have analysed neighbourhood safety by combining numerous elements of safety into an environmental rating (Humpel et al., 2004, Suminski et al., 2005). For example, one study combined responses to questions about traffic safety, street lighting and crime to generate a neighbourhood safety rating (Suminski et al., 2005). The application of combined safety measures disguise the source of the problem, making it difficult to target appropriate interventions that might help alleviate the problem and improve perceptions of safety.

Research has variously used subjective and objective assessments of neighbourhood safety, and some research has incorporated both. Objective safety measures analysed include police crime data (Forde, 1993, Gomez et al., 2004, Piro et al., 2006) and independent ratings of the amount of police attention required (van Lenthe et al., 2005). Other studies have assessed aspects of the environment that promote or deter feelings of safety. For example, trained auditors have rated neighbourhood level incivilities (Ellaway et al., 2005, Shenassa et al., 2006), and gauged street lighting or surveillance from houses (Craig et al., 2002, Pikora et al., 2006). However, the vast majority of the research tackling the association between safety and walking relies on subjective data. Pikora and colleagues (2006) comment that individuals' perceptions of safety may be a more important predictor of walking than objective environmental safety ratings, and future work should incorporate both facets (Pikora et al.,

2006). One study that analysed subjective safety and objective crime in a sample of elderly non-institutionalised residents, found neighbourhood level violence (objective) was significantly associated with less physical activity among men, whereas perceived safety (subjective) was significantly associated with less physical activity among women (Piro et al., 2006). Moreover, low perceived safety among women was not clustered, indicating that perceived safety is more psychologically complex and independent of local reported crime levels.

3 Socio-ecological model

A theoretical model was developed to outline the hypothesised relationships between the urban design of neighbourhoods, perceived safety and walking (Figure 1). The effect of the physical and social environment, and individual factors (e.g. age, sex, socio-economic status, previous victimisation) on the dependant variables 1) perceived safety and 2) local walking will be tested. The research model adopts a socio-ecological approach, which integrates the numerous, inherently multidisciplinary, elements that contribute to health related behaviours or outcomes (Stokols, 1992). The principle components of the model are discussed below.

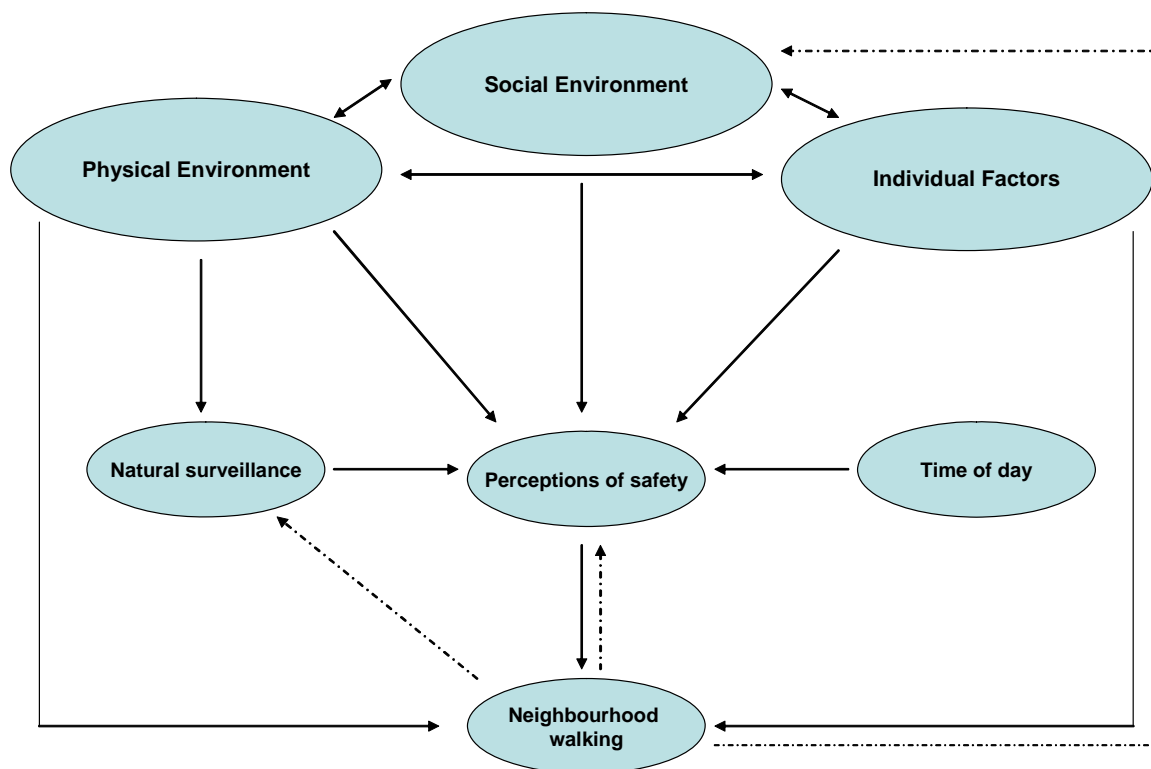


Figure 1 The research model

3.1 Individual factors

It is well documented that certain groups in society exhibit greater fear of crime (Hale, 1996). While men tend to be at greater risk of victimisation, women are generally more fearful than men (Carach and Mukherjee, 1999, Wilson-Doenges, 2000). Some suggest women's fear can

be explained in terms of the array of victimisation experiences which almost exclusively affect women, such as being followed by a man in public) (Keane, 1998, Lupton, 1999) and the fear that this behaviour might escalate into something more serious (Pain, 1997). Older age, lower socio-economic status and previous victimisation are also tend to be associated with increased fear of crime (Hale, 1996).

Of the research investigating safety and walking or physical activity, more significant associations have been found among sample populations already known to experience greater anxiety about crime. This inclination is demonstrated by findings from a cross sectional study by the Centre for Disease Control. Physical inactivity was more likely among those who perceived their neighbourhood to be unsafe from crime, with the greatest effect being among those 65 years or older or from racial/ethnic minority groups, and women reported more concern about safety than men. Notably there was little association between inactivity and perceived safety for those with higher educational attainments (Weinstein et al., 1999). Moreover, while most researchers examined adult samples (with men and women), on several occasions significant effects were only apparent when men and women were analysed separately (Humpel et al., 2004, Foster et al., 2004, Suminski et al., 2005, Shenassa et al., 2006, Piro et al., 2006).

3.2 Physical environment

3.2.1 New urbanism

In Australia, new suburban developments are increasingly planned according to new urbanism design principles, as highlighted by the introduction of the Liveable Neighbourhoods Design Code in Western Australia. New urban design theoretically promotes resident interaction (and sense of community) through access to services and facilities, walkable streets and site design. New urbanism was developed in the 1980s in response to suburban sprawl, which has been blamed for car dependence, pollution and traffic congestion, loss of green belt land, isolation of women and children, social and economic segregation, and the erosion of sense of place and community (Talen, 1999, Krieger, 2002). A new urban subdivision combines elements of traditional housing design in dense, mixed-use subdivisions which are pedestrian and car friendly, and are ideally linked to public transport (Calthorpe, 1994). Moreover, new urbanism aims to make streets safe and inviting for pedestrians through housing design that promotes natural surveillance (Congress for the New Urbanism, 2005).

Public health research supports some of the claims about the connection between new urbanism and walkability. Factors that encourage local walking include the presence of footpaths or walking trails, traffic control measures and access to local shops (Corti et al., 1996, Lund, 2002). Whether changes to suburban design are able to improve safety, or at least the perception of safety, remains in doubt. For example, Poyner (1983) notes that safer neighbourhoods are characterised by greater homogeneity, with less mixed use development, a greater proportion of single family housing and restricted vehicular and pedestrian access (Poyner, 1983). This assertion is at odds with new urbanism principles, and would indicate that the current wave of development is, contrary to expectations, actually creating more vulnerable neighbourhoods. The following section briefly traces the connection between the built environment and the crime.

3.2.2 Neighbourhood design and crime

Since the 1960s, several different perspectives on the relationship between the built environment, human interaction and crime have emerged (Zelinka and Brennan, 2001). Jacobs (1962) introduced the notion of defensible space when she commented that safe streets need a clear distinction between public and private space, and identified the importance of 'eyes on the street' and pedestrian traffic. She argued that the presence of pedestrians makes the streets safer, but also makes them lively and interesting to watch – which encourages surveillance from adjacent buildings. Moreover, she suggested that higher housing densities and the presence of local businesses generate street traffic, and that local residents and business proprietors supervise street activity (as 'sidewalk guardians') (Jacobs, 1962).

These themes were investigated and refined by Newman (1972), who documented the nature, pattern and location of criminal activity in New York's residential housing projects. He defined defensible space as the mechanisms that 'combine to bring an environment under the control of its residents' (Newman, 1972). Newman suggested that a building which adheres to the principles of defensible space can encourage residents to take responsibility for the space surrounding their dwelling. Some critiques of defensible space are grounded in its tendency to overlook the social context. For example, the social structure of the building tenants may account for some differences attributed to building form, various measures intended to encourage territoriality may also restrict activity, making a space less lively and therefore inhibiting surveillance (Merry, 1981), and territoriality will not effectively reduce crime when many of the offenders are themselves residents of the housing project (Cooper Marcus and Sarkissian, 1986).

The application of defensible space extended into the suburbs, as demonstrated by the cul-de-sac, which for many years was promoted as the safest type of urban layout (Fairs, 1998). Research appears to confirm the validity of this claim, with greater accessibility and higher traffic flows (vehicular and pedestrian) being linked to a greater incidence of property crime (Beavon et al., 1994). Studies have examined the effect of retrofitting neighbourhoods with cul-de-sacs (Newman, 1995) or street closures and traffic barriers (Atlas and LeBlanc, 1994). In both cases these interventions occurred in degraded, high crime neighbourhoods, with large volumes of vehicle through traffic. One author noted that while their research found these measures to be effective, the modifications may simply make residents feel safer, consequently increasing their use of public space and generating more natural surveillance (Atlas and LeBlanc, 1994). More recent analysis of suburb design and vulnerability to crime had conflicting results. Streets with more pedestrian traffic and greater visibility from the public domain and neighbours were shown to have fewer burglaries (Hillier and Shu, 2003).

The core themes of defensible space have evolved into the field of crime prevention through environmental design (CPTED). Numerous agencies, including the Western Australian Planning Commission, have developed CPTED guidelines. The key principles in the local guidelines are surveillance, access control, territorial reinforcement, target hardening and management and maintenance (Western Australian Planning Commission, 2006). There is some disagreement as to whether target hardening should be included in CPTED, as an over reliance on barriers may cause residents to withdraw into their homes, negating the effectiveness of other CPTED elements (Cozens et al., 2005) (see Cozens 2005 for a review of the CPTED literature). Target hardening describes the upgrading of physical security barriers to make a property more difficult to penetrate (e.g. locks, bars and security screens, solid doors, alarms, and walls and fences) (Zelinka and Brennan, 2001). It has been postulated that some obvious security measures in public space (e.g. CCTV, private security guards) may signal to pedestrians that the area is unsafe (Painter, 1996). If this notion is

accurate; visible home security precautions (e.g. roller shutters) may also generate concerns about safety, particularly in suburban neighbourhoods.

3.2.3 Natural surveillance

In terms of public health practice, there are potential synergies between walking to achieve health benefits and walking to enhance safety through surveillance. Research into the correlates of walking has identified associations between neighbourhood design features, such as access to destinations, street connectivity and aesthetics; and increased local walking (McCormack et al., 2004). As a consequence, neighbourhoods which are designed to be 'walkable' may generate more pedestrian traffic, in turn improving residents' perceptions of safety.

Natural surveillance comprises the opportunity for observation from adjacent buildings and surveillance from pedestrian or vehicular traffic (Angel, 1968). Jacobs (1962) described how the presence of more people on the streets made them safer from crime, however research examining this premise is inconclusive. Work by Angel (1968) generally supports Jacob's assertion. He identified a 'critical intensity zone' – when very few people are present, there are not enough potential victims to draw would-be offenders to the scene, and therefore the area is safe from crime. As numbers increase, there are adequate victims to attract offenders, yet there are insufficient people to provide surveillance. This, according to Angel, is when most crime takes place. With higher pedestrian traffic volumes, the surveillance function is achieved and the streets are again safe from crime (Angel, 1968). This concept is analogous with routine activity theory, which states that three elements are necessary for a crime to occur: 1) an offender; 2) a target; and 3) the absence of a capable guardian. A capable guardian encompasses any member of the public (e.g. neighbour, friend, relative or bystander) whose presence might deter the offender from proceeding (Clarke and Felson, 1993). Further research indicates that different volumes of pedestrian traffic are associated with different forms of crime. An investigation of crimes committed at bus stops found most serious offences occurred late at night when people (and therefore surveillance) were scarce (Loukaitou-Sideris, 1999). On the other hand, most public nuisance crimes (e.g. pick pocketing, street drinking, buying and selling of drugs and stolen merchandise) occurred when there was a large volume of pedestrian traffic, which served to mask low level offences (Mayhew et al., 1979, Loukaitou-Sideris, 1999).

But does the presence of more people necessarily increase perceived safety? An Australian qualitative project had mixed results, with some respondents feeling safer when few people were present and others feeling safer when more people circulated throughout the neighbourhood (Lupton, 1999). Alternatively, other research asked participants to list locations they perceived to be unsafe, which were then assessed according to a set of criteria by police. Most locations perceived as unsafe were 'quiet and deserted' and 'poorly lit', suggesting the presence of other people does alleviate fear (Vrij and Winkel, 1991). However the social environment may mediate the connection between the presence of people and perceived safety. Hunter and Baumer (1982) found that subjective exposure to pedestrian traffic only made people feel safer if they were strongly connected to the neighbourhood. Respondents without this connection experienced a greater fear of crime in the presence of the same amount of pedestrian traffic. The authors conclude that, 'each additional person represents another potential offender' (Hunter and Baumer, 1982).

Indeed, the opportunity for surveillance does not necessarily mean that people are observing the streets or will intervene (Mayhew et al., 1979, Merry, 1981). As such, the effectiveness of

natural surveillance is dictated by the social context, as it is the probability of intervention that deters crime and increases perceived safety (Hunter and Baumer, 1982). Qualitative research highlights that criminals make logical assessments about where to offend, avoiding places where they are likely to be observed or where residents are likely to act (Merry, 1981). Similar findings were observed by a Home Office Research Unit (U.K) study, in which telephone kiosks with natural surveillance were only marginally less vandalised than those without surveillance. The composition and behaviour of the local population was a more significant influence (Mayhew et al., 1979).

Street lighting is an essential component of surveillance. Improving street lighting offers a basic and cost effective means of improving surveillance and altering perceptions of safety (Painter, 1996). Interventions that improved street lighting have been associated with lower crime rates (Painter, 1996), less fear of crime (Vrij and Winkel, 1991, Painter, 1996), and increased pedestrian activity after dark – increasing surveillance (Painter, 1996). In addition, improved street lighting was found to increase respondents' belief that other pedestrians might quickly intervene and offer assistance if required (Vrij and Winkel, 1991).

3.2.4 Neighbourhood incivilities

Wilson and Kelling (1989) coined the term 'broken windows' to describe how signs of disorder or 'incivilities' in a neighbourhood can escalate if unchecked. Incivilities can be characterised by physical disorder (e.g. abandoned cars and buildings, litter, and graffiti) or social disorder (e.g. loitering teenagers, street drinking, drug taking and dealing, homelessness and rowdy behaviour) (Skogan and Maxfield, 1981, Perkins and Taylor, 1996). When incivilities are not dealt with quickly, residents tend to interpret neighbourhood decline as being worse than it actually is. They perceive more social problems and can lose confidence in local authorities. This can instigate a spiral where residents' fears grow, restricting behaviour and weakening informal social controls. Consequently, incivilities increase, offenders gain confidence and criminals from surrounding areas are drawn to the neighbourhood (Wilson and Kelling, 1989, Skogan, 1990).

The influence of incivilities on crime and neighbourhood perceptions has attracted considerable attention in the literature. Research has identified relationships linking incivilities with increased burglary (DeFrances and Titus, 1993), greater perceived crime (Lewis and Maxfield, 1980), greater fear of crime (Lewis and Maxfield, 1980), weaker social ties (Ross and Jang, 2000) poorer well-being (Airey, 2003) and poorer health (Cohen et al., 2000). Indeed, residents have been found to express greater concern over the incivilities than the crime itself (Wilson and Kelling, 1989, Lewis and Maxfield, 1980). Incivilities appear to act as an intermediate variable, where the presence of disorder increases concern about crime and generates more fear in the neighbourhood. Conversely when incivilities are absent, residents are better able to cope with higher crime rates (Lewis and Maxfield, 1980).

Research has connected the presence of disorder directly with health outcomes. In one study, various sources of objectively measured disorder were combined into a 'broken windows index'. Ultimately the broken windows index had a stronger association with gonorrhoea rates than poverty did (Cohen et al., 2000). Another study identified a link between disorder and physical activity. European residents in neighbourhoods with high levels of incivility (measured as objectively rated litter, graffiti and dog waste), were about 50% less likely to be physically active and about 50% more likely to be overweight or obese (Ellaway et al., 2005). The same study reported the opposite effect for areas rated highly for the level of greenery

(i.e. residents in greener neighbourhoods were more physically active and less likely to be obese). These results suggest that aesthetics and incivilities may represent two extremes of the same spectrum.

Most research on incivilities has focused on inner city environments, with few studies addressing disorder in a suburban context. Brown and colleagues (2004) suggest the cause and effect of suburban and urban incivilities may differ. The nature of the urban environment can generate more incivilities due to a greater volume of people, a more diverse range of society, and the location of businesses which 'invite trouble' (e.g. public bars and bottle shops) (Brown et al., 2004). Suburban physical incivilities include graffiti; litter and vandalism etc., but also encompass housing condition (e.g. garden and lawn maintenance, peeling paint and sagging roofs) (Brown et al., 2004). As such well maintained housing signals the resident's proprietary, and offers a symbolic barrier between public and private space (i.e. CPTED principle - territoriality).

Place attachment, as expressed through housing personalisation, alterations and condition, may indicate the strength of a resident's attachment and imply they are 'more vigilant territorial guardians' (Brown et al., 2004). Further, well maintained housing may limit crime because burglars infer that neighbours would notice and react to their presence (Brown et al., 2004). Brown et al (2004) found 'mundane incivilities' (e.g. unkempt lawns and litter) were associated with crime vulnerability in the suburbs. Moreover, the condition and maintenance of suburban neighbourhoods has been associated with perceived safety. When residents are satisfied with their physical and social environment (particularly housing maintenance and upkeep) they tend to feel safer (Austin et al., 2002).

3.3 Social Environment

Crime and perceived safety are inextricably tied to the social environment (Jacobs, 1962, Wilson-Doenges, 2000, Merry, 1981, Cooper Marcus and Sarkissian, 1986, Newman, 1972, Angel, 1968). Various terminologies have been employed over the years to describe the social environment, however recently the concept of social capital has found widespread acceptance. Social capital is broadly conceived as, 'those features of social organisation, such as networks, norms of reciprocity and trust in others that facilitate cooperation between citizens for mutual benefit' (Putnam, 1993). A number of other social constructs overlap with social capital, and elaborate on similar themes. Collective efficacy is of particular relevance to the incidence of crime and perceived safety. The concept encompasses the social cohesion of the neighbourhood and residents' 'willingness to intervene for the common good' (Sampson et al., 1997). Residents are more likely to intervene if their community is trusting and open rather than fearful (Sampson et al., 1997)

The stability of a neighbourhood affects the ability of its residents to develop social capital (Putnam, 1995), collective efficacy (Sampson et al., 1997) and sense of community (Davidson and Cotter, 1986, McMillan and Chavis, 1986). Sampson et al (1997) propose that residential tenure (i.e. home ownership) is the key social characteristic that promotes neighbourhood stability and therefore collective efficacy. Similarly, Davidson and Cotter (1986) identified a correlation between home ownership and sense of community. By purchasing a home, residents had invested in the area and were more committed to the suburb. Home ownership restricts mobility and increases length of residence, and expected length of residence is a strong indicator of sense of community (Glynn, 1981).

Researchers have identified the importance of various forms of social connectedness in limiting neighbourhood crime. For example, Kawachi et al (1999) found the incidence of crime may, to some degree, reflect the level of social capital in the local community. Both violent and property crime have been associated with relative deprivation (income inequality) and low social capital (Kawachi et al., 1999b). Similarly, Sampson et al (1997) found a strong negative association between collective efficacy and violence, after controlling for social composition. Furthermore, stronger neighbourhood ties appear to reduce fear of crime. Riger and Lavrakas (1981) documented that incidental contact between neighbours did not impact fear of crime, whereas *stronger* neighbourhood bonds and residential ties were effective in reducing fear of crime (Riger and Lavrakas, 1981).

Research has independently linked social capital or collective efficacy with health outcomes. For example, an ecological study in the USA found states with the lowest social capital ratings had significantly greater odds of fair to poor self-reported health (Kawachi et al., 1999a). In another study, collective efficacy was associated with improved health outcomes, such as BMI, risk of overweight and overweight status (Cohen, 2006). Stocks of social capital may help elucidate the relationship between crime and health, either through reducing risky behaviour and increasing social control (Kawachi et al., 1999a) or protecting residents against community stressors (Steptoe and Feldman, 2001). Kawachi et al (1999) postulate a number of pathways through which social capital may improve health. One explanation is that greater stocks of social capital may: 1) facilitate rapid diffusion of health information; 2) increase the probability that healthy behaviours are adopted; and 3) allow for the containment of deviant health related behaviours. The informal social control of deviant behaviour (i.e. collective efficacy) limits risky behaviour and helps prevent disorder and more serious crime. As such, social capital and collective efficacy may be joined in a causal pathway, where the community trust implicit in social capital is a precursor to collective efficacy, which in turn limits crime and incivilities (Kawachi et al., 1999a).

Neighbourhoods designed to encourage walking may help generate social capital among residents. There is some evidence that that walkable neighbourhoods have greater social capital (Leyden, 2003) and sense of community (Lund, 2002, Kim and Kaplan, 2004) when compared with car dependent neighbourhoods. Furthermore mixed-use neighbourhoods have been found to have greater sense of community than single-use neighbourhoods (Nasar and Julian, 1995). By creating an environment for pedestrians, the opportunity for social interaction between neighbours is enhanced, however strolling walks, rather than destination walks have been associated with increased social contact (Lund, 2003). These results generally support the notion that liveable neighbourhoods are able to promote social contact and/or increase stocks of social capital. However recent findings to the contrary re-enforce the relevance of perceived safety. Wood (2006) compared walkable and conventional neighbourhoods in the Perth Metropolitan area, and found greater social capital in the conventional neighbourhood, even after adjusting for various demographic and residency characteristics. Although a small study comprising only three neighbourhoods, she noted that safety concerns were more problematic in the traditionally planned neighbourhood, and this may go some way towards explaining the counterintuitive results (Wood, 2006).

4 Research methodology

4.1 RESIDE (RESIDential Environments) Project

The Safety and Walking Study sits within the broader RESIDE (RESIDential Environments) Project. The RESIDE project is a five year research project funded by Healthway and the Australian Research Council conducted in collaboration with the Department of Planning and Infrastructure (DPI), the National Heart Foundation and the Water Corporation. The study aims to evaluate the impact of urban design on health. In particular, the impact of urban design on walking, cycling, use of public transport and sense of community will be studied.

The study is designed to evaluate the impact of the DPI's 'Liveable Neighbourhoods' guidelines. The Liveable Neighbourhoods guidelines aim to encourage more walking by incorporating six design elements into new housing estates, four of which are specifically related to walking locally: street design, mixed density, mixed use planning and access to a mix of small and large public open space.

All people building new homes in new housing developments throughout metropolitan Perth between July 2003 and December 2005 (n=7000+) were invited to take part in this research project. Some 1813 people were recruited to participate in the study. To allow for the study of self-selection, in the main project study participants are surveyed three times: 1) Baseline – while their houses are being built and before they move into their new neighbourhood; 2) 1st follow-up – about one year after moving into their new home; 3) 2nd follow-up – about two years after that. In addition to self-administered surveys, DPI databases and environmental scans are being used to examine people's access to public open space, shops, public transport, footpaths, street layout and other aspects of the built environment. An objective measure of the study participant's level of physical activity is also being collected. A pedometer (small motion sensing device) will count the number of steps a person does in a week.

4.2 Safety and Walking Study

The Safety and Walking Study aims to explore the relationship between urban design factors intended to promote resident safety, and investigate any ensuing affects on local walking behaviour. The project is structured to test the hypothesised relationships depicted in the theoretical model. Specifically, the project will:

- Examine the extent to which liveable neighbourhoods (LN) and conventional neighbourhoods (CN) differ, if at all, in the implementation of measures to create safer communities (i.e. natural surveillance, traffic);
- Investigate whether neighbourhood design measures intended to promote surveillance influence the perception of safety among residents;
- Explore the association between neighbourhood image (e.g. incivilities, garden/lawn maintenance, and home fortification) and perceived safety among residents;
- Examine the association between association between neighbourhood safety and residents walking behaviour.

Resident perceptions and objective neighbourhood data will be collected to explore these objectives. The data collection procedure is outlines below.

4.3 Data collection

4.3.1 Perceptions

Survey data provides a cost-effective and time-efficient method for collecting information on the design of respondents' homes and their opportunities for surveillance, as well as

subjective assessments of neighbourhood condition and safety. New and existing items were assembled for the questionnaire, focusing on:

- Housing design and street surveillance;
- Resident behaviour that may promote natural surveillance and territoriality;
- Fear of crime and perceived risk;
- Perceptions of local problems, disorder and crime;
- Experiences of victimisation;
- Protective and constrained behaviour; and
- Collective efficacy.

Questions were initially subject to 'pre-pilot' testing using a convenience sample of about 20 people. The purpose was to ensure the survey items were logical, easily comprehended and simple to complete. After amendments, the reliability of the items was assessed using a test-retest methodology (n = 170). Volunteers recruited through the UWA Staff and Student email lists were recruited to complete the survey items on two occasions, about 10 days apart. Changes were made based on reliability testing results and space limitations.

RESIDE participants receiving their 2nd questionnaire between April and August 2006 were invited to complete an additional survey. Furthermore, the safety questions have been included in the 3rd RESIDE questionnaire, which will be posted to participants from September 2006. Data collection for this project will be finalised in April 2007. To detect a 0.4 standard deviation (85% power and alpha 0.05) difference in the key outcome (perceived safety) a sample size of 540 is required. This calculation includes an inflation factor of 0.10 to accommodate clustering in estates and a refusal inflation factor of 1.2. This two stage data collection process ensures an adequate sample size to examine the project objectives and test the theoretical model

4.3.2 Environmental data

Neighbourhood walkability

The RESIDE project is using Geographic Information Systems (GIS) to generate a series of environmental measures, such as residential density, access to destinations and connectivity. These are based on a 1.6 km radius (representing a 15 walk) from study participants' homes. The RESIDE measures are also relevant to this study as higher population densities and greater walkability will theoretically generate more pedestrian traffic, increasing natural surveillance.

Surveillance and incivilities

Researchers have used various techniques to objectively assess neighbourhood surveillance and condition. For example, Pikora and colleagues (2002) audited all streets within a 400 m radius of respondents' homes to assess the quality of the neighbourhood for walking and cycling. Items included garden maintenance, the presence of street lights and street surveillance from houses (Pikora et al., 2002). Similarly, Austin (2002) photographed and audited respondents' homes to create an objective measure of housing maintenance and quality. Auditors also rated the general appearance of the neighbourhood, although it is unclear how this was measured (Austin et al., 2002). Raudenbush and Sampson (1999) drove through neighbourhoods at five miles per hour and videoed both sides of the street. Later, random street blocks were selected and coded for physical and social incivilities (Raudenbush and Sampson, 1999). Alternatively, Porta and Renne (2005) measured urban design elements by taking photographs along the centre of city streets at 25 metre intervals and digitising

various features in AutoCAD. One feature mapped was 'softness', which encompasses 'transparency' (the amount of window space facing the street) and 'transitional space' (features which blend the transition between public and private space, such as verandahs, porticos, entry setbacks etc.) (Porta and Renne, 2005). The challenge for this project is to develop a time and cost effective method of assessing participants' residential environments for surveillance, territoriality, disorder and maintenance.

In addition to this, RESIDE has conducted an audit of all public open space (POS) greater than 2 hectares that falls within 1.6 km of each respondent's house. A number of safety items, focusing on the presence of incivilities, park maintenance, surveillance from surrounding roads and houses, and activity generating businesses in the streets adjacent to the park were developed for inclusion in the Public Open Space Tool (POST). The safety items were subjected to inter-rater reliability testing prior to the park audits proceeding. These data will provide an objective assessment of POS surveillance and park incivilities, and will provide information to generate neighbourhood ratings for incivilities, maintenance and surveillance. Furthermore, street lighting data has been acquired from Western Power Corporation. This information includes post locations, post descriptions (e.g. lamp) and globe power in watts.

Objective crime

Police crime statistics will also provide objective neighbourhood measurements. Certain crimes are underreported, particularly burglaries without loss and theft from the person (Mirrlees-Black et al., 1998), however these data still provide an objective measure of street or suburb level problems, depending on the detail of crime locations provided. This study is specifically interested in actual and attempted home burglary and offences committed against a person (e.g. offences threatening or endangering life generally, and robbery) in public space (including car parks, park and ovals, public transport, streets or footpaths, vacant/bush land, agricultural land, beach, river/lake). Offences in public space are of relevance because safety concerns in this context may limit residents' physical activity. Home burglary has been selected as it occurs more frequently and can disseminate fearfulness throughout a community. These crimes will be used as independent variables in the model.

An additional component of this research phase will be the content analysis of The West Australian and community newspapers specific to respondents' suburbs. Newspapers will be checked for articles with reference to issues with law and order in the respondents' suburbs. Any mention of local offences (encompassing property crime, crimes committed against a person and incivilities) will be recorded. Newspapers will be gathered over the months leading up to the completion of the survey questions by respondents, and will generate a measure of indirect victimisation. If necessary, this could also form a proxy measure of local crime. The relevant newspapers will be collected in preparation for this component of the project; however the analysis may be excluded from the project if time is limited.

4.4 Data analysis

The project will generate several subjective measures of personal safety (e.g. fear of crime, perceived risk, constrained/protective behaviour); and other measures such as collective efficacy. For each of these variables, it is proposed that a summary score be generated for analysis. Similarly, for objective environmental data, estates could be rated for various neighbourhood features. For example, the RESIDE POS audit collected data on park incivilities, and these data will be summarised into a neighbourhood level disorder score.

Housing estates will be compared in terms of perceived personal safety measures and other objectively measured neighbourhood elements, such as surveillance or disorder. Differences in personal safety will be examined in terms of the neighbourhood elements (e.g. perceived safety in estates with high surveillance versus perceived safety in estates with low surveillance).

Statistical analysis will be conducted to test the theorised relationships depicted in Figure 1. Specifically, the effect of the physical and social environment, and individual factors on the dependant variables: 1) perceived safety and 2) local walking will be examined. Initially the influence of the individual characteristics on the outcome measures will be explored; however these factors will be adjusted for in the next level of analysis. Data will be analysed using ANOVA/linear regression for continuous variables and cross tabulations/logistic regression for dichotomous variables. As the project will collect individual and neighbourhood level data, multi-level modelling will also be used to explore these data. Adjustments will be made to compensate for clustering (by estate) using mixed methods for quantitative variables and GEE methods for dichotomous variables.

5 Concluding remarks

Public health research conducted to date exploring the association between resident safety and local walking (or physical activity) confirms that, for some, the safety of the neighbourhood can constrain local activity. However, while many researchers have unearthed significant findings, equal numbers have found no effects, and the field requires more attention to establish whether safety is a significant influence on walking; and if so, to identify appropriate interventions. This paper introduced a theoretical model and research methodology for the Safety and Walking Study – a project designed to examine the influence of neighbourhood design on resident safety, and explore any subsequent affect on walking. When complete, the results will contribute to a growing body of literature examining the correlates of walking; but will also highlight the influence, if any, of suburban design on perceptions of safety. As the Liveable Neighbourhoods Design Guidelines aim to create safe, walkable communities through activity and surveillance, it is important to explore whether urban design that encourages surveillance can indeed influence perceived safety and local activity.

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