
Healthy Built Environments

A Review of the Literature



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BUILT ENVIRONMENT



THE HEALTHY BUILT ENVIRONMENTS PROGRAM

HEALTHY BUILT ENVIRONMENTS:
A review of the literature

Prepared by:
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The University of New South Wales
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Program's web site:
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Healthy Built Environments

A Review of the Literature



The Healthy Built Environments Program vision is that built environments will be planned, designed, developed and managed to promote and protect health for all people.

List of Abbreviations

AHURI: Australian Housing and Urban Research Institute	MET: Metabolic Equivalent
ALR: Active Living Research	MPC: Master Planned Community
ANGELO: Analysis Grid for Environments Linked to Obesity	n: number
ANU: Australian National University	NEMS-S: Nutrition Environment Measures Study-Store
APAIS-Health: Australian Public Affairs Information Service – Health	NHF: National Heart Foundation
ARC: Australian Research Council	NHMRC: National Health and Medical Research Council
ATRI: Australian Transport Index	NSW: New South Wales
BEnv: Built Environment	PA: Physical Activity
BMI: Body Mass Index	PCAL: Premier’s Council for Active Living
BRFSS: Behavioral Risk Factor Surveillance System	RESIDE: Residential Environment Project
CBA: Cost-Benefit Analysis	RURAL: Rural and Remote Health Database
CINAHL: Cumulative Index to Nursing and Allied Health Literature	SEPP: State Environmental Planning Policy
CLAN: Children Living in Active Neighbourhoods	SES: Socio Economic Status
CPTED: Crime Prevention Through Environmental Design	TAFE: Technical and Further Education
DARE: Database of Abstracts of Reviews of Effects	TB: Transport Behaviour
dB(A): Decibel (A Scale)	TND: Traditional Neighbourhood Design
DCP: Development Control Plan	TOD: Transit-Oriented Developments
EBMR: Evidence-Based Medicine Reviews	TRB: Transport Research Board
GIS: Geographic Information Systems	TMD: Total Mood Disturbance
GPS: Global Positioning System	UA: Urban Agriculture
HABITAT: How Areas in Brisbane Influence Health and Activity	UCLA: University of California Los Angeles
HBEP: Healthy Built Environments Program	UK: United Kingdom
HIA: Health Impact Assessment	UNSW: University of New South Wales
LAeq: Level equivalent continuous sound	USA: United States of America
LAFANS: Los Angeles Family and Neighborhood Study	US: United States
LEP: Local Environment Plan	VHT: Vehicle Hours Travelled
LGA: Local Government Area	VKT: Vehicle Kilometres Travelled
	VMT: Vehicle Miles Travelled
	WA: Western Australia
	WHO: World Health Organisation

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The Healthy Built Environments Program Overview

The Healthy Built Environments Program vision is that built environments will be planned, designed, developed and managed to promote and protect health for all people.



The Healthy Built Environments Program

The Healthy Built Environments Program is an innovative collaboration that brings the built environment and health together.

The Program is situated in the City Futures Research Centre, Faculty of the Built Environment at the University of NSW (UNSW). The Healthy Built Environments Program receives its core funding from the NSW Department of Health.

As Australia faces increasing health costs from rising rates of obesity, diabetes and other lifestyle diseases, health workers are seeking to influence the design of cities to make them more supportive of healthy ways of living. Recent research has demonstrated links between modern epidemics and the way of life in cities.

Car-dominated transport, reduced opportunities for exercise, increased fast-food availability and lack of social connection are all implicated. Increasingly the health sector is focusing on prevention, and to be effective, health professionals need to work in

Research – the Healthy Built Environments Program is developing a research strategy to prioritise research questions and foster interdisciplinary and policy relevant research. Research funding from bodies such as the Australian Research Council (ARC), National Health and Medical Research Council (NHMRC) and the Australian Housing and Urban Research Institute (AHURI) is sought to undertake relevant projects. Postgraduate students are also engaged to work on appropriate projects.

This Literature Review is a major project under the research strategy of the Healthy Built Environments Program.

Education and workforce development – the Healthy Built Environments Program is delivering innovative, cross disciplinary education and capacity building. Specific programs are delivered to NSW Health staff. Formal courses in healthy built environments are taught at the University of NSW.

The Healthy Built Environments Program is an innovative collaboration that brings the built environment and health together.



collaboration with other professional groups, especially those from the built environment.

The Healthy Built Environments Program is contributing to revitalising the relationship between the built environment and health professions so that together we can create built environments that support people being healthy in their everyday lives.

Healthy Built Environments Program Strategies

The Healthy Built Environments Program strategy aims to support the development in NSW of current and future communities in which the built environment promotes good health for all. This is being done through the Healthy Built Environments Program's three identified core strategies:

Leadership and advocacy – the Healthy Built Environments Program aspires to be a leader in NSW advocating for improved links between health and the built environment. This advocacy involves government and non-government agencies, the private sector and the community and is achieved through scholarly publications disseminating the latest research, popular media articles, talks and events.

HEALTHY BUILT ENVIRONMENTS PROGRAM

Further Information:

Further information on the Healthy Built Environments Program can be obtained by visiting the Program's website: <http://www.fbe.unsw.edu.au/cf/hbep/> or contacting the Healthy Built Environments Program by email: hbep@unsw.edu.au

FRUIT



A woman with a yellow backpack, wearing a black t-shirt and a white skirt, is looking at the flowers. She is standing on a grey tiled floor.

Price tags for flowers: \$2.99, \$3.99, \$4.99, \$5.99, \$6.99, \$7.99, \$8.99, \$9.99, \$10.99, \$11.99, \$12.99, \$13.99, \$14.99, \$15.99, \$16.99, \$17.99, \$18.99, \$19.99, \$20.99, \$21.99, \$22.99, \$23.99, \$24.99, \$25.99, \$26.99, \$27.99, \$28.99, \$29.99, \$30.99, \$31.99, \$32.99, \$33.99, \$34.99, \$35.99, \$36.99, \$37.99, \$38.99, \$39.99, \$40.99, \$41.99, \$42.99, \$43.99, \$44.99, \$45.99, \$46.99, \$47.99, \$48.99, \$49.99, \$50.99, \$51.99, \$52.99, \$53.99, \$54.99, \$55.99, \$56.99, \$57.99, \$58.99, \$59.99, \$60.99, \$61.99, \$62.99, \$63.99, \$64.99, \$65.99, \$66.99, \$67.99, \$68.99, \$69.99, \$70.99, \$71.99, \$72.99, \$73.99, \$74.99, \$75.99, \$76.99, \$77.99, \$78.99, \$79.99, \$80.99, \$81.99, \$82.99, \$83.99, \$84.99, \$85.99, \$86.99, \$87.99, \$88.99, \$89.99, \$90.99, \$91.99, \$92.99, \$93.99, \$94.99, \$95.99, \$96.99, \$97.99, \$98.99, \$99.99, \$100.99

Price tag for apples: \$7.99

Price tag for melons: \$9.99

Price tag for tomatoes: \$7.99

Price tag for apples: \$7.99

Price tag for melons: \$9.99

Price tag for melons: \$9.99

Price tag for apples: \$7.99

RESTAURANT



Executive Summary

The built environment has an important role to play in supporting human health as part of everyday living. This Literature Review examines the research evidence which demonstrates this link.

TOILETS



The built environment has an important role to play in supporting human health as part of everyday living. This Literature Review examines the research evidence which demonstrates this link. The primary aim is to establish an evidence base that supports the development, prioritisation and implementation of healthy built environment policies and practices. Further, the Review identifies gaps in the evidence to inform future research directions.

The focus of the Review is on the key built environment interventions or domains that support human health. These are:

1. **The Built Environment and Getting People Active.**
2. **The Built Environment and Connecting and Strengthening Communities.**
3. **The Built Environment and Providing Healthy Food Options.**

These built environment domains address three of the major risk factors for contemporary chronic disease:

- Physical inactivity,
- Social isolation, and
- Obesity.

The Review is structured around the three identified built environment domains. Key themes, strengths and weaknesses in the existing research, recommendations for future studies and policy implications are discussed and summarised for each theme (Section 5). This Section is supported by an Annotated Bibliography of 70 studies (Appendix 3). Each study is summarised and healthy built environment policy implications interpolated from the findings. The evidence in this Review is further

supported by a detailed Glossary of commonly used terms in the healthy built environment literature (Appendix 2). This is particularly important for a Review which embraces an interdisciplinary body of work. We have written the Review with an interdisciplinary audience in mind – professionals, researchers and students from the health and built environment disciplines.

The methodology employed for the Review was systematic and rigorous (Section 4). Built environment and health databases were searched using tailored key word searches (Appendix 1). A burgeoning literature on healthy built environments was identified with specific references subsequently screened using established parameters for the Review (Section 3). At the conclusion of this screening process, 1,080 references remained for inclusion. The identified literature is dominated by research on Getting People Active, with 62 percent of references having a physical activity focus. Eighteen percent and 11 percent of references relate to the other domains of Connecting and Strengthening Communities and Providing Healthy Food Options respectively. A fourth group of references was also established during the categorisation process. This body of work was labelled Professional Development. It includes case studies on best practice models for policy change, research on cost benefit analysis and market demand to encourage policy change, together with work on the theoretical underpinnings of the healthy environment relationship, including the nature of evidence. Nine percent of references were categorised in this way.



Major Themes in Each Domain

The key messages from each built environment domain are as follows:

The Built Environment and Getting People Active:

- A mix of social, economic, political and built environment policies is required to positively influence levels of physical activity.
- Keeping necessary trip distances short through mixed use and compact development will help to make active transport a viable option.
- While higher density areas generally display environments conducive to physical activity, the research suggests that increasing the residential density of the built environment alone will not necessarily encourage increased physical activity. Density, mixed use and micro-design elements *in some combination* are most likely to influence levels of physical activity.
- Destinations give people a place to walk to. Replacing uniform urban form with a variety of uses can lead to shorter distances between origins and destinations, which encourages active forms of transport.
- Grid street patterns decrease distances between origins and destinations. Decreased distance between commonly accessed uses encourages utilitarian physical activity.
- Well maintained footpaths and bike paths encourage walking and cycling for transport, as does the provision of bike parking and other end of trip facilities. Perceptions that cycling is unsafe

because of traffic, and perceptions that walking is unsafe because of exposure to crime, are key infrastructure related deterrents to walking and cycling for transport and recreation.

- People with access to good quality and safe open space are more likely to be physically active for recreation.
- Stair climbing is physical activity which can easily be integrated into everyday life. Visible stairways signed by point-of-choice prompts increase the rate of stair climbing.

The Built Environment and Connecting and Strengthening Communities:

- Community is complicated. This relates to demographic, cultural, ability, socio-economic and other attributes. What works to promote community in one locality, within a particular group or at one time, will not necessarily translate to another.
- The location and treatment of green and open spaces facilitate contact with nature, as well as contact with community.
- Casual encounters with community can occur anywhere. Providing facilities for comfortable waiting at public transport stops encourages the incidental interactions which become building blocks of community.
- Community gardens are forums for incidental and organised interaction. They are spaces for people to establish and maintain



contact with community and contact with nature.

- Both regional scale urban structure and micro scale building design influence incidental interaction on streets and in neighbourhoods.
- While sense of community and social interaction are determinants of health, a large body of research suggests that people will not interact within, or feel part of, a community that they perceive to be unsafe.
- Travel modes affect opportunities for casual social interaction. While active transport presents opportunities for causal interaction not afforded by the private car, it also potentially reduces accessibility to family and friends.
- The built environment can promote orderly social interaction by removing ambiguity in expectations and educating communities about behavioural norms.
- Participation in shaping the built environment supports interaction and psychological health directly by encouraging a sense of empowerment and custodianship. The way the built environment is governed can foster this participation.

The Built Environment and Providing Healthy Food Options:

- There is a clear link between exposure to healthy food options and healthy eating. Attempts to quantify this relationship have been based on mixed methods and have produced mixed results.
- Access to healthy food is more difficult in lower socio-economic status areas. This relationship needs to be further explored in an Australian context.
- Land use around schools can assist in reducing child and adolescent access to unhealthy food options. Nevertheless, further studies of the food environment around schools in Australia are required.
- The link between exposure to community gardens and farmers' markets, with increased consumption of fresh fruit and vegetables, is obvious although difficult to quantify. Markets and gardens also facilitate community interaction and physical activity. They are an extremely valuable element of a healthy built environment.
- Urban agricultural lands play an important part in the production and supply of healthy food to urban areas in Australia and should be protected.
- The impact of advertising signage on healthy food choices, particularly in an Australian context, is under researched.



Policy Implications in Each Domain

The policy implications from each built environment domain are as follows:

The Built Environment and Getting People Active:

- Policies modifying the built environment to encourage health outcomes need to be embedded within an integrated suite of changes. It would be rare for a built environment modification on its own to result in immediate behavioural change.
- Policies to increase land use densities need to be conceptualised as policies which bring uses, and not just people, closer together. Higher densities should be pursued in the context of both the existing macro (regional) urban framework of services and infrastructure, together with the micro urban fabric of design features that make higher densities liveable.
- There is strong research to suggest that visible stairways signed by point-of-choice prompts will increase the rate of stair-climbing. A policy to ensure new buildings are designed and developed with visible stairways might be a good catalyst to develop tangible policy based partnerships between health and planning.
- There is consistent evidence that infrastructure and facilities such as well maintained and connected footpaths, bike paths and open spaces will encourage physical activity. Policies to support the development and maintenance of this infrastructure should be

supported. Policies to make these environments safe (and perceived as safe) from crime and traffic will also encourage physical activity.

The Built Environment and Connecting and Strengthening Communities:

- Planning policies based on new urban design, including increases in densities and mixing of uses, will generally encourage social interaction. These interactions will not occur, however, unless adequate provision is made to protect individual privacy. Such policies should be accompanied by other community building programs, including the establishment of community groups, staging of community events, and even the support of fledging local retailing to ensure their viability.
- Policies to maintain green and open spaces should embrace increased physical activity, social connectivity and improved mental wellbeing as desired outcomes. With continuing growth of urban populations, policies need to target the acquisition of land for greenspace and improve the quality of existing greenspace networks beyond their traditional role as recreational areas.
- Community gardens should be supported by dedicated personnel and appropriate funding. Pursuing partnerships with other agencies such as neighbourhood schools, TAFE colleges, botanical gardens,



gardening clubs, recycling and sustainability groups, and local councils, can be a way to engage community based knowledge, as well as support.

- Policies to involve communities in crime prevention programs and policies based on existing CPTED guidelines need to be pursued. Crime prevention policies must be coordinated with other healthy built environment policies.
- Planning of environments that are new and unfamiliar should include provisions for educational programs and infrastructure. Policies to retrofit existing public spaces and environments with appropriate, creative and consistent signage detailing behavioural expectations should be pursued.
- Public participation provisions in existing built environment policy and legislation should be regularly reviewed to ensure they make use of contemporary technology and are suitable for today's communities. Policies for public participation in governance of the built environment should be adaptable to encourage inclusivity through participation from all community members. The involvement of children in the planning of green and open spaces should be particularly encouraged.

The Built Environment and Providing Healthy Food Options:

- The most convincing literature concerns the co-location and advertising of unhealthy food options near schools. Policies to reduce fast-food exposure in the

vicinity of school environments are justified.

- Given the relative dearth of research on the impact of the built environment on healthy eating options in an Australian context, it is difficult to recommend further policy change beyond that already discussed for encouraging physical activity.



Key Recommendations for Future Research

The key recommendations for future research cut across and synthesise the three built environment domains. In summary, they are as follows:

Focus on How to Change Existing Environments:

Research on the link between health and the built environment has tended to concentrate on what needs to change, rather than how health can be supported by modifying existing built environments. Approaches to retrofit existing built environments in ways that require minimal infrastructural investment require further research.

Pursue Interdisciplinary Understanding:

Major opportunities exist to develop the interdisciplinary nature of healthy built environments research. This needs to focus on how current knowledge about the relationship between health and the built environment is best implemented.

Explore the Evidence Required to Justify Policy Change:

There is a need to explore the standards of evidence required to justify and initiate change in the built environment that will support human health. Establishing non-spuriousness by removing confounding variables (such as residential self selection) and establishing time precedence through longitudinal research, are regularly identified as the missing elements of causal proof. At the same time there are researchers who question whether causal proof of the relationship between the built environment and health can ever be established. More comprehensive ways to explore and understand the issues need to be embraced. This includes the use of

case studies, in-depth observations, cost benefit analysis, environmental and social impact assessment, and demand analysis.

Examine Synergies and Scale:

There is a need to better understand synergies between social, cultural, environmental and economic drivers, as well as between the geographical scales at which these drivers operate. Related to this is the requirement to understand synergies between community subgroups and the way different groups interact with environments and each other.

Pursue Opportunities to Monitor Interventions:

Opportunistic monitoring of interventions should be undertaken, particularly to analyse their impact over time. Researchers and professionals need to work closely so that healthy built environment modifications can be targeted for research. This demands the development of a mechanism to link researchers with relevant professionals such as local strategic planners, consent authorities and health workers to ensure that opportunities for intervention monitoring are not overlooked.

Seek a Balance between Consistent and Adaptive Methods:

There is a need to find a balance between consistent and objective methods to measure and analyse built environment variables and health outcomes. Methods need to



be adaptable to different contexts to enable understanding of the nuances of people and places, including the ways that built environments can be healthy for minority groups, as well as the majority.

The Literature Review concludes with a discussion of the essential attributes of the relationship between health and the built environment that need to be recognised and enacted to progress both the research and its translation into policy.

The key message is that there is a strong relationship between people's health and the built environment and that this relationship is complex and contextual.





1.0 Introduction

This Literature Review is a major undertaking for the Healthy Built Environments Program. Under the contract that the HBEP has with its core funder, the NSW Health Department, it is specified that the Program will review the published scholarly evidence on the links between the built environment and health. It is further stated that the results of this endeavour will inform the development of a strategic research plan as well as be used in educational capacity building and other activities of the Program.



Given the vast quantity of the literature on the built environment and health, a steering committee was established to assist with focusing the Review. The following foci were determined for the Review:

- The two primary aims
- The ten parameters
- The framework
- The table of contents
- The template for references in the annotated bibliography

The Review focuses on the three key built environment interventions to support health – Getting People Active, Connecting and Strengthening Communities, and Providing Healthy Food Options. These built environment interventions or domains address three of the major risk factors for chronic disease in the Australian and NSW community – physical inactivity, obesity and social isolation. A major aim of the Review is to assist policy makers in the health and built environment professions who need access to the latest evidence to support the implementation of policies that promote physical activity, social interaction and healthy eating. Given this interdisciplinary audience, we have attempted to communicate in plain English throughout the Review. If jargon or specific technical terminology is unavoidable, it is defined. A comprehensive and detailed Glossary is also provided to help communication across a wide audience. The importance of clear communication in the interdisciplinary area of healthy built environments is widely recognised as a critical issue (Lake et al. 2010).

Similarly, the nature of research evidence is an important issue and can be a challenge for those engaged in this interdisciplinary work. There are different traditions in the type of evidence used and most highly valued by those researching in health and the built environment. At one end of the spectrum is the randomised control trial highly valued in the health sciences. This type of investigation is ‘often impractical and sometimes unethical in studies involving people and the built environment’ (NSW Health, 2009, p. 5). This Review encompasses a comprehensive range of robust and valid evidence across the health and built environment disciplines, acknowledging that the ‘methods used to investigate, and the findings available about, the links between health and the built environment are often different to those encountered in more controllable situations’ (NSW Health, 2009, p. 5).

Related to the nature of evidence is the way in which findings about the built environment can be applied across different geographical scales, demographic groups, majority and minority communities, and diverse socio-economic contexts – all of which characterise contemporary people-place relationships. Climate change and cultural diversity are further challenges facing the implementation of healthy built environments, as is the political context of decision making. Nevertheless, while there are challenges in working across the disciplines, there are opportunities ‘to generate new collective ways of working’, foster innovation and ‘to create novel interventions, policies and practice’ (Townsend et al. 2010, p. 12).





2.0 Structure of this Review

The Review is presented in three main sections.



The Review is presented in three main sections.

Aims and Parameters (Section 3) – this details the rationale behind the Review and the main parameters employed to shape the authors’ treatment of this vast body of literature.

Methodology (Section 4) – this outlines the process used to break the literature down into ‘domains of health and the built environment’. This section also details the search methodology.

The Evidence (Section 5) – this contains the body of the Review. Literature is summarised and discussed under the three domains, with key studies, key themes, conclusions, policy implications and recommendations for future research articulated for each domain. Every theme is accompanied by sample quotes from the evidence considered relevant by the authors. Examples are also given to demonstrate the ways that the evidence can be translated into policy to underpin practical healthy built environment actions.

There are three appendices in the Review.

Appendix 1 contains a diary of database searches undertaken to source the literature. This supports the methodology outlined in Section 4.

Appendix 2 is a Glossary of commonly used terms in the health/built environment literature.

Appendix 3 contains an Annotated Bibliography of the key studies identified in Section 5. Each reference is summarised with key words, study aims and methodology (in some cases this information is cited verbatim from the reference). We conclude each study in the annotated bibliography with our interpretation of the main policy implications. These will assist health and built environment professionals to apply the research evidence to policy development.



Aims and Parameters



Methodology
(Appendix 1: Diary of Database Searches)



The Evidence
(Appendix 3: Annotated Bibliography)



Glossary



3.0 Aims and Parameters

The primary aim of this Literature Review is to establish:

1. an evidence base to assist in the development, prioritisation and implementation of healthy built environment policies; and
2. a clear understanding of areas of evidence paucity in order to inform future research directions.



The Review is policy oriented, focusing on areas where NSW Health can be influential. The Review takes a lead from recently published key literature reviews to present a range of evidence and subsequently hypothesise a number of areas where research is lacking.

The Review is intended to provide a plain English discussion of the relevant literature that is accessible across both health and built environment disciplines.

The parameters for the Review are as follows:

1. The Review aims to be policy oriented, focusing on areas where NSW Health can be influential.
2. The Review does not analyse primary data.
3. The Review provides a plain English discourse of the literature that is accessible to all.
4. The Review does not consider the direct effects on health arising from transportation systems' emissions and noise, nor the health impact of transport accidents.
5. The Review is outcomes based. It does not specifically address matters relating to methods for measurement of the built environment or of health.
6. The Review concentrates on external urban form.
7. The Review only references research with specific implications for the Australian context.
8. The Annotated Bibliography is not limited to peer reviewed literature. Nevertheless, any primary research cited as justification for key themes has been published in peer reviewed journals.
9. The Annotated Bibliography only contains studies published in English.
10. The Review promotes interdisciplinary discourse, including a discussion of the nature of evidence in healthy built environments research.





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PATCH

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4.0 Scope and Methodology

Food for everyone

*Mandarins
Oranges
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Mint
Native Mint
Coriander
Rocket
Strawberries
Raspberries
Kaffir Lime leaves
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Passion fruit
Bay leaves
Lemon Myrtle leaves
and more ...*



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4.1 Defining the Scope of the Review – the three key domains of the healthy built environment relationship

The structure of the built environment and its ability to influence the way people live, move and interact is integral to human health. This relationship is multi-dimensional, crossing spatial, temporal and discipline boundaries with a complexity difficult to map, monitor and define. Despite these difficulties, in order to achieve the aims of this Review, it is necessary to identify areas of evidence paucity and provide tangible guidance on policy development.

Three key **domains** of the healthy built environment relationship have been identified as the best way to achieve the aims of the Review. These domains were initially defined using the knowledge of the HBEP, with subsequent endorsement of the Literature Review Steering Committee. As the work progressed, the identification of these domains as the most pertinent and useful was reinforced. They are:

1. **The Built Environment and Getting People Active.**
2. **The Built Environment and Connecting and Strengthening Communities.**
3. **The Built Environment and Providing Healthy Food Options.**

These built environment interventions are the foundations for supporting human health as they address the major risk factors for contemporary chronic disease – namely, decreased physical activity, increased stress and social isolation, and poor nutrition (Booth et al. 2001). This is articulated in Table One and Diagram One.



The Built Environment and Getting People Active



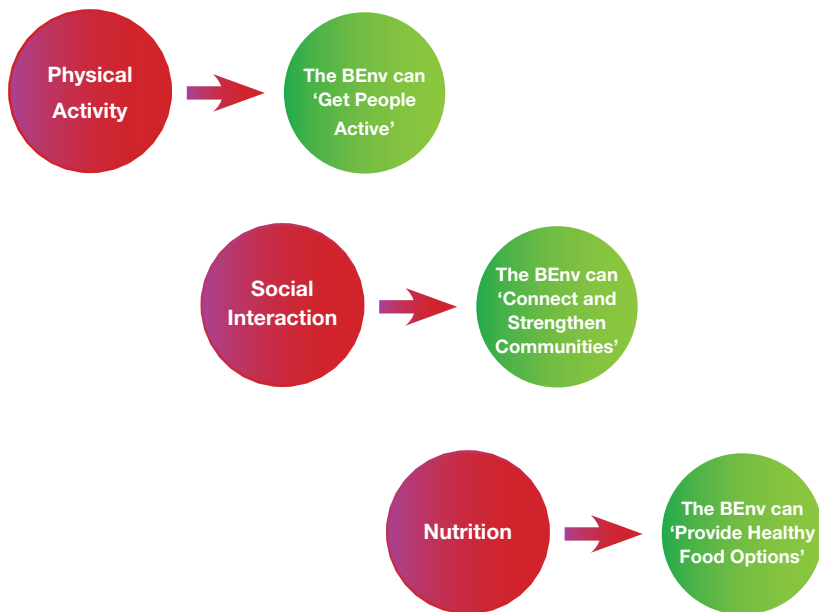
The Built Environment and Connecting and Strengthening Communities



The Built Environment and Providing Healthy Food Options

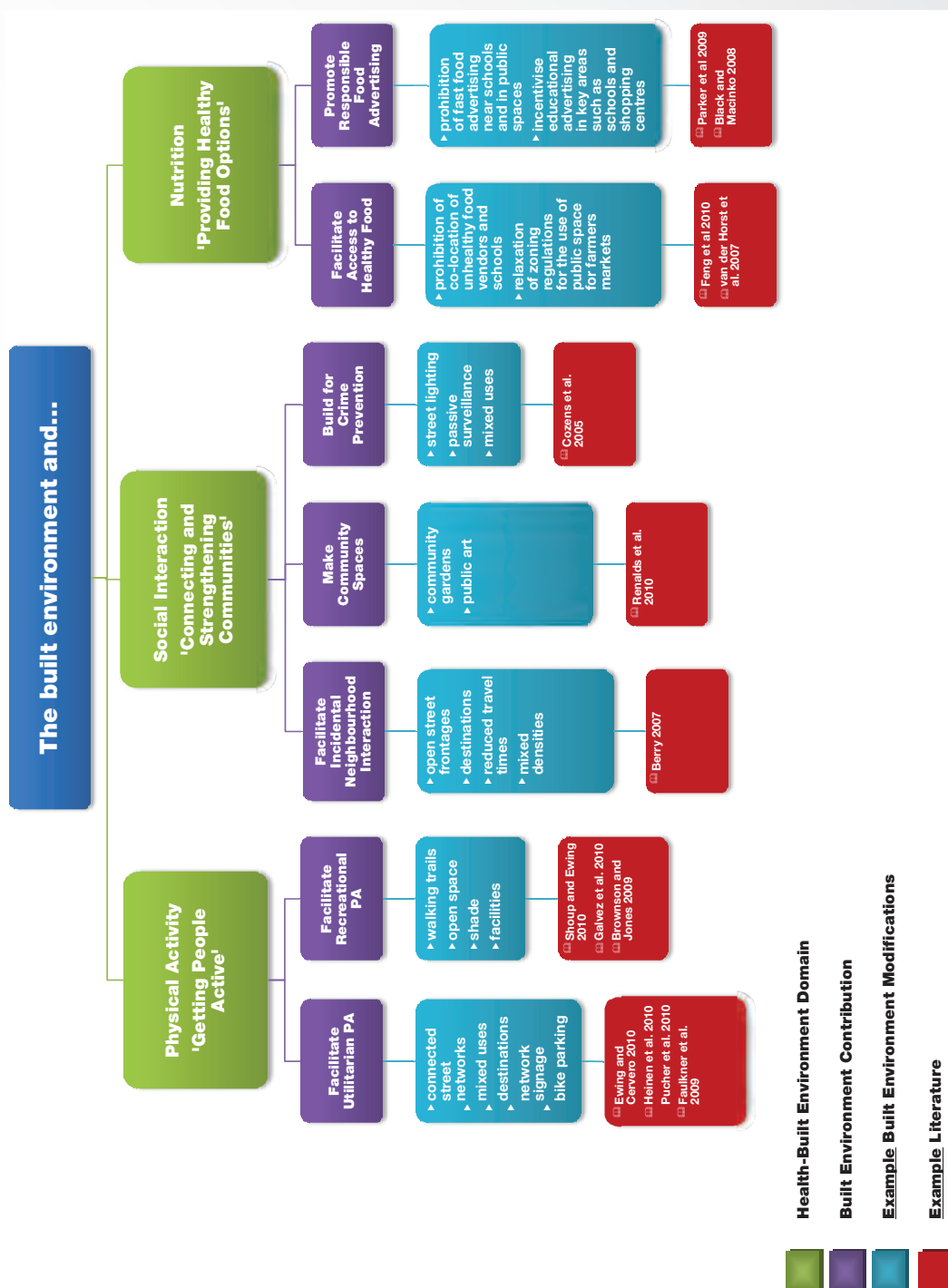
Table 1: Relationship between Disease Determinants, Risk Factors and Built Environment Domains

Example disease	Relevant disease risk determinant ¹	Example risk factor	Relevant domain of the health-built environment relationship
Type II diabetes	Physical Activity	Decreased activity in daily life	The built environment can Get People Active
Depression	Social Interaction	Increased personal isolation and fear	The built environment can Connect and Strengthen Communities
Heart disease	Nutrition	Reduced access to fresh fruit/vegetables	The built environment can Provide Healthy Food Options



¹ Note, the disease risk determinants in this table are those considered most relevant to the three built environment domains discussed in this Review.

Diagram 1: The Domains of Healthy Built Environments



4.2 Methodology

The methodology for this Review was systemic and rigorous. The steps employed are fully detailed here. First, economic, health, medical, transport and environmental internet and 'grey' literature databases were searched using terms tailored for each database (as recommended in Weaver et al. 2002). The parameters for the Review were also used in defining relevant search terms. The databases and key word combinations used are listed in Appendix 1. This part of the Review took place during April and May, 2010.

The search results were then screened using article title and abstract, with duplications and obviously irrelevant studies removed. Papers were also sought from experts in the field, including the project steering committee. This led to the compilation of 1,615 references relevant to the built environment and health.

The next step in the methodology was to assess these references for inclusion in the Review. This was done using the established parameters for the Review and the three key domains of the built environment-health relationship. Following this assessment, each remaining reference was allocated a code based on its 'Health-Built Environment Domain' and 'Built Environment Contribution' (as articulated in Diagram 1). The peer reviewed status of each reference was also checked against the criteria of Ulrich's Periodicals Directory². An additional category of 'other' was created to classify literature covering further aspects of healthy built environments, as well as a new, emerging body of scholarship. This was labelled 'Professional

Development' and forms part of the Review.

In total 1,080 references remained for inclusion in the Review.

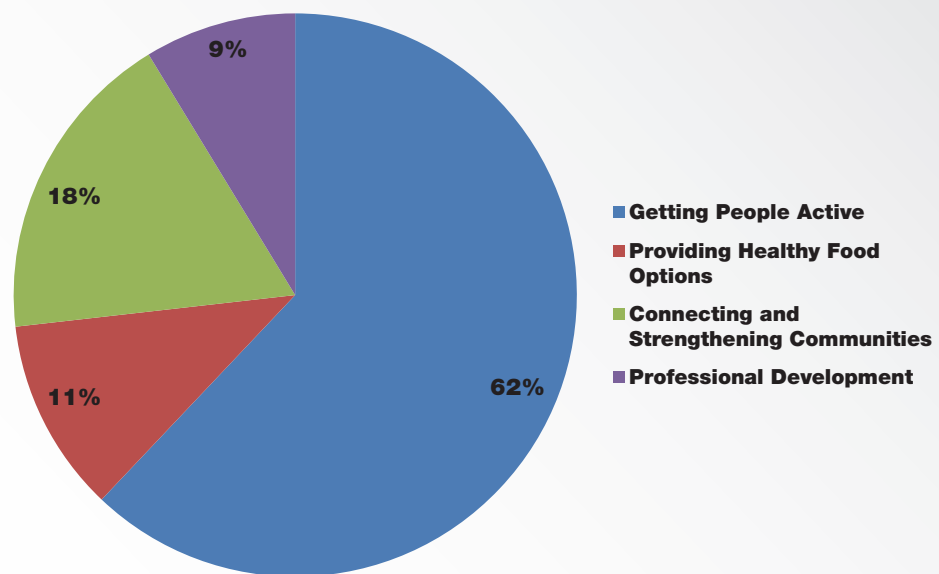
The dominance of literature related to physical activity – Getting People Active – is illustrated in Diagram 2. A total of 769 references were tagged with codes relevant to physical activity and it was subsequently decided to use a 'review of reviews' methodology to examine this literature. Thirty seven literature reviews were selected for this process. Selection was based on the knowledge of the authors and Review committee, together with a search of the 713 physical activity references for the word 'Review' in the key words or title.

Following an initial overview of the 37 literature reviews, key themes were identified and research outcomes assessed. References from 2010 were also analysed to ensure that the latest research was captured.

The same methodology was used to assess the remaining primary references in the literature categorised as relevant to Connecting and Strengthening Communities (224 studies) and Providing Healthy Food Options (138 studies). The only difference in methodology is the use of primary references in both of these categories, rather than the use of 'review of reviews'.

² Ulrich's Periodicals Directory is the standard library directory and database of bibliographic and publisher information for academic and scholarly research journals. It is trusted as an authoritative and comprehensive source across academic disciplines and around the world.

Diagram 2: Breakdown of References Post Categorisation



A further category 'other' was established. The majority of this literature relates to Professional Development with 109 references identified. This fourth category includes case studies on best practice models for policy change, research on cost benefit analysis, and market demand assessment

to encourage policy change. The category also embraces research on the interdisciplinary nature of the health-built environment relationship, including debates about different types of research evidence needed for policy development and implementation. This is discussed in Section 6.



5.0 The Evidence

The evidence presented in this Review has been summarised using the three ‘domains’ of the healthy built environment relationship as category headings:

1. The Built Environment and Getting People Active;
2. The Built Environment and Connecting and Strengthening Communities; and
3. The Built Environment and Providing Healthy Food Options.



Research is first presented on the benefits of encouraging each domain – for example, the benefits to physical health of physical activity. The analysis then proceeds to a discussion of the evidence on the specific ways that the built environment influences each domain – for example, the provision of walking trails can encourage physical activity. This analysis is presented as a narrative on how the built environment can be modified to promote good health. Reference is then made to seminal studies chosen because of the strength of the findings and their relevance to the Australian context. Key themes are subsequently outlined with conclusions, and sample policy and evidence tied to each theme. Recommendations for future research, strengths and weaknesses in the literature, together with policy implications, conclude each domain.



5.1 The Built Environment and Getting People Active





5.1.1 The Benefits of Getting People Active

There is a well established link between the composition of the built environment and our ability to be physically active (Booth et al. 2000). The gradual removal of physical activity from daily life has set in train a raft of negative health related consequences. The rapid increase in non communicable disease such as coronary heart disease and diabetes, currently experienced in both developed and developing countries, is of major concern (Booth et al. 2001).

Contemporary recognition of the relationship between physical activity and health benefits has grown concurrently with increasing mortality from non communicable chronic diseases and sedentary lifestyles. The research of Morris and Crawford in the 1950s explored the observations that sedentary workers suffered more heart disease than those in active jobs. They compared bus conductors with bus drivers and government clerks with postmen to arrive at this conclusion (Morris and Crawford 1958 p. 5111). Their study of the incidence of myocardial fibrosis (evidence of early coronary heart disease) in 3,800 corpses enabled confirmation of the hypothesis that 'men in physically active jobs have a lower incidence of coronary (ischaemic) heart disease in middle age than men in physically inactive jobs' (Morris and Crawford 1958 p. 5111). This early study importantly recognised that an absence of movement in daily life is unhealthy.

Beyond health specific benefits, it appears that physical activity is also linked to overall community well-being (Wood et al. 2010) through the encouragement of social interaction and community engagement (Echeverría et al. 2008). Moreover, there are economic and environmental benefits to physical activity that go beyond an individual's health (Bauman et al. 2008; Shoup and Ewing 2010).

Of course, since 1958, the role of physical activity as a modifiable risk factor of disease has been well researched and is now firmly established. The remainder of this section explores the way the built environment can encourage physical activity within an increasingly sedentary society.

5.1.2 How Can the Built Environment Get People Active?

The built environment can be modified to facilitate or constrain physical activity. It can be structured in ways that increase opportunities for, and reduce barriers to physical activity.

Characteristics of the built environment influence physical activity. These characteristics differ depending on population groups (e.g. children, youth, the elderly, socially and economically disadvantaged, differently abled), for varying purposes of physical activity (e.g. transportation, exercise), and in diverse contexts (e.g. inner suburban, outer suburban, regional, rural). The form of the built environment, such as residential and commercial density, land use mix, connectivity and accessibility, also influences the way we move and what we do within that environment. In particular, the built environment can shape travel behaviour, including the quantity of walking, cycling, public transport and car travel, as well as the amount of leisure time that is available for other healthy pursuits. The built environment can also facilitate opportunities for recreational physical activity, by providing well maintained and useful open spaces, in addition to safe and amenable streets for non-utilitarian walking and cycling.

5.1.3 Key Studies

There has been a lot of research on the links between the built environment and physical activity. This section provides an overview of current research outcomes to support the associations between the built environment and physical activity. Using the search methodology outlined in Section 4, 769 articles were identified as reviewing relevant research or directly examining the relationship between the built environment and physical activity. Given the huge number of papers in this area and the work to date, a review of existing reviews was employed as the principal method to examine this body of literature. A total of 55 review papers published between 2000 and 2010 summarising the relationship between the built environment and physical activity were subsequently



identified within the 1,300 articles. Four 'grey' reviews of the literature were added based on the knowledge of the authors and recommendations from the steering group. Finally, references from 2010 were also assessed to ensure that the latest research not incorporated in existing reviews was captured. It should be noted that a number of reviews met the search criteria yet obviously aimed to relate to a very general audience. These reviews were not included. It was considered that they would add nothing more to our study.

To further narrow the focus of the Review and avoid duplication, if a review identified by the search criteria was reviewed in the same context, more recently, the older review was excluded. For example, Gebel et al. 2005 review the built environment implications for physical activity from nine reviews, including Lee and Moudon (2004). Gebel et al. (2005) therefore replaces Lee and Moudon (2004) and the eight other prior reviews already covered for the purposes of this Literature Review. An exception to this is the landmark study conducted by the US based Transportation Research Board (2005).

Using this process of elimination, 37 studies were ultimately reviewed, with the following studies included in the Annotated Bibliography in Appendix 3.

Bauman and Bull 2007
Black and Macinko 2008
Brownson et al. 2006
Burke et al. 2008
Cao et al. 2009
Cavill et al. 2008
Davison et al. 2008
Dunton et al. 2009
Ewing and Cervero 2010
Ewing and Dumbaugh 2009
Faulkner et al. 2009
Feng et al. 2010
Ferreira et al. 2007
Frost et al. 2010
Galvez et al. 2010
Gebel et al. 2005
Gebel et al. 2007
Handy et al. 2009
Heinen et al. 2010
Kaczynski and Henderson 2008
Kahn et al. 2002
Leck 2006
Mead et al. 2006
Ogilvie et al. 2007
Pucher et al. 2010

Radbone and Hamnett 2003
Renalds et al. 2010
Saelens and Handy 2008
Sallis and Glanz 2009
Sallis et al. 2009
Shoup and Ewing 2010
Wendel-Vos et al. 2007

While these reviews vary in quality and approach, common themes were identified to explore the elements of the built environment that can get people active.

5.1.4 Major Themes in This Domain

Articulating the Evidence

Evidence from multilevel and quasi-experimental evaluations of environmental changes is now beginning to surface to clarify the comprehensive body of published cross sectional research. Increasingly, the idea that neighbourhoods can be designed and modified to support physical activity is justified as a public health issue. Nevertheless, it remains difficult to define exactly what it is about the built environment that gets people active and what form this environment might take in an Australian context.

The following section draws the literature together under common themes. Our starting point is a discussion about the application of ecological theories of health promotion and behaviour change to the way people are physically active within their built environment. Concluding that a 'policy mix' is required, the Review goes on to illuminate built environment attributes of mixed uses, distances and density, and the way the literature treats these attributes, including their impact on physical activity. The Review then turns to the built environment's role in facilitating recreational physical activity. It concludes with evidence on the way built environments can support every day movement as part of how people engage with the environments where they live and work.

The Policy Mix Required

Key Message: Research on encouraging physical activity generally follows socio-ecological models of behaviour and concludes that a mix of social, economic, political and built environment policies is required to positively influence levels of physical activity.

Popular barriers to physical activity are multi-dimensional and complex, crossing spatial, temporal and discipline boundaries. Radbone and Hamnett (2003) review a number of survey based studies on why people do not walk. They conclude that time needed, danger from motor vehicles, fears about personal security, inclement weather, poor health, quality and amenity of pedestrian facilities, distance, having

dependents or baggage, and perceptions of a 'lack of glamour' associated with walking compared with other travel modes are the most often identified barriers. In a review of bicycle commuting, Heinen et al. (2010) emphasise that time, safety, perceptions of social norms, and the impracticality of distance are among the most important barriers to cycling uptake. Bauman et al. (2008) cite a survey of 2,403 cyclists conducted by Garrard et al. (2006) to identify confidence, motivation, skills, beliefs, attitudes, time, opportunity, and perceptions of enjoyment, as the primary barriers to cycling. The main inference from this analysis of barriers to physical activity is that some are attitudinal, while others relate to the built environment and to the biophysical environment. Some are highly influenced by political decision making, others by economic conditions and social norms.

This complexity suggests that traditional biological and psychological models of behaviour focused on the individual will not provoke the kind of behavioural change required to increase physical activity (Brownson et al. 2005; Sallis and Glanz 2009; Pouliou and Elliott 2010). Instead, the most effective interventions will operate at multiple levels. They will be tailored to place (Mitra et al. 2010) and the people living in that place, respecting that individuals of different ages (Carver et al. 2010a; Frank et al. 2010), socio-economic and cultural backgrounds (Dahmann et al. 2010; Franzini et al. 2010; Turrell et al. 2010) and genders (Bonham and Koth 2010; Michael et al. 2010) will respond to interventions differently. Furthermore, while environmental change can be low cost, high reach, and provide supportive environments for later targeted interventions (Brownson et al. 2006), educational programs, policy change and economic incentives must also be employed (Gebel et al. 2005; Rodriguez 2009). The socio-ecological model of behaviour change is based on the idea that comprehensive approaches to change physical activity levels need to consider interventions at multiple levels – the individual, social and environmental. The latter component, environmental influences on physical activity, is the subject of this section of the Review.

The requirement for a mix of adjustments is evident from the research



on single focus 'one off' interventions. In a meta analysis of built environment/transport research to 2009, Ewing and Cervero (2010) found walking and cycling behaviour to be generally 'inelastic' with respect to changes in the built environment. This infers that mode uptake for walking and cycling is generally not responsive to the small scale built environment modifications assessed in their review (Ewing and Cervero 2010). This is supported by Krizek et al. (2009) who assessed over 300 articles on cycling and walking. They stress that 'only via an integrated range of environmental features...pricing policies (and) education programs will substantive changes result' (Krizek et al. 2009 p.5). Despite their inference of inelasticity of travel behaviour, Ewing and Cervero (2010) still conclude that the combined effect of built environment variables on physical activity could be quite large. However, this is an effect that does not readily reveal itself through meta-analysis of small scale individual modifications.

Sample Policy

'The NSW BikePlan features encouragement actions to make cycling as easy and accessible as walking or driving a short distance by:

- developing an internet portal to cycling information, including interactive bike mapping on the Transport Info 131500 website...
- rolling out cycling skills and awareness training for adults, with a priority focus on Parramatta, Liverpool and Penrith...
- preparing teacher resources on student bike-riding skills...'

The NSW Bike Plan 2010 p. 5.

Sample Evidence

'...separate [cycling] facilities are only part of the solution. [Cycle friendly] cities reinforce the safety, convenience, and attractiveness of cycling with extensive bike parking, integration with public transport, comprehensive traffic education and training of both cyclists and motorists, and a wide range of promotional events intended to generate enthusiasm ... At the same time, car use is made expensive, less convenient, and less necessary through a host of taxes and restrictions on car ownership, use, and parking. And land use policies foster relatively compact, mixed-use developments that generate more bikeable, shorter trips.'

Pucher and Buehler 2007 p. 53.

Accessibility and the Importance of Distance

Key Message: Research consistently shows that keeping necessary trip distances short through mixed use and compact development will help to make active transport a viable option.

Accessibility is generally measured as the distance between origin and destination and, in the majority of the literature, distance is significantly correlated with active transport. Longer distances discourage all mobility, particularly those involving physical activity. Essentially, shorter distance represents increased convenience and therefore reduced cost to the individual through time and effort required to use physically active transport modes.

Both perceived and actual distance between destinations are significantly and positively correlated with physical activity (Transportation Research Board 2005; Bauman and Bull 2007). The importance of distance is strongly emphasised in the review of commuting by cycle undertaken by Heinen et al. (2010). They cite at least 11 studies which conclude that an increase in trip distance results in cycling having a much lower share in mode choice. The same conclusion is confirmed by the Australian 'Journey to Work' census data. This indicates that cycle commuters tend to live closer to their work than other types of commuters (Rissel and Garrard 2006). Distance is also a regularly cited variable that encourages utilitarian walking. Wen et al. (2010) conclude that the inconvenience of distance is a major barrier to walking to work. Bauman and Bull (2007) cite proximity and walkable distance as more often associated with both utilitarian and recreational walking.

Sprawl is a proxy for contemporary suburban form, characterised by low density and homogeneity of land use, which invariably results in increased distances between uses. Automobile dependency has enabled the development of low density, single use suburbs and it logically follows that poor accessibility by active transport is often used as an indicator of urban sprawl. There have been numerous studies seeking to clarify the apparent link between urban sprawl, decreased physical activity and increased obesity (Ewing et al. 2003; Ewing 2005;

Frumkin 2005; Brown et al. 2008; Garden and Jalaludin 2009; Trubka et al. 2010). As an example, Feng et al. (2010) review 22 studies which overwhelmingly indicate significant associations between sprawl and physical activity. In the context of adolescents using active travel options to get to school, Dunton et al. (2010) cite sprawl as being associated with less utilitarian physical activity and higher obesity outcomes. Generally, research in this area concludes that it is the poor accessibility and increased distances between land uses characteristic of 'sprawl', rather than sprawl as a tangible concept, that discourages physical activity. This is particularly so in relation to utilitarian physical activity.

If accessibility and distance are key determinants of physical activity, the question remains - how far are people willing to walk and cycle? Krizek et al. (2009) indicate a strong market for cycling trips less than two and a half kilometres. Keijer and Rietveld (2000), Rietveld (2000) and Martens (2004) suggest that the bicycle is most often used for distances up to three and a half kilometres. More recent studies have shown people are willing to cycle up to ten kilometres to access high frequency public transport services (as reviewed by Pucher et al. 2010). The standard distance for walking is cited anecdotally as 400 metres (Krizek et al. 2009). However, similar to cycling, various studies have shown that people will walk greater distances for utilitarian purposes to access, for example, public transport or other services (Besser and Dannenberg 2005). Burke and Brown (2007) present detailed information on the distances people walk for transport purposes in Brisbane. They use the South East Queensland Travel Survey which provides information on the weekday travel of 10,931 respondents. Burke and Brown report that the median distances people walk from home to all other places, using the walk mode only, is just under one and a half kilometres (1.45). In essence, their research suggests that the more desirable the destination, the further people are willing to walk or cycle to access it. Nevertheless, this is constrained, with the limit being defined by context and time.

Time, and the recognition that distance is a surrogate for time, is often excluded from the literature. Time is a cost

of active transport both in real terms and because it represents the amount of effort required (Saarloos et al. 2009). Lack of time is a major reason why people do not engage in healthy behaviours (Tranter 2010). It is easy to conceive that a ten minute cycle across the flats of Amsterdam would get the average commuter cyclist a greater distance than a ten minute ride across the ridges of Sydney's northern beaches or a steep coastal town. Unfortunately, incorporating time into the complex models used to predict walkability and cyclability is far more difficult and contextually dependent than incorporating more objective measures of distance. Despite this, future studies need to recognise the proxy-based relationship between time and distance when determining propensity for active transport to access destinations.

Sample Policy

'Locate food stores, shops and local facilities (such as post boxes and public telephones) within close walking distance to dwellings and businesses. The concept of 'close walking distance' will vary according to people's different fitness levels but usually ranges between 400 to 800 metres...'

National Heart Foundation of Australia (Victorian Division) 2004 p.13.

Sample Evidence

'The most consistent set of conclusions (on the built environment correlates of walking) relates to proximity to potential destinations. Five reviews found sufficient evidence to conclude that accessibility based on distance to destinations is associated with more walking... Three reviews concluded that mixed land use is also associated with more walking. Because mixed land use means destinations are within closer proximity, this finding is consistent with the findings for accessibility.'

Saelens and Handy 2008 pS557.



The Surrogate of Density

Key Message: While higher density areas generally display environments conducive to physical activity, the research suggests that increasing the residential density of the built environment alone will not necessarily encourage increased physical activity. The intuitive notion that higher density may encourage physical activity is now being substituted in the research by the concept that density, mixed use and micro-design elements in some combination are most likely to influence levels of physical activity.

It makes sense that higher densities will essentially lead to shorter distances between origins and destinations and, as established above, shorter distances encourage active transport. Land-use concepts, such as new urban designs, link higher density levels with increased shares of non-motorised travel (Leck 2006; Saelens and Handy 2008; Walton et al. 2008; Rodríguez 2009). This suggests that in denser urban areas, distances between locations are shorter, and consequently can be bridged more easily on foot or by bicycle. This assumption is, to an extent, supported by the research.

Using 17 primary studies, Leck's 2006 meta-analysis assessed the significance of five urban form variables – residential density, employment density, land use mix, sidewalk ratio, and grid percentage – together with seven travel variables – vehicle miles travelled, vehicle hours travelled, vehicle trips, non-work vehicle trips, and probability of commuting by automobile, transit, or by walking. The analysis found residential density is the most important built environment element that influences travel choices. Residential density was positively statistically significantly correlated with the probability of commuting to work by active transport modes. Leck also found employment density to exert a strong influence on travel behaviour. In their report on 'Getting Australia Moving' Bauman et al. (2008) refer to Handy (2004) and review others as evidence of the ills of low density land use and its connection to car-dependent societies. Radbone and Hamnett (2003) cite an unpublished study by Holtzclaw (1994) which concluded that a doubling of density produces 25 to 30 percent less

driving per household when all of the conditions generally accompanying density are present. These conditions include better public transport, more local shopping, and a pedestrian-friendly environment. After citing various studies on density and vehicle miles travelled (VMT), Ewing also confirms Holtzclaw's recommendation that 'doubling urban density results in a 25-30 percent reduction in VMT, or a slightly smaller reduction when the effects of other variables are controlled' (Ewing, 1997, as cited by Radbone and Hamnett 2003 p. 3). Heinen et al. (2010) reviewed Pucher and Buehler (2006), Guo et al. (2007), Parkin et al. (2008) and Zahran et al. (2008) to conclude that higher densities lead to a higher cycling share. Litman (2007) concludes that higher densities are related to lower levels of car ownership and car use which in turn has positive effects on walking and cycling environments. Similarly, Witlox and Tindemans (2004) found that inhabitants of higher density city centres choose the bicycle as a mode of transport more often than residents in the suburbs. Further, the landmark review of the US Transportation Research Board (2005), the 'TRB Report', concludes that there are links between higher density, at both origin and destination, and decreased automobile use and increased walking and public transport use. Finally, Bauman and Bull (2007) rate population density as significantly associated with physical activity.

The research generally shows, therefore, that aggregate physical activity levels, particularly active transport share, will increase with density. However, the question remains, how much density is enough to encourage active transport options? The idea of 'proper city densities' (Jacobs 1961 p. 221) has been the subject of debate in planning theory and practice for quite some time, although its relationship with physical activity is a more recent topic of discussion and theorisation. Both Radbone and Hamnett (2003) and the TRB Report (2005) cite a US study by Dunphy and Fisher (1994) which indicates that the total number of trips does decline (slightly) with density, while there is an increase in trips by public transport, walking, cycling and taxi. This study showed trip share by walking and cycling increased markedly above densities of 7,500 people per square mile. By comparison, the average population density in Sydney was 1,347 people per square mile in the 2001 census.

This suggests that density would have to more than triple before reaching the point at which mode shares would alter. Conversely, more recent evidence reviewed by Feng et al. (2010) suggests that walking begins to increase at densities between 1,000 and 3,999 people per square mile. A population density of 3,000 people per square mile was found to be required to decrease distances travelled by car. These conflicting propositions of 'proper' densities to encourage walking and cycling infer that the relationship between density and active travel is one of correlation rather than cause. As articulated by Feng et al. (2010), it is possible that the variable of density is simply a 'surrogate for an unobserved... latent construct' (Feng et al. 2010 p. 185).

The literature often cites density as a proxy for other variables (TRB Report 2005). This leads many of the reviews to conclude that density is less significant than other built form variables, often accompanying density, in influencing travel behaviour. A higher density neighbourhood will typically have less parking, a greater variety of land use, more people out and about, houses and shops which abut the street, and the presence of footpaths, straight roads, small blocks, and better public transport services. The review by Ewing and Dumbaugh (2009) also suggests higher density areas are safer in terms of incidence of traffic accidents. It is very difficult to isolate the impact of any one of these factors and this complexity is compounded by the undeniable importance of socio-economic, demographic and attitudinal factors in influencing travel patterns.

The key message here is that it is not density as such which will get people active. Rather, higher densities often shorten aggregate trip distances. This conclusion is supported by the meta analysis of Ewing and Cervero (2010) which suggests that several of the variables that often go hand-in-hand with population density, impact travel demand more than simple population density per se. Increasing levels of density alone will not serve to promote more active transport without increased mixing and connecting uses to bring services and other destinations closer to where people live and work.

Having discussed the idea that density is more than likely a proxy for other

built environment variables in its ability to encourage physical activity, there are potentially some specific aspects of density that will encourage people to walk and cycle. The ability for higher density areas to provide more 'eyes on the street' (Jacobs 1961 p. 66), for example, is one aspect of density which has a tangible relationship with physical activity. Higher densely populated areas contain more people which in turn contribute to both the perceived and actual safety often required to encourage physical activity. This accepted planning wisdom has been confirmed by Galvez et al. (2010) in the context of children's active commuting to school. Children with many friends within walking distance of their school were more than twice as likely to actively travel to school. Additional studies confirm that seeing people out and about engaging in physical activity, is likely to encourage others to be active (Robinson 2005; Galvez et al. 2010).

Sample Policy

'As a guide, the following minimum residential densities are suggested:...

- 20 to 30 dwellings per site hectare for areas in 400m of neighbourhood centres and 250m of main bus routes; and
- 30 to 40 dwellings per site hectare for areas in 400m of town centres and metropolitan railway stations.'

WA Planning Commission, Liveable Neighbourhoods 2004 p. 9 E1.

Sample Evidence

'The evidence for the relationship between density and weight status is mixed, regardless of the level of analysis.'

Robertson-Wilson and Giles-Corti 2010 p. 24.



Destinations and Mixed Uses

Key Message: Destinations give people a place to walk to. Replacing uniform urban form with a variety of uses can lead to shorter distances between origins and destinations, thereby encouraging active forms of transport.

Mixed land uses can result in shorter distances between origins and destinations, which generally encourage people to be more physically active.

Radbone and Hamnett (2003) cite a variety of studies matching travel survey data to travel behaviours for residents in neighbourhoods with mixed and single-use characteristics. This work consistently found associations between mixed use development and active travel behaviour. The TRB Report (2005) also cites research which found positive correlations between land use diversity and physical activity, with particular reference to walking for transport. This conclusion is supported by Davison et al. (2008) who cite Kerr et al. (2006) and McMillan (2007) to suggest that children are more likely to walk or bicycle to school in areas with a diverse land use mix. While Bauman and Bull (2007) do not distinguish between recreational and utilitarian physical activity, their review concludes that there is a significant relationship between populations living with shops and services nearby and physical activity. Black and Macinko (2008) in reviewing Mobley et al. (2006), Frank et al. (2004) and Saelens et al. (2003) also come to the conclusion that an easy walk from home to commercial areas has a significant correlation with increased walking, as well as lower population level body mass index (BMI). The meta-analysis conducted by Leck (2006) found mixed land use and the provision of destinations to be an overwhelmingly significant built environment element influencing active travel behaviour. So too did the review by Gebel et al. (2005) of Cervero and Duncan (2003), Foster and Hillsdon (2004), Frank et al. (2005) and Hoehner et al. (2005). Consistent with prior work, Ewing and Cervero's (2010) meta-analysis found that walking is most strongly related to measures of land use diversity, intersection density, and the number of destinations within walking distance.

To address the issue that mixed uses, like density, often serve as a proxy for a variety of travel influencing

socio-demographic variables, the TRB Report (2005) cites a study by Frank and Pivo (1994). This investigation employed multiple regression techniques to analyse data collected on a regional basis. Partial correlations showed that both density and land use mix were significantly and positively related to mode share by public transport and walking for work trips, and negatively to work trips by car. Ewing and Cervero's (2010) meta-analysis was able to quantify this conclusion by calculating the elasticity of travel behaviour to built environment interventions. This study's key conclusion is that propensity to walk for transport is most elastic (i.e. sensitive) to employment-housing balance and distance to shopping and services. These are both features of an urban landscape characterised by mixed use.

Sample Policy

'Neighbourhood structure should have the following characteristics:

- size and shape generally defined by a five minute walk from the neighbourhood centre to its perimeter, typically 400m...
- the centre acts as a community focus with a compatible mix of uses, including retail...community facilities and open spaces such as a small square...'

WA Planning Commission. Liveable Neighbourhoods 2004 p. 7 E1.

Sample Evidence

'Access to post boxes, bus stops, convenience stores, newsagencies, shopping malls, and transit stations within 400 m (OR 1.63-5.00) and schools, transit stations, newsagencies, convenience stores and shopping malls within 1500 m (OR 1.75-2.38) was associated with participation in regular transport-related walking. A dose-response relationship between the mix of destinations and walking for transport was also found.'

McCormack et al. 2008 p. 33.

Small Scale Urban Design and Facilities

This section considers the importance of the form and character of street networks, together with facilities and infrastructure, in enabling safe and convenient physical activity.

Street Networks

Key Message: Grid street patterns decrease distances between origins and destinations. Decreased distance between commonly accessed uses encourages utilitarian physical activity.

There have been a number of studies that have attempted systematic comparisons of traditional and contemporary suburban neighbourhood structures to determine the way they influence physical activity. Specifically, researchers have endeavoured to analyse activity inducing differences between traditional grid street layouts and curvilinear, or 'dendritic', networks of more contemporary suburban neighbourhoods. See for example Southworth and Owens 1993, Frank 2000, Randall and Baetz 2001, Radbone and Hamnett 2003, Wendel-Vos et al. 2007 and Ewing and Cervero 2010. Evidence suggests that legible and direct street networks are particularly important in encouraging active transport in more vulnerable demographic groups such as children and the elderly. Citing Timperio et al. (2006), Davison et al. (2008) conclude that children are more likely to walk or bicycle to school when the route is direct and navigation of steep roads minimal. Children are also more likely to actively commute to school in walkable neighbourhoods characterised by grid street patterns with higher intersection densities (Kerr et al. 2006, McMillan 2007). In relation to the elderly, Hall and McAuley (2010) examined the determinants of whether a cohort of 128 UK based women aged over 65 attained 10,000 steps every day. Using Geographical Information Systems (GIS) and pedometer data, they conclude that participants who did not achieve 10,000 steps per day reported significantly less walkability, expressed as street connectivity, compared with those who achieved the daily 10,000 steps.

In general, research on street networks concludes that grid-like patterns with high intersection densities create

better street connectivity, decrease distances between origins and destinations, and are more navigable. These are all characteristics of streets which welcome and encourage walkers and cyclists.

Sample Policy

'The street network should provide a high level of internal connectivity...The street network should have no more than 15 percent of lots fronting culs-de-sac... Cul-de-sac should be laid out, so that pedestrians and cyclists can have through access.'

WA Planning Commission. Liveable Neighbourhoods 2004 p. 8 E1 and p. 8 E2.

Sample Evidence

'Using cross-sectional (*n*70) and longitudinal (*n*32) data (collected 2003–2006), associations of neighborhood design and demographics with walking were examined...In terms of street-network patterns, moving to an area with fewer culs-de-sac was associated with about 5,303 more steps per week (757 more steps per day).'

Wells and Yang 2008 p. 317.



Infrastructure and Facilities

Key Message: Well maintained footpaths and bike paths encourage walking and cycling for transport, as does the provision of bike parking and other end-of-trip facilities. A perception that cycling is unsafe because of traffic, and a perception that walking is unsafe because of exposure to crime, are key infrastructure related deterrents to walking and cycling for transport and recreation.

A wide range of detailed design features in the built environment allow people to feel safe, confident and comfortable when walking or cycling. Feeling safe, confident and comfortable increases people's propensity to walk and cycle as a form of travel. The infrastructure and facilities to achieve this are discussed here.

Designing for Confidence and Comfort: the importance of infrastructure

Heinen et al. (2010) cite the studies of Noland and Kunreuther (1995), Pucher (1998), Dickinson et al. (2003) and Martens (2007) which found that commuting cyclists consider safe bicycle parking to be important. This is further confirmed by Pucher et al. (2010) who reviewed 139 research papers to conclude that bike parking will generally facilitate increased cycling, especially if it is secure and undercover. Interestingly, Pucher and Buehler (2009) found that secure bike parking is more of an issue in countries lacking a strong, traditional cycling culture, including Australia. This study also highlights the importance of end-of-trip facilities in the workplace, including showers and lockers, to encourage active commuting. In addition, provision of facilities in the workplace sends a strong signal to employees of employer acceptance of active commuting.

Infrastructure, such as off-road cycle paths, is important to cyclists, particularly beginner cyclists. The question of what infrastructure to provide is very much related to safety (Krizek et al. 2009). A comprehensive analysis by Pucher (2001) suggests that countries with more separated and off-road cycling facilities have a higher modal split share of cycling and greater levels of bicycle safety. Preferences for particular cycling facilities, however, differ across socio-economic

groups, and between experienced and non-experienced cyclists. Inexperienced cyclists, women and younger cyclists tend to consider off road bicycle infrastructure to be more important (Krizek et al. 2005; Daley et al. 2007; Garrard et al. 2008; Krizek et al. 2009; Heinen et al. 2010). For experienced cyclists, bicycle lanes are not considered to be any more desirable than wide curb lanes (Taylor and Mahmassani 2000; O'Connor and Brown 2010). Continuous networks are also deemed important by inexperienced cyclists and for those commuting by bike where time is an issue (Heinen et al. 2010; Winters et al. 2010).

The presence of well maintained footpaths emerges in the literature as a significant, positive correlate to walking (as analysed by the TRB Report 2005). Bauman and Bull (2007) cite presence of footpaths as having a consistent association with physical activity generally. Davison et al. (2008) indicate that footpath provision is important to encourage active transport to school. Krizek et al. (2009) also allude to the importance of footpath provision in supporting both utilitarian and recreational physical activity, as does the review of Saelens and Handy (2008). Krizek et al. (2009) explain that while quantification of the relationship between footpath provision and walking is complex, the relationship is strong enough to justify policy change.

Designing for Safety

Safety, both perceived and real, is of paramount importance to all forms of active travel and locality based recreational physical activity. Crime is often cited as a barrier to exercising outdoors and to active commuting (TRB 2005; Ferreira et al. 2007; Black and Macinko 2008; Mendes De Leon et al. 2009; Durant et al. 2010). Parental perception of crime is also given as a reason for discouraging children to actively commute to school (Davison et al. 2008; Ding et al. 2010; Galvez et al. 2010; Carver et al. 2010b). Crime and fear of crime are further discussed in Section 5.2 (The Built Environment and Connecting and Strengthening Communities).

Traffic safety is considered important in encouraging active transport. Characteristics of the built environment undoubtedly either hinder or support the provision of safe traffic environments (Carver et al. 2010b). The TRB Report (2005) and Black and Macinko (2008) found that the decision to walk is correlated

with the speed of automobile traffic, as is the decision to cycle (Heinen et al. 2010). This inference is interesting considering Australia maintains some of the highest automobile speed limits in the world. The results of a six year long Canadian study of 500 adults found that perceived traffic danger was a major predictor of increased BMI (Berry et al. 2010).

Parental perceptions of traffic safety have been consistently deemed instrumental in predicting children's active commuting to school, as well as their general physical activity levels. For an Australian example see Andrews 2010; for a Swiss based study see Bringolf-Isler et al. (2010). Rodriguez (2009), Galvez et al. (2010) and Carver et al. (2010a) suggest that educational programs are effective in combating parental perceptions of safety as a barrier to increased physical activity in children, particularly active commuting to school. Jerrett et al. (2010) used a quasi experimental approach to examine the relationship between measured traffic density near the homes of children and attained BMI over an eight-year period. They found that increased traffic density within a 150 metre radius around a child's home, led to significant positive associations with BMI. This result applied to both sexes at age 18 and persisted after numerous confounding variables were controlled. The inference is that increased traffic results in less independent child mobility – generally walking or cycling. These results were confirmed recently in Australia as part of the longitudinal Melbourne based Children Living in Active Neighbourhoods ('CLAN') study. Cross sectional data from 440 children was used to compare physical activity levels with parental safety concerns, including those associated with active travel to school. The study concluded that parental restriction of physical activity due to safety concerns results in lower levels of physical activity for children outside school hours. Interestingly, this was particularly true for adolescent girls (Carver et al. 2010b). Indeed, the overarching conclusion is that the behaviour of parents, their attitudes to health and physical activity, together with their perceptions of safety, are more influential on children's physical activity than elements of the built environment per se. Policy interventions targeting parental role modelling and support for healthy

parental behaviour are therefore important associates of any built environment modifications (Crawford et al. 2010).

The importance of safety in encouraging active travel to school was further reviewed by Faulkner et al. (2009). Their analysis of nine studies found that children who actively commute to school accumulate significantly more daily physical activity than their chauffeured school mates. Faulkner et al. (2009) also concluded that active commuters to school did not necessarily have lower incidence of overweight and obesity. Despite this, they join with numerous other researchers in recommending that a focus on active school transport is still appropriate given that adequate participation in physical activity during childhood is critical to the prevention of chronic disease later in life (Frumkin 2003; Dannenberg et al. 2003; Cooper et al. 2010; Pabayo et al. 2010).

Sample Policy

'Schools need full width concrete path paving around the main entrance...The full width concrete paved areas are... linked directly to the adjacent path paving network.'

Blacktown City Council, NSW, Engineering Guide for Development 2005 p. C-7.

Sample Evidence

'As children develop and are given more independent mobility, it appears that the way neighbourhoods are designed particularly in terms of proximity and connectivity to local destinations...and the presence of footpaths becomes a determinant of whether children are able, and are permitted by their parents, to walk and use destinations locally.'

Giles-Corti et al. 2009 p. 995.



Rebuilding Physical Activity into Everyday Life - Incidental Movement

Key Message: Stair climbing is physical activity which can easily be integrated into everyday life. Visible stairways signed by point-of-choice prompts are able to increase the rate of stair climbing.

Little is known about designing buildings to encourage incidental physical activity. Considering the amount of time individuals spend indoors – particularly in schools and at the work place – building design can potentially provide people with opportunities to be physically active (TRB Report 2005).

Kahn et al. (2002) identified six studies on the effectiveness of point-of-choice prompts to encourage stair use as a substitute for taking escalators or elevators within buildings. The studies were conducted in the USA and the UK and in covered settings such as shopping malls, train stations and universities. The review reports a range of effects from a 5.5 percent net increase to 128.6 percent increase in stair use.

Findings from several of the studies suggest that prompts should not only advocate stair use but also articulate the benefits. Two studies reported different levels of effectiveness for obese and non-obese people. Although the signs were effective in both groups, the median net increase in the percentage of people taking the stairs was greater among the obese group. Among obese people, a sign that linked stair use to the potential for weight loss showed a higher increase in stair use than a sign linking stair use to general health benefits (Kahn et al. 2002). The TRB Report (2005) also emphasises the capacity of stair use to provide a low cost way to integrate physical activity into daily routine, particularly stair wells in the workplace. These findings have been confirmed by a 2010 systematic review of 25 studies on the effectiveness of point-of-choice prompts to increase the rate of stair climbing in the general population (Nocon et al. 2010). Point-of-choice prompts in this study were posters and banners at public transport stops, shopping malls and office buildings. Of the 32 results for escalator settings, 28 reported a significant increase in stair climbing. However, the results were not as

convincing for elevator settings. A study by Eves et al. (2009) on the effect of the width of stair wells and stair use in railway stations echoes this conclusion. They demonstrated that people are generally willing to use the stairs instead of an escalator in peak periods if the width of the stair well is sufficient to cater for demand.

A major barrier to the implementation of point-of-choice signage to increase stair use is that stairways are often hidden from public view, as well as being poorly lit and maintained. In extreme cases, stairways are secured to prevent access. It is important to note that differently abled persons have varying capacity for stair useage. We believe that this has to be considered in designing buildings to encourage greater stair utilisation for the enhancement of physical activity levels of the entire population.

Sample Policy

'The design and location of escalators should be based on peak flow rates... Alternative access (adjacent stairs) is required.'

NSW Ministry of Transport Guidelines for the Development of Interchange Facilities 2008 p. 18.

Sample Evidence

'In five studies, the median increase in stair-climbing was 53.9%. The remaining study showed an unspecified increase in stair-climbing and also found that the signs were effective in getting those who were less active (as measured by responses to a brief survey) to take the stairs.'

Kahn et al. 2002 p. 77.

Recreational Physical Activity

Key Message: People with access to good quality and safe open space are more likely to be physically active.

Recreational Facilities and Open Space

The built environment provides opportunities for people to be active in public parks, walking trails and on foot paths and streets. Through land use zoning and regulation, the built environment can also support opportunities for recreation provided by indoor facilities from publicly operated leisure centres to privately owned health clubs.

There is substantial evidence that people who live close to a variety of recreation facilities are more physically active than those who do not enjoy such proximity (Wendel-Vos et al. 2007; Sallis and Glanz 2009). Bauman and Bull (2007) reviewed 13 studies to conclude that access to physical activity facilities is consistently correlated with physical activity levels. Black and Macinko (2008) cite Frank et al. (2004), Giles-Corti et al. (2005), Ellaway et al. (2005), Mobley et al. (2006) and Roemmich et al. (2006) as reporting that populations with better access to high quality open and green space are more likely to walk and undertake physical activity. Kaczynski and Henderson (2008) reviewed 50 quantitative studies on the relationship between the provision of recreational spaces and physical activity to reveal a positive association between the two. Bauman and Bull (2007) summarised Davison and Lawson (2006) to conclude that living near parks, playgrounds, and recreation areas is consistently related to children's total physical activity. These conclusions are supported by Dunton et al. (2009), Galvez et al. (2010), Loukaitou-Sideris 2010 and Veitch et al. (2010). Galvez et al. (2010) further emphasise that children's parks and playgrounds need to be perceived as both safe and accessible.

Research suggests that people have specific ideas about their ideal outdoor area for physical activity. For example, in some States in the USA, basketball and racquet courts are preferred over baseball fields (Floyd et al. 2008). In an Australian context, Giles-Corti (2006b) has suggested that our penchant to interpret 'open space' as sporting ovals should adapt to include open areas that are well endowed

with shade and landscaping to encourage walking as well as organised sport. This type of research can guide the design of recreation facilities and forms the basis for literature suggesting that the aesthetic quality of recreational areas is important (Galvez et al. 2010). The overarching implication is that to encourage physical activity, open space must be designed cognisant of local context and well maintained.

Despite the strength of this research, a recent study undertaken by Searle (2009) suggests the provision of local open space in various high density developments in Sydney falls well short of best practice recommendations. The study concludes that this under provision is a result of funding confusion and different local and State planning requirements.

Walking and Cycling for Recreation

The environments that encourage utilitarian walking and cycling are not necessarily conducive to walking and cycling for recreation. Perceived and actual safety remain of primary importance (Spangler-Murphy et al. 2005; Black and Macinko 2008), as does the provision of street networks that are legible and well maintained, with footpaths, shade and lighting (Powell et al. 2007; Saelens and Handy 2008). Aesthetics, however, replace destinations and network density, with recreational walkers not particularly interested in taking the most direct route (Agrawal et al 2008). The provision of special purpose walking trails is more likely to encourage recreational walking. Various studies throughout Australia demonstrate that people will use walking trails if they are provided (see for example Merom et al. 2008). A review by Kaczynski and Henderson (2008) on associations between parks and physical activity found that provision of open space was more positively correlated with walking for exercise than recreation itself. More recently, Michael et al. (2010) found quite the opposite, concluding that open recreational spaces were not related to walking for a cohort of older men in the USA.



Sample Policy

- Provide open spaces within safe, comfortable walking distances
- Locate public open spaces within a maximum of 500 metres walking distance from dwellings...
- Provide large local parks (1 hectare minimum) within 500 metres safe walking distance from all dwellings, and small local parks within 150 to 300 metres safe walking distance of all dwellings...³

National Heart Foundation (Victorian Division) 2004 p. 15.

Sample Evidence

'Within the physical environment, the availability of physical activity equipment is a convincing environmental determinant of vigorous physical activity/sports.... Other relevant environmental factors may be the availability, accessibility and convenience of recreational facilities.'

Wendel-Vos et al. 2007 p. 438.

5.1.5 Strengths and Weaknesses in the Research

Consistency of Measurement

The need for consistent and objective measurement of built environment and physical activity variables is a commonly cited weakness in research on the Built Environment and Getting People Active.

As an example, Kirk et al. (2010) recommend standardisation of measurement in seeking to characterise 'obesogenic' environments. This comprehensive review of 146 primary studies concludes that the 'environment may play a critical role in obesity development, prevention and management, but we have yet to determine the best method for measuring that effect accurately and consistently, or develop an appropriate theory to encompass this very complex and dynamic system' (Kirk et al. 2010, p. 116). There are other studies recommending consistency in measurement of built environment variables. These include Cunningham and Michael (2004) measuring the impact of the built environment on older people's physical activity, Davison and Lawson (2006) and Davison et al. (2008)

measuring environmental characteristics associated with children's physical activity, and Pucher et al. (2010) and Heinen et al. (2010) analysing the built environment's impact on cycling.

There is also literature which recognises that standardised measurements, particularly of built environment variables, risk underestimating the diversity of people and place (Brownson et al. 2006; Brownson et al. 2009; Schaefer-McDaniel et al. 2010). This apparent conflict in the role of standardisation arises from the interdisciplinary nature of healthy built environment research – an issue further discussed below.

Regardless of the complexity of standardising measurement of the built environment, the literature consistently recommends standardisation of measurements of physical activity, with the most common request being the use of objective measures of physical activity instead of the more convenient option of self reported variables (Badland and Schofield 2005; Ferreira et al. 2007; Black and Macinko 2008; Cavill et al. 2008; Feng et al. 2010).

Evidence of Causality

Linked to the common call for standardisation is an identified need to establish that the relationship between the built environment and health is a causal relationship. Studies have consistently found a significant association between health and the built environment, generally through cross sectional research, however associations are insufficient to establish true causality³.

Establishing non-spuriousness by removing confounding variables (such as residential self selection) is often cited as a major weakness in research on the health-built environment relationship (Tzoulas et al. 2007; Reynolds et al. 2009; Story et al. 2009; Ewing and Cervero 2010). The lack of longitudinal research required to prove time precedence is also identified as another missing element of causal proof (Humpel et al. 2002; Radbone and Hamnett 2003; Owen et al. 2004; Gebel et al. 2005; Brownson et al. 2006; Davison and Lawson 2006; Heath et al. 2006; van der Horst et al. 2007; Wendel-Vos et al. 2007; Black and Macinko 2008; Saelens and Handy 2008; Cao et al. 2009; Faulkner et al. 2009; Handy et al. 2009; Ogilvie 2009; Reynolds et al. 2009; Feng et al. 2010; Heinen et al. 2010; Pucher et al.

³ To robustly infer causality, scientific research generally requires at least four kinds of evidence: statistically significant association, non-spuriousness (a relationship that cannot be attributed to another variable), time precedence (cause precedes effect) and causal mechanism (a logical explanation for why the alleged cause should produce the observed effect) (Cao et al. 2009).

2010 and Renalds et al. 2010).

The inability of the research agenda to date to establish true causality is a 'weakness' perhaps not of the research itself but of the seemingly unpredictable way people relate to their environments. Juxtaposed to the call for causality is research accepting that the randomised controlled trials often underpinning causal proof are impractical for studies on the built environment and health simply because it is impossible to randomly assign exposure to built environment modifications (Brownson et al. 2006; Bauman and Bull 2007). This scholarship suggests that the constant focus on causality is a weakness of the research agenda in itself. Further, attention would be better directed towards the establishment of a more practical standard of proof acceptable in the absence of causality (Gebel et al. 2005, Ogilvie et al. 2006;; Cavill et al. 2008; Story 2009).

Interdisciplinary Understanding

A lack of overarching disciplinary collaboration has also been identified as a weakness in the research (Weaver et al. 2002; Owen et al. 2004; Badland and Schofield 2005; Davison and Lawson 2006; Barton 2009; Brownson and Jones 2009; Feng et al. 2010; Galvez et al. 2010). In contrast to recommendations for standardisation and causality are recommendations to better understand the cultures and accepted wisdoms of the different disciplines involved in healthy built environment research. The recommendation for better interdisciplinary collaboration is consistently identified throughout this Review. It is both a common weakness in the literature to date, and an opportunity for healthy built environment research into the future.

Synergies and Scale

Finally, research points to the need to better understand synergies between social, cultural, environmental and economic drivers, as well as between the geographical scales at which these drivers operate (Radbone and Hamnett 2003; Duncan et al. 2005; Heath et al. 2006; Krizek et al. 2007; Tzoulas et al. 2007; van der Horst et al. 2007; Black and Macinko 2008; Davison et al. 2008; Barton 2009; Cao et al. 2009; Ewing and Dumbaugh 2009; Story et al. 2009; Falconer et al. 2010; Schaefer-McDaniel et al. 2010; Feng et al. 2010; Heinan et al. 2010; Kirk et al. 2010). One of the research themes identified relates to the policy mix needed

to influence physical activity. Research to date generally fails to articulate frameworks to explore this policy mix and the synergies between actors influencing health and the built environment.

5.1.6 HBEP Opportunities for Future Research

Pursue Research on Ways to Work Together

Major opportunities exist to develop the interdisciplinary nature of healthy built environment research. This should focus on how the current knowledge of the relationship between health and the built environment might be best implemented. Recent research addressing this emerging opportunity is discussed in Section 6 (Professional Development). Detailed strategies for promoting interdisciplinary collaboration are also listed in Story et al. (2009).

Explore the Evidence Required to Justify Policy Change

A part of interdisciplinary collaboration is exploring the varying standards of evidence used by different disciplines to justify and provoke change. Cavill et al. (2008) uses decision making in transport planning as an example, highlighting that '...transport policy decisions are taken every day and sometimes on approaches that often lack transparency and scientific rigour' (Cavill et al. 2008 p. 298).

Governance of the built environment is contested – economic, political and popular agendas must be pieced together alongside scientific evidence to effect change. Evidence requirements need to be articulated and understood between disciplines. Once this has occurred, better ways to present the evidence can be explored. Cost benefit analysis, environmental and social impact assessment and demand analysis are just some of the research tools that could be used to demonstrate the benefits of modifying the built environment to get people active. These different standards of proof can be pursued outside of evidence of true causality.



Pursue Opportunities to Monitor Interventions

A contemporary focus on 'how' to change built environments for health should not replace empirical research. Opportunistic monitoring of relevant interventions should be undertaken, particularly to analyse the impact of interventions over time (Gebel et al. 2005; Story et al. 2009). Research is currently emerging from quasi-experimental and longitudinal studies around the world, including the RESIDE project in Perth, WA (Giles-Corti et al. 2007), the CLAN study in Melbourne (Crawford et al. 2010) and the HABITAT study in Brisbane (Burton et al. 2009). With partners Landcom, the National Heart Foundation of Australia and NSW Health, the HBEP has obtained funding for a three year ARC Linkage grant to also conduct a longitudinal study tracking residents' behaviour over time in a number of developments in NSW. This project commenced in 2011.

Ways to identify opportunistic monitoring of interventions and establish surveillance systems for change present practical research opportunities. Some authors recommend maintenance of an information repository for current research (Davison et al. 2008; Story et al. 2009). This repository could be on-line and act as a reporting platform that will make 'lessons learned' available as quickly as possible. This search for answers needs to extend beyond post-project analysis. A method to improve awareness of proposed modifications to the built environment to encourage physical activity needs to be established. In Australia this will mean a mechanism for researchers to be in contact with local strategic planners and consent authorities so that when opportunities arise for intervention monitoring they are not missed.

5.1.7 Policy Implications

- Policies modifying the built environment to encourage health outcomes need to be embedded within an integrated suite of changes. It would be rare for a built environment modification on its own to result in immediate behavioural change.
- Policies to increase land use densities need to be conceptualised as policies which bring uses, and not just people, closer together. Higher densities

should be pursued in the context of both the existing macro (regional) urban framework of services and infrastructure, together with the micro urban fabric of design features that make higher densities liveable.

- There is strong research to suggest that visible stairways signed by point-of-choice prompts will increase the rate of stair climbing. A policy to ensure new buildings are designed and developed with visible stairways might be a good catalyst to develop tangible policy based partnerships between health and planning.
- There is consistent evidence that infrastructure and facilities such as well maintained and connected footpaths, bike paths and open spaces will encourage physical activity. Policies to support the development and maintenance of this infrastructure should be supported. Policies to make these environments safe (and perceived as safe) from crime and traffic will also encourage physical activity.

5.1.8 Summary of Key Messages

The Policy Mix Required

Research on encouraging physical activity follows socio-ecological models of behaviour and concludes that a mix of social, economic, political and built environment policies is required to influence physical activity.

Accessibility and the Importance of Distance

Keeping trip distances short through mixed use and compact development will make active transport a more viable option, more often.

The Surrogate of Density

Higher density areas may display environments conducive to physical activity. However, increasing the residential density of the built environment alone will not necessarily encourage increased physical activity. Density, mixed use and micro-design elements *in some combination* are most likely to influence levels of physical activity.

Destinations and Mixed Uses

Destinations give people a place to walk to. Replacing uniform urban form with a variety of uses can lead to shorter distances between origins and destinations, which encourages active transport.

Street Networks

Grid street patterns decrease distances between origins and destinations. Decreased distance between commonly accessed uses encourages utilitarian physical activity.

Infrastructure and Facilities

Well maintained footpaths and bike paths encourage walking and cycling for transport, as does the provision of bike parking and other end of trip facilities. These facilities need to be provided as part of a package of policies aimed at encouraging behaviour change, for example educational programs and restrictions on motor vehicle use. Perceptions that cycling is unsafe because of traffic, and walking is unsafe because of exposure to crime, are key infrastructure related deterrents to walking and cycling for transport and recreation.

Recreational Physical Activity

People with access to good quality and safe open space are more likely to be physically active for recreation.

Rebuilding Physical Activity into Everyday Life – Incidental Movement

Stair climbing is physical activity which can easily be integrated into everyday life. Visible stairways signed by point-of-choice prompts are able to increase the rate of stair climbing.





5.2 The Built Environment and Connecting and Strengthening Communities



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5.2.1 The Benefits of Connecting and Strengthening Communities

When people feel commitment and care towards a group, they have a sense of community (Butterworth 2000). This is also associated with feelings of social connection and belonging. A sense of community and belonging within the places where people live, work and travel, is an influential determinant of mental and physical health (Hawe and Shiell 2000; Baum and Ziersch 2003; Ogunseitan 2005; Warr et al. 2007; Poortinga et al. 2007; Cohen et al. 2008; Echeverria et al. 2008; Beard et al. 2009; Dahl and Malmberg-Heimonen 2010). Belonging fosters perceptions of security, confidence and comfort which can encourage people to be 'out and about', physically active in their neighbourhood, as well as socially connected to others (McNeill et al. 2006; Michael 2006; Wood et al. 2010). Being 'out and about' also opens up opportunities for incidental interactions – the day to day meeting and greeting of people who live, work and travel in the same spaces during the same times. Incidental interaction augments connection and caring, increases perceptions of safety and decreases feelings of loneliness and isolation, all of which have proven links to positive mental health (Beard et al. 2009; Maas et al. 2009a; Maas et al. 2009b; Odgers et al. 2009; Berry and Welsh 2010; Yang and Matthews 2010).

The relationships between good health and a sense of community, social interaction and community empowerment, are well studied and accepted. The following section draws on the work of researchers such as Hawe and Shiell (2000), Cattell (2001), Wakefield and Poland (2005), Araya et al. (2006), McNeill et al. (2006), Prezza and Pacilli (2007), Ziersch et al. (2009), Nogueira (2009) and Berry and Welsh (2010), all of whom acknowledge the health benefits of connected and strong communities. The Review encompasses other literature examining the details of *how* the built environment can be developed and managed to support these community related health determinants.

5.2.2 How Can the Built Environment Connect and Strengthen Communities?

The built environment can foster a sense of community through enabling day to day interaction with people, nature and other environments. This interaction occurs on streets and in public spaces that are safe, accessible to all, responsive to local cultural context, as well as aesthetically pleasing.

Beyond its influence on actual urban structure, the built environment can facilitate orderly social interaction through removing ambiguity in expectations and educating communities about behavioural norms. This is particularly important in new and unfamiliar environments, such as newly established community gardens and shared pathways. Education can be as simple as proper placement of signage making explicit expected behaviour in shared public spaces.

Participation in the shaping of the built environment can also support psychological health by fostering feelings of empowerment and belonging. The way the built environment is governed can cultivate this participation.

Finally, opportunities to promote community connectedness should not be perceived as limited to the neighbourhood of residence, nor its walkable catchment. The importance to health of belonging and commitment to people and place applies well beyond to the work environment, commercial centres, recreational facilities and spaces of mobility such as roads and footpaths, and whilst travelling on public transport. Fostering a sense of belonging, caring and commitment, for example, among commuting cyclists or public transport users, increases the perception of safety of these activities.

5.2.3 Key Studies

In categorising the references, 224 were identified as relating to Connecting and Strengthening Communities. These inform the key themes in Section 5.2.4. Of these references, those listed below were considered to be key studies. Each reference is included in the Annotated Bibliography in Appendix 3.



Abraham et al. 2010
 Bartolomei et al. 2003
 Barton 2009
 Berry 2007
 Butterworth 2000
 Cohen et al. 2008
 Evans 2009b
 Kingsley et al. 2009
 Lavin et al. 2006
 Mehta 2007
 Poortinga et al. 2007
 Pretty et al. 2007
 Prezza and Pacilli 2007
 Renalds et al. 2010
 Semenza and Krishnasamy 2007
 Sugiyama et al. 2008
 Sustainable Development
 Commission 2008
 Thompson et al. 2007
 Tzoulas et al. 2007

5.2.4 Major Themes in This Domain

This Section explores research on how the built environment can be developed and managed to promote strong and connected communities.

There is no set formula for 'community'

Key Message: Community is complicated. This relates to demographic, cultural, ability, socio-economic and other attributes. What works to promote community in one locality, within a particular group or at one time, will not necessarily translate to another.

Literature discussing the role of the built environment in developing communities and promoting social interaction often highlights the contextual nature of these health determinants. What works to promote community in one locality or within a particular social group will not necessarily work elsewhere. Any attempt to examine, or even build community, needs to consider the 'subtleties of diversity' (Evans 2009b, p. 199). These subtleties apply across place and time. Social interactions, and the way built environments can facilitate them, will vary as neighbourhoods develop and change. For example, it is easier to facilitate social interaction and cohesion in contexts of relative homogeneity and stability (Bridge 2006; Chaskin and Joseph 2010). Interactions in neighbourhoods will also

vary throughout the seasons (Hess 2008) and from morning to night (Kim et al. 2007).

Engaging young people in positive neighbourhood opportunities is worth special consideration as they have the potential to either bridge or exacerbate social divisions (Chaskin and Joseph 2010). The elderly also interact with environments and each other in different ways (Patterson and Chapman 2004) as do people from varying socio-economic groups (Burke et al. 2009), ethnicities (Tinsley et al. 2002; Sugiyama and Ward Thompson 2008) and genders (Burke et al. 2009).

Adding to the complexity of planning and building for community is that many contemporary urban dwellers are comfortable thinking about local community in essentially functional ways. There is no longer social or popular pressure to seek and maintain community connections – often membership to community relies on convenience. In this sense, local relationships are still enjoyed but are largely casual and flexible (Crang 2000; Paay and Kjeldskov 2008; Chaskin and Joseph 2010; Williams and Pocock 2010).

Finally, there is literature that questions the role of the built environment in shaping social capital and interaction. To measure the extent to which perceptions of social capital are contextual, Araya et al. (2006) compared results of factor analysis on individual questionnaire responses with results from analysis at household and postcode scales. They found little correlation between neighbourhood and individual factors and concluded that there is a stronger individual determination of social capital rather than a contextual or neighbourhood effect.

Nevertheless, the vast majority of literature concurs that there is a relationship between the built environment, social interaction and social capital. Echoing research on the built environment and physical activity, the consensus is that the relationship is complicated and difficult to define.

Interaction in Open Spaces – contact with nature as well as community

Key Message: Green and open spaces facilitate contact with nature, as well as contact with community.

The presence of green, natural settings can facilitate physical activity (see for example Booth et al. 2000; Humpel et al. 2004; Frank et al. 2004; Ellaway et al. 2005; McNeill et al. 2006; Mobley et al. 2006; Pikora et al. 2006; Roemmich et al. 2006; Bauman and Bull 2007; Neuvonen et al. 2007; Sugiyama and Ward Thompson 2007; Wendel-Vos et al. 2007; Bell et al. 2008; Black and Macinko 2008; Kemperman and Timmermans 2009; Sallis and Glanz 2009 and Galvez et al. 2010). The benefits of natural, green and open spaces extend well beyond the provision of trails for walking and fields for playing (Beer et al. 2003; van den Berg et al. 2007; Hartig 2008). Rooted in the biophilia hypothesis (popularised by Wilson and Kelling 1984), research suggests that there is an instinctive bond between human beings and other living systems. Removal of this bond by 'building out' natural elements (including plants, animals and even the weather) is fundamentally detrimental to health.

A comprehensive review of the relationship between nature and health was undertaken by Grinde and Patil (2009). This appraisal of 50 articles examined the health benefits associated with mere visual contact with nature (i.e. without actually being physically active or immersed in nature) to conclude that an environment devoid of nature has a negative effect on health and quality of life. Focusing on mental well-being, Townsend and Weerasuriya (2010) amassed a huge body of literature in their comprehensive review which also demonstrates the many direct benefits of green spaces and nature for health.

In an Australian context, Sugiyama et al. (2008) collected survey data from 1,895 residents of Adelaide to explore relationships between mental and physical health and perceived greenness in the environment. Among their detailed conclusions, they found a significant relationship between greenness and mental health, however recreational walking and social coherence only accounted for part of this association. They hypothesise that there are restorative effects of natural environments that may explain the connection.

In an analysis of survey results from 11,238 Danes, Schipperijn et al. (2010), found the main reason for use of green space was to enjoy the weather and get fresh air – not necessarily to engage in

physical activity. Similarly, research by Frick et al. (2007) revealed a preference for low stimulus natural areas to promote relaxation and escape, rather than organised physical activity. Open spaces cluttered with equipment or highly manicured gardens were not favoured. This finding emerged from interviews with 325 residents of Zurich, Switzerland about preferences for open space. Another paper presents a review of 120 related research articles on contact with nature. In the piece, Abraham et al. (2010) summarise commonly cited health benefits of contact with nature. These include the promotion of mental well-being through attention restoration, stress reduction, and social engagement and participation. In the Netherlands, Maas et al. (2009a) explored the hypothesis that green space improves health simply due to the way it can foster increased social contact. They measured variables of social contact and health in 10,089 residents and calculated the percentage of 'green space' within one and three kilometres from each individual's address. After adjusting for socio-economic and demographic characteristics, they found an inverse relationship between green space in people's living environment and feelings of loneliness. Less green space was associated with a perceived shortage of social support. Cohen et al. (2008) analysed data from the Los Angeles Family and Neighborhood Study (LAFANS) together with geographical data from Los Angeles County to specify which social and environmental features were associated with personal reports of collective efficacy, including the presence of parks. The study found that parks were independently and positively associated with collective efficacy. It was concluded that parks set the stage for neighbourhood social interactions, thus serving as a foundation for underlying health and well-being. This finding was echoed by Sugiyama and Ward-Thompson (2007) who found that parks were integral to interaction in an elderly cohort of UK residents.

There is evidence that contact with nature is particularly important in highly urbanised environments (Beer et al. 2003; Neilsen and Hansen, 2007; Hartig 2008; Maller et al., 2010). Small scale encounters with nature and people within natural settings are equally as significant to health as access to large areas of natural open space. Maller et al. (2010) conducted interviews with key informants in 12



primary schools in Melbourne to examine ways to enhance the frequency of such chance encounters with nature for children. Learning activities such as tending gardens with vegetables, flowers, and native plants, practising habitat conservation, regeneration and monitoring, as well as caring for animals, were all observed by interviewees as benefiting child health and well-being, particularly mental health (Maller et al. 2010). Wake (2007) outlines ways to encourage the involvement of children in natural spaces, including gardens. Johnson (2007) further examines the importance of facilitating children's incidental interaction with nature through environmental learning activities.

Maller et al. (2010) investigated links between inner city high-rise living, access to nature, and health and well-being in Australia. They conducted 30 in-depth interviews in developments within ten kilometres of Sydney and Melbourne. Both cities have maintained strategic planning provisions to consolidate residential areas (Victorian Department of Infrastructure 2002; NSW Department of Planning 2005). As a result, urban green space, including seemingly trivial spaces such as common gardens and facades featuring plantings, will be increasingly important to alleviate the stresses often associated with higher density living, including noise and lack of privacy. Interviewees in the Maller study preferred natural scenery such as trees, parks, or bodies of water. They expressed that simply having a view of natural elements induced feelings of relaxation and resulted in self-reported awareness of enhanced well-being. Some residents had access to rooftop gardens which were described as important in providing a range of nutritional, physical, social, and psychological benefits. Not the least was an opportunity to better accommodate companion animals – a consistently cited catalyst to social capital and mental and physical health (as reviewed by Cutt et al. 2007). This finding was further supported by Gidlöf-Gunnarsson and Öhrström (2007). These researchers used questionnaires to assess the role of nature in providing opportunities for escape, rest and relaxation for 500 people living in both noise affected and noise unaffected high density developments in Sweden. It was concluded that easy access to nearby green areas can offer relief from long term noise annoyances and reduce the prevalence of stress related

psychological symptoms. Guite et al. (2006) measured the impact of various physical and social factors in the built environment on the mental health of 2,696 adults in higher density areas in London, UK. They also found that the perceived ability to escape to green spaces away from noise and over-crowding was significantly linked to mental well-being.

Further studies on the psychological and other health benefits of human interaction with nature include Pretty et al. (2007) and Korpela and Ylén (2007).

Sample Policy

'The specific aims of this policy are:

- to protect bushland for its scenic values, and to retain the unique visual identity of the landscape...
- to maintain bushland in locations which are readily accessible to the community...
- to promote the management of bushland in a manner which protects and enhances the quality of the bushland and facilitates public enjoyment of the bushland compatible with its conservation.'

'SEPP 19 Bushland in Urban Areas'. Clause 2(2) (NSW).

Sample Evidence

'In the high-rise developments studied, residents were found to prefer natural scenery such as trees, parks, or bodies of water, rather than images of the built form, noting that the views of nature evoked feelings of relaxation and resulted in self-perceptions of higher well-being.'

Maller et al. 2010 p. 555.

Interaction in Other Spaces

Key Message: Casual encounters with community can occur anywhere. Providing welcoming and safe common areas around apartment blocks or facilities for comfortable waiting at public transport stops, for example, can encourage the incidental interactions which become building blocks of community.

There is literature exploring the importance of 'third places'— places that provide for informal and unorganised social interaction. They can be public, such as a children's playground or park bench, or private, such as a pub, cafe or shopping mall. They can be large, such as a town square or train station, or small, such as a stairwell or common entry to a building. Third places are distinguished from other areas where social interaction might occur in that there is no sense of having to perform a 'role' – third places are therefore not specifically at 'home', 'work' or 'school'.

Williams and Pocock (2010) argue that third places are important fertile grounds for encouraging connected networks of community. The more opportunities available, the greater the chance of developing tangible, lasting and caring connections. Echoing this Review's discussion on the complexity of community, Williams and Pocock (2010) emphasise that third places are socially and generationally subjective. For example, teenagers will require different places for opportunistic interaction than the elderly.

In an interesting evaluation of data from 40 in-depth interviews conducted in Adelaide, Baum and Palmer (2002) suggest strategies to encourage lively third places to enhance contact between people in deprived socio-economic areas. More radical recommendations include a subsidy scheme to support the viability of local shops and cafes, as well as local parks with employed facilitators to encourage community development.

Provision of a third place does not, by itself, guarantee a remedy to strengthen a weak community. Ganapati (2008) explored the impact of privately owned third places – an increasingly common arrangement where regulatory concessions can be granted to developers to provide spaces such as town squares, pedestrian malls or pocket parks. Third

places are often deeply political and contentious. Rules and regulations, as well as design, can be used to both intentionally and unintentionally exclude some users. The exclusion of homeless persons from parks by designing benches so that they are impossible to sleep on is one such example (Davis 1990). Planning for public spaces therefore needs to go well beyond allocating space to considering design and long term management.

Regarding design, Zhang and Lawson (2009) surveyed activities in informal public and common spaces outside three high-density residential communities in Brisbane. They conclude that such spaces are important in facilitating day to day meeting and greeting and recommend that places should be useful and have a welcoming design. This can be as simple as promoting common entries and inviting stairwells.

Rear laneways, a key element of new urbanist design, also act as a third place for interaction. Laneways facilitate off-street car parking, allow houses to have front doors and verandahs not dominated by driveways and garages, as well as front gardens that address public streets. The laneway importantly allows more pedestrian-oriented and sociable streets and can, in itself, act as a place for casual social interaction. In a survey of four San Diego neighbourhoods with alleys, Ford (2001), for example, found residents used these spaces for many purposes, including informal socialising with neighbours. More recently, Hess (2008) found that alleys in new urbanist developments create a secondary shared space that both supports causal interaction yet competes with space in the formal street. Hess uncovered more interaction at the rear of properties than in the front and concludes that street presentation is subsequently neglected. In this sense, the provision of rear laneways can impact on the ability for new urbanist developments to provide Jane Jacob's 'eyes on the street' required for safety, as well as social interaction. Hess concludes that patterns of resident use of the front and back of their properties, and their impact on the sociability of neighbours, is complex.



Sample Policy

‘Create pleasing places to be:

- Landscape open spaces and other public places (e.g. squares and malls) to provide pleasant places for people to sit, meet and talk...
- Provide natural shade or structured shelter within activity centres and open spaces to promote sitting, meeting and talking...’

National Heart Foundation of Australia (Victorian Division) 2004 p. 15.

Sample Evidence

‘Access to convivial neighbourhoods not only encourages more walking, but also encourages interactions between neighbours, thereby increasing sense of community, which in turn may beneficially influence positive mental and physical health in local residents.’

Giles-Corti 2006b p. 2.

Interaction in Community Gardens and Farms

Key Message: Community gardens are forums for incidental and organised interaction. They are spaces for people to establish and maintain contact with community and contact with nature.

In a comprehensive study of the community garden movement in the UK, Holland (2004) used quantitative (surveys) and qualitative (in-depth interviews) methods to conclude that while some gardens played a strategic role in food production, all gardens were ‘based in a sense of community, with participation and involvement being particularly strong features’ (Holland 2004, p. 1). Wakefield et al. (2007) researched the health impacts of community gardens in Toronto, Canada. Using a combination of participant observation, focus groups and in-depth interviews, their study concludes that gardens encourage physical and psychological health. They attribute the latter to contact with nature as well as a general sense of community inherent to the opportunity to garden together.

The research also highlights many of the challenges faced in establishing community gardens in urban settings,

including general lack of understanding, from both decision-makers and community members, of the benefits of community gardens. Bartolomei et al. (2003) examined the social and health-promoting role of a community garden scheme in a high-rise public housing estate in Sydney. The findings of this study confirm the contributory role of community gardens in strengthening social interaction. The scheme was associated with increased opportunities for local residents to socialise and develop vital cross-cultural ties in a very diverse environment. The authors note: ‘there were many stories of how participating in the Gardens has helped to diminish cultural boundaries and negative racial stereotypes’ (Bartolomei et al. 2003, p. 5). Kingsley et al. (2009) also studied community gardens in Australia. This Melbourne based research describes gardens as places of refuge and social support, where knowledge is shared. These conclusions are generally echoed by other studies finding that the benefits of community gardens extend well beyond physical activity and access to healthy food (Hynes and Howe 2004; Wakefield et al. 2007; Thompson et al. 2007; Macias 2008; Teig et al. 2009).

Sample Policy

‘Community gardens are encouraged within city parks and on city-owned property. As part of the master plan process for new parks, the city shall consider implementing new community gardens based on input from residents.’

City of Santa Rosa (Santa Rosa, USA) 2009 p. 6-16

Sample Evidence

‘Community gardens can play a significant role in enhancing the physical, emotional and spiritual well-being necessary to build healthy and socially sustainable communities.’

Thompson et al. 2007 p. 1034.

Interaction on Streets and in the Neighbourhood

Key Message: Both regional scale urban structure and micro scale building design influence incidental interaction on streets and in neighbourhoods.

Research suggests that sprawling suburbs not only restrict opportunities for physical activity and access to healthy food, but also undermine social capital. This is generally attributed to the increased distances between uses, overt reliance on private car travel and typically 'closed' residential urban form. The hypothesis is that these factors reduce opportunities for interaction and result in feelings of disconnectedness and isolation. The research outcomes on the impact of sprawl on social capital and interaction is, however, mixed.

Correlating a county sprawl index with the results of a national survey assessing community capital, Nguyen (2010) found that some elements of social capital were actually strengthened in lower density, typically 'sprawling' suburban areas. This study measured community capital using the variables of 'diversity of friendship', 'informal social interaction', 'organised group interaction', 'number of group involvements', 'faith-based social capital', 'social trust' and 'giving and volunteering'. The research discovered that more compact, higher density areas displayed particularly low scores for social interaction, faith-based social capital, and giving and volunteering. This finding follows our Review's discussion on the relationship between physical activity and density. Increasing density alone will not necessarily bring about intended consequences for healthy built environments. Establishment of community groups and programs, as well as provision of places and spaces for informal interaction, are just as important in higher density areas as they are in suburban neighbourhoods to develop social capital and promote social interaction.

The link between traditional neighbourhood design (versus suburban 'sprawl') and social capital has been further explored in the UK. Speller and Twigger-Ross (2009) recently published the qualitative component of longitudinal research on changes to an established mining community resulting from forced relocation. The previous community

street layout was relatively consolidated, consisting of five straight rows of terrace houses. The new village was less dense and built in a curvilinear design. Initial results indicate that the reduced visual access to others resulting from the new design had the effect of diminishing sensory connectedness and restricting traditional information flows. This eventually led to unwanted isolation, deterioration in collective identity and weakened social support among long time residents.

Lund (2003), who used survey data from eight new urbanist neighbourhoods in California, also found empirical support for the idea that neighbourhoods with consolidated grid-like streets, nearby access to shopping, and good pedestrian environments, exhibit increased casual social interaction compared to more suburban cul-de-sac designs. Cozens and Hillier (2008) undertook a detailed examination of street layouts and their impact on social interaction in European and Australian contexts. They specifically compared interaction on grid-like streets with dendritic street networks. They found that while some research shows social interaction is higher in communities with grid-like street layouts, other studies dispute this finding (for example, du Toit et al. 2007). Echoing much of the research in this area to date, they conclude that any 'one-size-fits-all' approach to the design of street layouts to encourage social interaction is 'myopic and simplistic' (Cozens and Hillier 2008, p. 51). The study calls for a more 'holistic approach to understanding the localised and contextual dimension to suburban street layouts and how they may affect human behaviour' (Cozens and Hillier 2008, p. 51).

There has been Australian based research on the sense of community established within Master Planned Communities (MPC) (Gwyther 2005; McGuirk and Dowling 2009; Williams and Pocock 2010). MPCs are usually geographically bounded, large-scale, private housing developments incorporating varying levels of infrastructure. They are not necessarily physically 'gated' although they are characterised by uniform housing design and a formal point of entry (McGuirk and Dowling 2009; Williams and Pocock 2010). It should be noted that MPCs can display an array of densities and street layouts – they are not necessarily synonymous with suburban sprawl or 'unhealthy' built



environments. Nevertheless, their impact on community development has been criticised (Ganapati 2008). MPCs have become a popular form of housing in American and Australian cities struggling to meet escalating housing demand. Various authors have explored the temporal link between the rise in the MPC and an apparent erosion of community. Williams and Pocock (2010) conducted 14 focus groups with residents of two newly established MPCs in Melbourne and Adelaide. They report that a sense of community is, in part, established in MPCs by the superficial familiarity facilitated by uniformity, centralised facilities and recreation areas. These things engendered feelings of trust, safety and 'togetherness' within the estate. The research also indicates that the effectiveness of built environment attributes in community building is very much augmented by community groups and events. These include mothers' clubs, church groups and progress associations.

Returning to the ubiquitous issue of density, Hipp and Perrin (2009) examined the importance of actual physical distance between dwellings in creating neighbourhood ties. They used a new urbanist development in the USA as a case study. Propinquity, or 'closeness' is also related to the discussion of density in Section 5.1 which concluded that there is no 'proper' density for a healthy built environment. Rather, it is the effects of distance and access mediated by densities which impact upon the built environment's ability to affect health. Similar principles apply to density and social interaction, with Hipp and Perrin (2009) concluding that increasing the physical distance between dwellings alone reduces the likelihood of social ties forming. This is juxtaposed to the research of Bramley et al. (2009) whose analysis of social connections in five UK cities found that scores of 'social sustainability' were lower in high density places. Perhaps sounding a warning bell for the psychological impact of high density areas, in a large review of European housing and health status for the World Health Organisation (WHO), Braubach (2007) found significant relationships between noise exposure and depression.

Overall, the research suggests that there is a threshold to be found between high and low densities for the formation of social networks and social interaction generally. People need to

retreat to their private space but they also require opportunities to randomly interact – whether they occur in shared driveways, corridors or at the mail box. Other studies assess the impact of density and propinquity on psychological states such as stress, anxiety and depression. This work includes Weich et al. (2002), Evans (2003), Sturm and Cohen (2004), Warr et al. (2007) and Burke et al. (2009).

Given the inevitability of higher density urban areas in our growing suburbs, it is worth considering whether density can be treated in some way to encourage interaction. Using surveys, observations and environmental measurements, MacDonald (2010) undertook a detailed study of the development of new high density residential neighbourhoods in the city of Vancouver. The research concluded that lining the ground floor of high rise apartment buildings with townhouses that have street entries can contribute a sense of liveability, providing life and visual interest on the street. Although the ground floor 'townhouse' type dwellings constituted just two percent of total dwellings constructed in the neighbourhoods, they dominated the 'feel' of each neighbourhood. This was because they constituted much of what was immediately seen from the street. Conversely, the upper floors of apartments add the density that makes neighbourhood amenities such as local retail, parks and community centres, possible. MacDonald provides detailed observations about the way the street level dwellings are constructed. Dwellings with secondary interior entries (for example, from a car parking area) do not contribute as much to a sense of street life, nor do front gardens too small to host an outdoor table and chairs. It is therefore not just a matter of lining the streets of high density areas with ground level accessible townhouses, but a complex mix of design variables which contribute to lively and safe streets. Indeed, MacDonald lists important design characteristics for ground floor direct entry units in high density developments:

'The entry door should be raised at least four to six steps above street level, so that people passing by cannot see too far into the unit, and residents feel less compulsion to screen off the front terrace.

The public-private transition space at unit entries should include a garden and a terrace, because this increases

the range of activities unit occupants might engage in, and also increases opportunities for personalization. A minimum terrace width of 6 feet is desirable, as this provides enough space to comfortably accommodate a table and chairs.

The unit should have multiple levels, so that the bedrooms are not on the street, and residents feel less compulsion to screen off the transitional space.

The front door should be designed to look like a front door, in terms of its orientation, style and detailing, and the terrace should be designed to look like a front terrace instead of a back yard. Otherwise, there can be a sense of confusion on the part of the passer-by as to whether one is looking at a publicly presented 'face' or voyeuristically looking into a private realm' (MacDonald 2010 p. 36).

Another element of the built environment associated with social interaction, feelings of connection and stress, is neighbourhood 'upkeep'. The extent to which the built environment is cared for and maintained can act as a physical indicator to underlying social disorder or fragmentation. This idea was first discussed in detail by Wilson and Kelling in their influential 'Broken Windows' thesis (1984). The theory is that the built environment plays host to signals of societal breakdown, such as derelict buildings, graffiti, vandalism, rubbish, conflict, public drinking, drug use and other forms of evident criminality (Warr et al. 2007). Further, this breakdown negatively impacts connection to place (Semenza 2003).

Closely linked to our Review's discussion of crime and social interaction below, the Broken Windows theory has been repeatedly supported by research, including work in Australia (Ziersch et al. 2007). In an effort to explore the relationship between social capital and aspects of the built environment, Wood et al. (2008), for example, collected data from 335 residents of three suburbs in metropolitan Perth. They concluded that a high level of neighbourhood upkeep was associated with greater social capital and feelings of safety. In a review of studies linking urban environments characterised by physical and social 'incivilities' with poor mental health; Berry (2007) discussed the

cumulative and lasting impact of derelict buildings, litter, excessive traffic and general over-crowding. Examining the changing role of form and function of rural Australia, Fraser et al. (2005) used survey data to assess the impact of residents experiencing rural decline on their mental health. The researchers found a positive association between decline and poor mental health status. It was acknowledged however, that decline is accompanied by stressors other than decay of the physical built environment. In New York, Hembree et al. (2005) used multilevel analyses to assess the relationships between the neighbourhood's built environment and the likelihood of death by drug overdose. They concluded that signs of deterioration of the built environment were significantly associated with an increased likelihood of fatal accidental drug overdose. They propose that disinvestment in social resources and differences in vulnerability to the adverse consequences of drug use in different neighbourhoods may explain the observed associations.

There is research suggesting that streets designed for walking and cycling will also promote social interaction. This relates to the fact that both utilitarian and recreational walking and cycling increase the chance of incidental interaction. This relationship has been the subject of various studies (Lund 2002; Brown et al. 2007) and others are providing further evidence. Richard et al. (2009), for example, found regular walking to be a strong predictor of social participation by the elderly living in Montreal, Canada. Mehta (2007) used structured and semi-structured observations of environmental quality of US commercial streets to examine the influence on social interaction. It was concluded that there is popular demand for commercial streets as social spaces for strolling and meeting, rather than simply channels of movement. Seating provided by businesses and public authorities, places to meet in the foyer of buildings, along with street furniture in town centres, were found to be particularly important in creating social and convivial streets. Businesses that serve as community places, for example privately owned squares and malls accessible to the public, were also important, as was the presence of wide footpaths. Interestingly, personalised street fronts were cited as contributing to social activities on neighbourhood commercial streets. This



could be as simple as allowing vendors to sell fresh flowers from outside their shop front or relaxing planning controls designed to promote an overtly uniform street presentation for commercial development.

Highlighting the complexity of the link between walkable streets and social and psychological aspects of health, du Toit et al. (2007) used data from an Australian sample (n = 2,194) to explore the proposition that more walkable neighbourhoods encourage local social interaction, a sense of community, informal social control and social cohesion. They concluded that the relationship was weak and that sociability in general is influenced by more than urban form. This conclusion resonates with this Review's earlier discussion on the genuine lack of a 'set formula' for community and associated health benefits.

Sample Policy

'Optimise the visibility, functionality and safety of building entrances by:

- orienting entrances towards the public street
- providing clear lines of sight between entrances, foyers and the street
- providing direct entry to ground level apartments from the street rather than through a common foyer.'

Residential Flat Design Code (2002) Part 2 Site Design, Site Amenity p. 56 (Department of Planning, NSW).

Sample Evidence

'People admire New York City's brownstones...and San Francisco's cheek-by-jowl Victorians, but are prone to say that...similar buildings cannot be built today. Vancouver's new neighbourhoods say it is possible to achieve the human-scale qualities of street facing townhouses with new building types. Planners have taken urban design theory and turned it into reality, and they have done it working with large developers.'

MacDonald 2010 p. 38.

Safety

Key Message: While sense of community and social interaction are key determinants of health, a large body of research suggests that people will not interact within, or feel part of, a community that they perceive to be unsafe.⁴

The broader link between safety and overweight was recently explored by Duncan et al. (2009) who correlated self reported BMI of 1,140 students in Boston, USA with survey data on perceptions of neighbourhood safety. Although the study did not progress to address why perceived safety was so strongly linked to poor health, in their fully adjusted model, statistically significant associations between feeling unsafe in one's own neighbourhood and overweight status were found.

A substantial body of research similarly explores the link between safety from crime and traffic with physical activity as a health determinant. These links have already been discussed in Section 5.1. In brief, some recent studies include: Mendes De Leon (2009) linking walking in older adults and perceived neighbourhood safety; Jones et al. (2009) exploring links between access to green space, physical activity and perceived safety in lower socio-economic neighbourhoods; Cradock et al. (2009) examining the role of safety and neighbourhood cohesion with physical activity in youths; Wood et al. (2008) exploring feelings of personal safety and their impact on walking in Perth, Australia; Roman and Chalfin (2008) investigating fear of crime and its impact on walking by Washington D.C., USA; McDonald (2008a) assessing objectively measured crime and walking in adults in the Bay Area, California, USA; Metcalf et al. (2004), Boarnet et al. (2005) and McDonald (2008b) highlighting the importance of safety to parents of primary school children in their decision to walk. Doyle et al. (2006) and Loukaitou-Sideris and Eck (2007) examine the relationship between safety and physical activity generally.

Research exploring the link between feeling safe and secure within a neighbourhood with health generally – for example, the impact that feeling unsafe might have on interaction in the neighbourhood – has also been conducted. Further, research on the way the built

⁴ Research suggests that perceptions of neighbourhood characteristics are just as instrumental in shaping behaviour as any objective measure of built form (Wood et al. 2010). This is particularly relevant to perceptions of safety from crime (Ellaway et al. 2005) and traffic (Winters et al. 2010). Reference to 'safety' in this Review should be interpreted as both perceived and objective safety unless otherwise specified.

environment can be modified to support safety, has been undertaken.

Burdette and Hill (2008) explored the link between neighbourhood disorder and obesity in Texas, USA. They confirmed that the association of neighbourhood disorder with increased risk of obesity is entirely mediated by psychological distress and poor self-rated overall diet quality. Irregular exercise only partially influenced the relationship. This suggests that there is a link, outside of physical activity, between the built environment's ability to keep people safe and subsequent health outcomes.

Highlighting the power of perception, Hynes and Howe (2004) found that community gardens and other natural and open public spaces are most common in localities where threat from crime is perceived as low. Studying teenagers in Italy, Prezza and Pacilli (2007) found that consistent use of public places for play in childhood resulted in less intense fear of crime and a better perception of community empowerment in adolescence. Examining the impact of fear of crime on mobility, Evans (2009a) concluded that fear of crime, rather than actual criminal activity, limits engagement with the transport system and opportunities for wider social inclusion (Evans 2009a). Fear of crime has also been used as a political excuse to justify gated communities or meagre provision of open space (Ganapati 2008). Permentier et al. (2007) found a strong link between a neighbourhood's reputation for crime, disorder and dislocation with the likelihood of interaction and community engagement. Designing spaces to prevent criminal activity is therefore just as important for its role in allaying public fears and potential political inaction, as well as reducing actual crime levels (Foster and Giles-Corti 2008).

If the relationship between safety and health is so strong, what is it about the built environment that makes people feel safe? Crime Prevention Through Environmental Design (CPTED) has emerged within the last 30 years as the umbrella term for environmental interventions aimed at reducing crime and fear of crime. CPTED is defined by Crowe (2000 p.1) as 'the proper design and effective use of the built environment [which] can lead to a reduction in the fear of crime and the incidence of crime, and to an improvement in the quality of life'. CPTED is based on four key strategies of 'territoriality'

(encouraging a sense of ownership), 'natural surveillance' (encouraging eyes on the street), 'activity support' (encouraging use over vacancy) and 'access control' (balancing surveillance and use with privacy).

Saville (2009) provides a comprehensive review of the rise in popularity of CPTED in built environment planning. This work moves beyond the traditional recommendations of CPTED to promote 'safe growth' – a new style of planning for crime prevention. Safe growth promotes community involvement with outside experts in the planning process for safe places. Saville's case study research from Toronto, Canada, assessed implementation of community participation in crime prevention planning over a nine year period. The primary conclusion was that crime reduction and increases in community participation have continued as a result of strong community involvement, together with infrastructural change to the neighbourhood. The importance of involving communities in built environment decision making is further discussed below under 'Participation and Empowerment'.

Sample Policy

'...orientate buildings:

- to allow surveillance from the street to the building, from the building to the street, and between buildings,
- to allow surveillance of the spaces around the building, and
- so that access points are in clearly visible locations.'

Rockdale City Council NSW 2002 p. 18.

Sample Evidence

'The study includes 83,736 Dutch citizens who were interviewed about their feelings of social safety. The percentage of green space in the living environment of each respondent was calculated, and data analysed by use of a three-level latent variable model...The analyses suggest that more green space in people's living environment is associated with enhanced feelings of social safety - except in very strongly urban areas, where enclosed green spaces are associated with reduced feelings of social safety.'

Maas et al. 2009a p. 1763.



Mobility and Interaction

Key Message: Travel modes influence opportunities for casual interaction, together with accessibility to form and maintain social ties. Travel modes can be a source of stress.

While active transport presents opportunities for causal interaction not afforded by the private car, it also potentially reduces accessibility to family and friends.

Closely tied to the idea of streets as interaction spaces is the impact of mobility on our ability to interact and form social ties.

While automobile use is more often cited as the enemy of healthy built environments, cars can facilitate maintenance of social connections. This is particularly so in contemporary suburbs characterised by low density with long distances between uses, families and friends (Greenaway et al. 2008). However, this positive aspect of car dependency may well be erased by the notorious connection between sprawl and long commute times. In localities where people travel further for social and leisure activities, there is also the expectation of travelling further for other trips, such as the daily commute (Zhang 2005). Besser et al. (2008) explored the hypothesis that declining trends in social capital among Americans could be due, in part, to long commute times. Using data from the US National Household Travel Survey, the study produced a ratio of socially-oriented-trips to work-oriented-trips, comparing the data against individual commute times. They concluded that a longer commute time (greater than 20 minutes) was significantly associated with no socially-oriented trips. If anything, this research highlights the finite nature of time available in each day. As discussed in Section 5.1, time spent in the relatively private and individualised space of the car (Freund and Martin 2007) often compromises time available for other activities, such as physical activity. The study by Besser et al. (2008) indicates this principle also applies to social interaction.

Also of relevance to mobility and social interaction is research assessing the health impacts of living in close proximity to traffic. Song et al. (2007) combined GIS data with US census statistics to examine the relationship between traffic

density, stress and depression. They concluded that perceived traffic stress was associated with higher rates of self reported depression. Furthermore, they found that neighbourhoods with greater vehicular volumes serve to reinforce the negative impacts of perceived traffic stress. This was regardless of whether vehicular volume was actually experienced through the act of car driving. These results indicate that people living in close proximity to traffic find high traffic volumes to be stressful even if they engage in less intrusive, more sustainable transport modes.

Sample Policy

'Impact of road noise or vibration on non-road development:

If the development is for the purposes of a building for residential use, the consent authority must not grant consent to the development unless it is satisfied that appropriate measures will be taken to ensure that the following LAeq levels are not exceeded:

- (a) in any bedroom in the building—35 dB(A) at any time between 10 pm and 7 am,
- (b) anywhere else in the building (other than a garage, kitchen, bathroom or hallway)—40 dB(A) at any time.'

State Environmental Planning Policy (Infrastructure) 2007, clause 102 (NSW).

Sample Evidence

'For participants in this study, social and recreational travel meant doing things significant to them: maintaining important relationships, accessing amenities and participating in their communities, sporting and entertainment activities... They fostered social connection between family and friends and provided opportunities for physical activity, behaviors essential to health and well-being... Although alternatives could be found for some of the less important trips, in most cases participants struggled to identify different (non car based) ways of achieving the purpose of their trips.'

Greenaway et al. 2008 p. 507, 510.

Orderly Interaction Through Education

Key Message: The built environment can promote orderly social interaction by removing ambiguity in expectations and educating communities about behavioural norms. This is particularly important in environments that may be new and unfamiliar, such as recently established community gardens and shared pathways.

For many people in Australian cities, healthy built environments are unfamiliar. Opportunities for physical activity on walkable streets and shared pathways, and in newly established gardens, innovative outdoor town centres and safe and attractive parks, are novel opportunities. Consolidated residential areas and mixed use neighbourhoods are also unfamiliar living spaces for many and the built environment has a role to play in educating communities about appropriate etiquette in these spaces. This can occur through placement of signage, facilitation of educational campaigns, and the provision of legible design (Gatersleben and Appleton 2007). When people know how to behave in a space the chance for friction between users is minimised and opportunities for positive, natural interaction enhanced. Newly established cycleways and shared paths provide an example of healthy built environments designed for interaction that have become spaces of tension between different types of cyclists, and between cyclists and pedestrians (Daley et al. 2007; Lo 2009; O'Connor and Brown 2010). Interestingly, similar environments are used daily without friction in countries such as Denmark and Germany. Pucher et al. (2010) suggest this ease of use is related to a strong cycling culture where behavioural expectations have been reinforced through several generations.

In relation to open spaces, Crawford et al. (2008a) examined the link between neighbourhood SES and features of public open spaces. The study found that while there were no differences across neighbourhoods in the number of playgrounds or the number of recreation facilities provided, open space in the highest socio-economic neighbourhoods had more signage regarding dog access and activity restrictions.

Sample Policy

'Potential conflicts between path users can be reduced through:

- Management – centre lines and signage encourage safe path use behaviour, such as keeping to the left.'

Department of Infrastructure, Planning and Natural Resources (NSW) 2004 p. 55

Sample Evidence

'Participants noted that most of the viable places to ride in inner Sydney were shared environments, which created tensions as cyclists, motorists and pedestrians struggled to harmoniously occupy narrow and limited infrastructure.'

Daley et al. 2007 p. 48

Participation and Empowerment

Key Message: Participation in shaping the built environment supports interaction and psychological health by encouraging a sense of empowerment and custodianship. The way the built environment is governed can foster this participation.

Participation in the built environment fosters a sense of stewardship and empowerment. This is linked to community interaction (Baum et al. 2000; Shutkin 2001; Brand 2003) and mental and physical health (Baum et al. 2006).

Semenza et al. (2007) assessed the health impact of an attempt to promote community participation in urban renewal by engaging residents in the construction of attractive urban places in three neighbourhoods in Portland, USA. Involvement was facilitated by the approval of community-designed street murals, public benches, planter boxes and information kiosks with bulletin boards in public spaces. Residents within a two-block radius of the three sites were systematically sampled and interviewed before and after the intervention. Multivariate results revealed improvements in mental health, increased sense of community, and an overall expansion of social capital. Brand (2003) examined the consensus



building processes used in nine Minnesota housing development projects finding that community involvement in the development process is critical to establishing social capital. They conclude with seven strategies for designing consensus building programs in the context of urban renewal.

Goltsman et al. (2009) highlight the link between environmental stewardship in children and health. They propose that children should be encouraged through learning and play to engage with their environment - both natural and built. They discuss a range of ways that this can be facilitated. They advocate using neighbourhood parks and open spaces for children's vegetable gardens or outdoor learning areas, rather than filling these spaces with 'manicured park lawns and manufactured play equipment' (Goltsman et al. 2009, p. 90). Their paper provides guiding principles and performance requirements for developing outdoor environments that engage children. Actual resources to build these environments are listed. These guidelines complement others outlined by Wake (2007) and Rayner and Laidlaw (2007) in an Australian context.

A sense of community ownership and engagement can be integral to both the development and maintenance of healthy built environment projects. Baum et al. (2006), for example, examined the factors enabling the continuation of the 'Healthy Cities Noarlunga' program over 18 years (1987-2005). They concluded that the initiative being accorded value by the community, facilitated by genuine community engagement, was a major factor emerging in sustaining the initiative.

Producing one's food is also an empowering experience. This can occur through urban agriculture, including community gardens (DuPuis and Goodman 2005). Using in-depth, key informant interviews to study the impacts of a community farm in Ontario, Canada, Sumner et al. (2010) highlight the important role the community farm plays in enabling connections of the gardeners to both community and the local food production process.

Sample Policy

'Involve your community in planning activities

- Engage community members early in the planning process to accommodate their ideas about their local area.
- Liaise with young people and children when planning new development areas or urban renewal projects.'

National Heart Foundation of Australia (Victorian Division) 2004 p. 22.

Sample Evidence

'Community organizing and public engagement resulted in the painting of a large street mural and the construction of several interactive art structures... participants created unique ecological constructions, including a cob [clay] kiosk, cob benches, a street mural, a lawn chessboard, a light clay sauna, and a walking labyrinth... Social capital displayed a statistically significant increase after the intervention. At all three sites, there was a consistent decline between the first and the second survey in the estimated marginal mean for the depression scale.'

Semenza et al. 2007 p. 13 and 15.

5.2.5 Strengths and Weaknesses in the Research

While studies on the impact of built environments on physical activity are further advanced than those of the built environment and strengthening community, the gaps identified in both research areas are similar. Common weaknesses include the lack of standardised measures of built environment and health variables, the need for more robust proof through longitudinal investigations, and elimination of confounding variables such as the impact of residential self selection. Studies also require better interdisciplinary collaboration and more detailed explorations on the synergistic impacts of multiple variables at different geographical scales. In addition to these commonly articulated weaknesses, the following more specific gaps have been identified as relevant to research on the Built Environment and Connecting and Strengthening Communities.

Bridging the Gap Between the Built Environment, Connected Communities and Health

Research exists on the way the built environment facilitates social connection and contact with nature, attachment to place and community empowerment. Similarly, there are studies on the way social connection, contact with nature, feelings of attachment and empowerment positively influence health. There is less research, however, bringing these two relationships together to assess the impact of the built environment on interaction, attachment and empowerment and its subsequent effect on health outcomes. Bridging this gap requires further collaboration between built environment and health research with fields as diverse as sociology, human geography, psychology and anthropology. These disciplines need to be actively drawn into healthy built environment work to include specific health outcomes in their explorations of the influence of the environment.

Using Research to Date on Physical Activity

The strength of research on the built environment and physical activity provides avenues for assessing the impact of built form on social interaction, empowerment

and attachment. Despite this, the research to date rarely explores or theorises synergies between built environments for physical activity and social interaction. Opportunistic interventions assessing the built environment's impact on health should include assessment of social interaction, feelings of involvement and empowerment, and attachment to place as health related variables.

The Natural Link in an Australian Context

There is a lack of systematic research demonstrating evidence that the natural environment increases levels of social interaction (Sustainable Development Commission 2008). This is particularly important in an Australian context where our natural environments (such as tracts of bushland and beaches) provide different challenges to enhancing social interaction when compared with the natural spaces experienced in Europe and North America.

Further research is needed to establish health responses to natural, semi-natural or artificial habitats. The health benefits from contact with nature need to be better explored at the population level (Tzoulas et al. 2007). Future studies should examine variations in landscape needs in different social groups, minority communities and different places (Poortinga et al. 2007). To better understand user needs, more participative designed studies and interventions are required (Abraham et al. 2010).

The Importance of Education in New Environments

The health benefits of educational programs and infrastructure, including directional and explanatory signage, are generally monitored and evaluated by their impact on participation rates. In addition to encouraging participation in healthy behaviour, educational programs and infrastructure can also develop understandings beneficial to health which can exist without participation. For example, a council authorised sign explaining the use of grass verges in an urban street for a community garden has the ability to defuse anxiety amongst those with opposing opinions on appropriate uses for the street verges. This benefit exists outside of participation and its measurement would be missed if the success of the infrastructural provision was evaluated based only on



participation. Monitoring and evaluation of educational programs should include an analysis of the impact on those community members who are not necessarily drawn to participate in the actual project, but nonetheless feel more comfortable in, and attached to their locality as a result of the awareness gained by the educational program.

5.2.6 HBEP Recommendations for Future Research

The recommendations for future research outlined in Section 5.1.6 also apply to this research agenda. Determining the way the built environment can connect and strengthen communities will require interdisciplinary collaboration, opportunistic monitoring of community projects and modifications, as well as an open discussion on the evidentiary requirements to support change. Of note is that interdisciplinary collaboration in this domain will require input from a different set of professionals, including ecologists and community psychologists (Berry 2007).

Social Capital and Residential Self Selection

The relationships between social cohesion, interaction, safety, crime and health are often attenuated by socio-economic and demographic factors. There are few attempts to unravel the complexities of this relationship. Do people actively seek opportunities for casual interaction in their neighbourhood when choosing a place to live? Do more sociable people choose dwellings overlooking parks or other communal spaces? The confounding variable of self selection is rarely mentioned in the literature in relation to social interaction.

Interaction through Active Transport

The interactive opportunities afforded by active transport have been relatively under-researched. Given the predicted shift to active transport modes (including public transport useage) there are opportunities to encourage and examine the interactions and communities that emerge as a result. Interactions occurring between these modes can also be sources of conflict, for

example between pedestrians and cyclists on shared paths or between commuters scrambling for the last seat on a crowded bus. The built environment can contribute to resolving these conflicts through better provision of infrastructure, together with educational programs.

The Relationship between Participation, Empowerment and Social Capital in Healthy Built Environments

Rooted in traditional human geography discourse is research warning against overemphasising the local and the value of local knowledge. Such cautions include taking care to source groups that are truly representative of 'the local'. While farmers' markets, for example, have been cited as forums for community interaction, there is also evidence that such markets can contribute to social stratification (Macias 2008). Future research needs to examine ways to engage communities in the context of healthy built environments without excluding individuals or groups.

5.2.7 Policy Implications

- Planning policies based on new urban design, including increases in densities and mixing of uses, will generally encourage social interaction. These interactions will not occur, however, unless adequate provision is made to protect individual privacy. Such policies should be accompanied by other community building programs, including the establishment of community groups, staging of community events and even the support of fledgling local retailing to ensure its viability.
- Policies to maintain green and open spaces should embrace increased physical activity, social connectivity and improved mental wellbeing as desired outcomes. With continuing growth of urban populations, policies need to target the acquisition of land for greenspace and improve the quality of existing greenspace networks beyond their traditional role as recreational areas.
- Community gardens should be supported by dedicated personnel and appropriate funding. Pursuing partnerships with other agencies

such as neighbourhood schools, TAFE colleges, botanical gardens, gardening clubs, recycling and sustainability groups, and local councils, can be a way to engage community based knowledge, as well as support.

- Policies to involve communities in crime prevention programs and policies based on existing CPTED guidelines need to be pursued. Crime prevention policies must be coordinated with other healthy built environment policies.
- Planning of environments that are new and unfamiliar should include provisions for educational programs and infrastructure. Policies to retrofit existing public spaces and environments with appropriate, creative and consistent signage detailing behavioural expectations should be pursued.
- Public participation provisions in existing built environment policy and legislation should be regularly reviewed to ensure they make use of contemporary technology and are suitable for today's communities. Policies for public participation in governance of the built environment should be adaptable to encourage inclusivity through participation from all community members. The involvement of children in the planning of green and open spaces should be particularly encouraged.

5.2.8 Summary of Key Messages

There is No Set Formula for 'Community'

Community is complicated. This relates to demographic, cultural, ability, socio-economic and other attributes. What works to promote community in one locality, or within a particular group, or at one time, will not necessarily translate to another.

Interaction in Open Spaces – contact with nature as well as community

An integral impact of the built environment and interaction is the location and treatment of green and open spaces, facilitating contact with nature as well as contact with community.

Interaction in Other Spaces

Casual encounters with community can occur anywhere. Providing welcoming and safe common areas around apartment blocks or facilities for comfortable waiting at public transport stops, for example, can encourage the incidental interactions which become building blocks of community.

Interaction in Community Gardens and Farms

Community gardens are forums for incidental and organised interaction. They are spaces for people to establish and maintain contact with community and contact with nature.

Interaction on Streets and in the Neighbourhood

Both regional scale urban structure and micro scale building design can influence incidental interaction on streets and in neighbourhoods.

Safety

While sense of community and social interaction are determinants of health, a large body of research suggests that people will not interact within, or feel part of a community that they perceive to be unsafe.

Mobility and Interaction

Travel modes affect opportunities for casual interaction, the ability to form and maintain of social ties, as well as being the source of stress associated with traffic and noise. While active transport presents opportunities for causal interaction not afforded by the private car, it also potentially reduces accessibility to family and friends.

Orderly Interaction through Education

The built environment can promote orderly social interaction by removing ambiguity in expectations and educating communities about behavioural norms. This is particularly important in new and unfamiliar environments, such as community gardens and shared pathways.

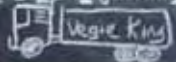
Participation and Empowerment

Participation in shaping the built environment supports interaction and psychological health directly by encouraging a sense of empowerment and custodianship. Governance of the built environment can foster this participation.





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5.3 The Built Environment and Providing Healthy Food Options





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5.3.1 The Benefits of Providing Healthy Food Options

Regular physical activity needs to be accompanied by a healthy intake of food to ensure that energy 'in' is balanced with energy 'out'. This is the key to maintaining a healthy weight. This Section examines the literature on the built environment's ability to encourage healthy eating.

At the individual level, overweight, obesity and resultant health problems are the outcomes of over consumption of calories and a resultant energy imbalance. The environment in which an individual exists affects energy balance by providing opportunities for energy output through physical activity, and encouraging energy input that is within the limits of dietary recommendations.

5.3.2 How can the Built Environment Provide Healthy Food Options?

Food retailing has a profound effect on dietary intake. The neighbourhood is a potent predictor of dietary patterns (White 2007).

Through zoning and land use regulation, the built environment can be shaped to support or inhibit healthy eating options. In the Australian state of New South Wales, for example, many local environment plans (LEPs) limit retail floor areas so they cannot accommodate supermarkets. There are also local and State regulations that prohibit urban agriculture and community gardens, as well as ancillary uses such as the sale of fresh produce from the road side or neighbourhood stalls.

Advocates and policy makers around the world have started to address zoning impediments to healthy food access. In San Francisco (USA), when rezoning threatened neighbourhood food access, a special-use district was created to encourage the siting of a supermarket. Local government in Sacramento recently overturned a prohibition on growing food in front yards (Ashe et al. 2007). In Australia, some local governments in growth areas recognise the importance of locating supermarkets and other fresh food outlets in accessible places. Appropriate provisions

are included in strategic plans – see for example the Pottsville Locality Based Development Code cited below.

Of primary significance in the literature is that the built environment can regulate food environments around schools. The evidence emphasising the importance of school food environments is convincing. Nevertheless, the use of regulation to positively influence food environments around schools remains rare (Kestens and Daniel 2010). The US State of Arkansas was the first jurisdiction to pass legislation to combat childhood obesity. Among other interventions, including compulsory BMI measurement and provision of nutritional information to parents, the Arkansas Act 1220 of 2003 limits the placement of vending machines in and around schools. BMI levels in school children in Arkansas have not increased since the implementation of the legislation in 2004 (Raczynski et al. 2009).

In addition to the food retail environment, land use zoning and regulation can be used to influence food production systems by protecting peri-urban agricultural lands capable of producing accessible healthy food.

Finally, zoning and regulation can be employed to limit marketing and advertising infrastructure such as billboards and signs. Billboards are a relatively inexpensive method of advertising which typically has high impact in that people tend to view the same billboards regularly. The built environment can influence the use and location of billboards to advertise unhealthy food options, particularly in the vicinity of schools.

5.3.3 Key Studies

In the categorisation of references, 134 were identified as relating to Providing Healthy Food Options. These studies have been used to inform the major themes in this Section of the Review. Of these references, those listed below were considered by the authors to be key studies. A summary of these references has been included in the Annotated Bibliography in Appendix 3.

Ashe et al. 2007
Burns and Inglis 2007
Coveney and O'Dwyer 2009
Crawford et al. 2008b
Kestens and Daniel 2010
Mehta and Chang 2008



Pearce et al. 2007
 Pearce et al. 2008
 van der Horst et al. 2007
 Winkler et al. 2006

5.3.4 Major Themes in This Domain

Food Accessibility – Generally

Key Message: There is a logical link between exposure to healthy food options and healthy eating. Attempts to quantify this relationship have been based on mixed methods and have produced mixed results.

Echoing the direction of healthy built environment research, the study of food environments has shifted to an examination of contextual, structural and environmental factors influencing food choices. This includes geographical accessibility to supermarkets and fruit and vegetable stores, and the variety and price of foods within these stores (White 2007; Coveney and O'Dwyer 2009). The accessibility of healthy food is at the heart of this issue. A number of studies indicate convenience of food access as a determinant of food choice (Jilcott et al. 2009; Powell and Bao 2009). White (2007) provides a comprehensive analysis of the emergence of convenience eating.

Various studies have convincingly linked exposure to energy dense foods, often featured in convenience stores and fast-food outlets, and exposure to healthier choices offered by supermarkets⁵, with weight status. Dengel et al. (2009), for example, collected blood profiles, body fat percentages and blood pressure measures from 188 adolescents in Minneapolis – St Paul, USA. Individual place of residence was mapped against proximity to various destinations, including convenience stores. A consistent inverse relationship between metabolic syndrome and distance from residence to convenience store was revealed. Galvez et al. (2009) conducted a similar study on 323 children in the State of New York, USA. They were able to conclude that children living on a block with one or more convenience stores were more likely to have a higher BMI compared with children living in blocks without convenience stores. Li et al. (2009) undertook a quasi-experimental study of one year change in body weight in 1,145

adult residents from 120 neighbourhoods in Portland, USA. The study revealed that neighbourhoods with a high density of fast-food outlets were associated with increases of 1.40 kilograms in weight. Zenk et al. (2009) examined access to food stores and fruit and vegetable intake in 146 neighbourhoods within three large geographic communities of Detroit, USA. Their study revealed that presence of a large grocery store in the neighbourhood was associated with consumption of more daily fruit and vegetable servings. In a smaller sample of 102 households, Bodor et al. (2008) examined the availability of fruit and vegetables in all shops, from small corner stores to supermarkets, in a community in Louisiana, USA. They were able to quantify that greater fresh vegetable availability within 100 metres of a residence was a positive predictor of vegetable intake. Further, they found that each additional metre of shelf space dedicated to fresh vegetables was associated with 0.35 servings per day of increased intake. Similarly, Laraia et al. (2004) studied the impact of accessibility to supermarkets on the diet of 918 pregnant women in North Carolina. After controlling for individual characteristics and the location of other food outlets, the study concluded that women living greater than four miles from a supermarket were more than twice as likely to have a poor diet during pregnancy than women living within two miles of a supermarket. Using individual data from the 2002-2006 Behavioral Risk Factor Surveillance System ('BRFSS', n=714,054), Mehta and Chang (2008) linked health data with fast-food and full-service restaurant density, along with restaurant mix in counties across the USA. The study concluded that fast-food restaurant density and a higher ratio of fast-food to full-service restaurants are associated with higher individual-level weight status.

Oreskovic et al. (2009b) sampled 21,008 children aged two to 18 years from Massachusetts, USA, linking clinical data on BMI with distance to, and density of fast-food restaurants. The study found proximity to the nearest fast-food restaurant was inversely associated with BMI. Density of fast-food restaurants was positively associated with BMI. Importantly, this relationship did not persist after controlling for socio-demographic factors. The erosion of the relationship post multivariate analysis is perhaps indicative of the well researched

⁵ Convenience stores and fast-food outlets are generally used as surrogates in studies for poor healthy food access, while the presence of a large supermarket is taken to indicate better access to healthy foods. This assumption is based on studies such as Morland et al. (2002) which found that with each additional supermarket in a census tract, fruit and vegetable intake increased. A longitudinal study by French et al. (2001) demonstrated a direct relationship between fast-food intake and weight gain over a three year period. This finding was also confirmed by an Australian based longitudinal study of women by Ball et al. (2002) which associated weight gain with fast-food consumption. A cross sectional study of 1,033 residents of Minnesota undertaken by Jeffery et al. (2006) produced similar findings.

socio-demographic stratification of overweight and obesity. The relationship of this phenomenon with the built environment is further discussed below. Other north American studies which have confirmed the link between exposure to energy dense foods through characteristics of the built environment to poor health include Hosler (2009) studying populations in rural Canada, and Dunn (2010) and Fraser et al. (2010) reviewing studies in the USA.

In contrast, Wang et al. (2007) assessed access to supermarkets for 7,595 adults in California, USA and found that having good access to chain supermarkets was actually related to a higher BMI for women. Similarly, Pearce et al. (2009) mapped travel distances to the closest fast-food outlet for all neighbourhoods against the results of a national health survey in New Zealand. The study found that residents in neighbourhoods with the furthest access to a multinational fast-food outlet were more likely to eat the recommended intake of vegetables, but also be overweight. The study concluded that better neighbourhood access to fast-food retailing is unlikely to be a driver of inequalities in diet-related health outcomes in New Zealand. The results of this study have been reiterated by recent research in Australia. As part of the Melbourne based CLAN study, Crawford et al. (2008b) examined associations between density of, and proximity to, fast-food outlets and body weight in a sample of 380 children and their parents (322 fathers and 362 mothers). Their results were almost the antithesis of the findings of many of the aforementioned US based studies. They concluded that:

'Among older children, those with at least one [fast-food] outlet within 2 kilometres had lower BMI z-scores. The further that fathers lived from an outlet, the higher their BMI. Among 13–15-year-old girls and their fathers, the likelihood of overweight/obesity was reduced by 80 percent and 50 percent, respectively, if they had at least one fast-food outlet within 2 km of their home. Among older girls, the likelihood of being overweight/obese was reduced by 14 percent with each additional outlet within 2 kilometres' (Crawford et al. 2008b p. 249).

These findings are similar to a study of 7,000 low income preschoolers in Cincinnati, USA, which found no relationship between overweight and

proximity to fast-food restaurants (Burdette and Whitaker 2004). Using a longitudinal quasi-experimental approach, Cummins et al. (2005a) examined the impact of a large retail centre in a deprived neighbourhood in Glasgow, Scotland. Adjusting for age, sex, educational attainment, and employment status, the researchers found no change in daily fruit and vegetable consumption over the 12 months following the increased exposure to food choice provided by the new retail centre. Returning to fast-food, Sturm and Datar (2005) found that fast-food restaurant density was unrelated to weight gain over four years in a nationally representative cohort of kindergarten children in the USA. Likewise, a cross-sectional study by Jeffery et al. (2006) revealed that proximity of fast-food restaurants to home and work was not associated with adults' BMI in Minnesota.

An array of methods and measures have been used to calculate the dietary and health impacts of exposure to healthy versus unhealthy foods, with an array of conclusions the only tangible result. Clearly, it is not simply exposure to fast-food that is the issue. As hypothesised by Mehta and Chang (2008), 'it is the availability of fast-food relative to other away-from-home choices that appears salient for unhealthy weight outcomes' (Mehta and Chang 2008 p. 127). The research of Mehta and Chang (2008) brings into question the relative 'demonisation' of fast-food. Many restaurants that do not meet the definition of a 'fast-food restaurant'⁶ serve food lacking in any nutritional advantage over the offerings of traditional fast-food outlets (Ashe et al. 2007). As observed by Crawford et al. (2008b), an inverse relationship between fast-food exposure and BMI averages can be explained by the possibility that 'neighbourhoods, which have many fast-food outlets, also have many other types of food outlets where "healthier" foods are available, thus diluting the exposure to fast-foods' (Crawford et al. 2008b p. 253). Indeed, without more in depth analysis of the entire retail environment in the study area, the data collected by Crawford et al. (2008b) could be more an indication of higher densities and mixed uses within an area. Both of these urban typologies have been shown to be related to healthy weight (see for example the review of Feng et al. 2010). It is therefore important to understand the nature of what food is available in all food outlets, rather than to



⁶ There is no standard definition for 'fast-food restaurant' followed in the literature (Jeffery et al. 2006). Australian and New Zealand studies generally use the major franchises such as McDonald's, KFC and Pizza Hut as proxy for a definition of 'fast-food restaurant' (see for example Reidpath et al. 2002).

simply quantify the number of fast-food outlets in a neighbourhood. This analysis is required before the relationship between exposure to fast-food outlets and obesity can be dismissed.

Sample Policy

'...to ensure that the village centre maintains its role and function as the primary active hub within the Pottsville locality, a comprehensive Structure Plan has been developed... The key components of the revised structure plan include:

- Increasing the maximum building height limit to 11 metres (allowing up to 3 storeys);
- Encourage commercial and residential uses to upper levels within the retail core;...
- Identification of a series of sites suitable for full-line supermarket development;...

Pottsville (NSW) Locality Based Development Code.

Sample Evidence

'The results reported here demonstrate that the restaurant environment is associated with weight status net of individual- and county-level factors. The relationship is complex, suggesting that the restaurant environment's influence goes well beyond a simple positive association between restaurant density and weight status.'

Mehta and Chang 2008 p. 131.

Food Accessibility and Socio-Economic Status

Key Message: Studies have consistently shown that access to healthy food is more difficult in lower SES areas. The majority of this research has been undertaken in the USA. Detailed studies on actual accessibility to, and variety within, food environments in lower SES areas in Australia are required.

Measures of the impact of food accessibility on health often rely on the socio-economic stratification of the prevalence of

overweight and obesity (Oliver and Hayes 2005; Cummins and Macintyre 2006). In Australia, Turrell et al. (1998; 2002; 2009), Carter et al. (2007) and Miura et al. (2009) found significant relationships between SES, food shortages and likelihood to purchase foods recommended for good health. The research of Giskes et al. (2002) and Turrell et al. (2002; 2009) revealed a positive correlation between lower SES and fruit and vegetable intake. Taking a novel approach, Cummins and MacIntyre (2005b) used national level data to examine the association between neighbourhood deprivation and the density of McDonald's restaurants in 38,987 small census areas in Scotland and England. They found statistically significant positive associations between neighbourhood deprivation and the mean number of McDonald's outlets per 1,000 people. Further, these associations were linear with greater mean numbers of McDonald's outlets per 1,000 people occurring as deprivation levels increased.

Many studies explore the hypothesis that the socio-economic gradient to poor health is partly a result of healthy food being more expensive and more difficult to purchase in socio-economically deprived areas (see for example Turrell et al. 2002; Inagami et al. 2006; Jetter and Cassady 2006; Kamphuis et al. 2006; Wang et al. 2007; Hemphill et al. 2008; and Franco et al. 2009). The debate linking SES and accessibility to healthy food has subsequently informed the development of the concept of 'food deserts'. Food deserts are defined as places where 'cheap and varied food is only accessible to those who have private transport or are able to pay the costs of public transport if this is available' (Acheson 1998, p65, cited in Wrigley 2002). It is worth remembering that the costs associated with accessing healthy food inferred by this definition are conceptualised as both time and money. Smaller stores, where prices are higher and the quality of fresh food lower, are characteristic of the food choices available in areas classified as 'food deserts'. Although the actual existence of food deserts has been questioned in the literature (Cummins and Macintyre 2002; Hackett et al. 2008), a comparatively vast array of research has been undertaken attempting to quantify the relationship between the location of food outlets, SES and poor health. Dowler (2001) studied the social stratification of fruit and vegetable access. They discovered large tracts of

estates in a UK town devoid of shops selling fresh fruit and vegetables. Pouliot and Hamelin (2009) found healthy food access to be particularly lacking in rural areas in Quebec, Canada, as did Smith and Morton (2009) for communities in rural Iowa and Minnesota, USA. Larsen and Gilliland (2008) used GIS to map the emergence of food deserts over time in urban London, Canada. They concluded that residents of lower SES neighbourhoods have the poorest access to supermarkets and that inequalities in this access have increased over time.

The link between accessibility and SES in Australia was highlighted by Burns and Inglis (2007). They mapped supermarket access (as a proxy for access to a healthy diet) and fast-food outlets (as a proxy for an unhealthy diet) against measures of SES in the City of Casey – a large outer municipality in Melbourne. Results indicated that while greater than 80 percent of residents lived within an eight to ten minute car journey of a major supermarket, more advantaged areas had closer access to supermarkets and less advantaged areas had closer access to fast-food outlets. Interpolating these findings, given that people living in areas of lower SES are more likely to not have access to a car, they are therefore more likely to have even less access to healthy food. In this sense, the prevalence of poor food choice and poor accessibility combine to intensify the impact of the relationship between SES and healthy food accessibility. MacIntyre (2007) discusses and questions the efficacy of these phenomena, using the label 'deprivation amplification'. This is defined as a 'process, applying across the whole range of environmental influences on health, by which disadvantages arising from poorer quality environments (for example, lack of good public transport) amplify individual disadvantages (for example, lack of private transport) in ways which are detrimental to health' (MacIntyre 2007 p. 2).

Melbourne was also the subject of an ecological study by Reidpath et al. (2002). This project examined the relationship between an area measure of SES and the density of fast-food outlets. Pizza Hut, McDonald's, Hungry Jacks, KFC, and Red Rooster stores were mapped in 269 postal districts. The study revealed a dose-response relationship between SES and the density of fast-food outlets. People living in areas with the poorest SES had two and a half times the exposure to fast-food outlets

than people in the wealthiest category. Heading north to Brisbane, the results of a study investigating whether access to retail outlets is similar across areas of varying socio-economic disadvantage were less convincing. Winkler et al. (2006) conducted cross-sectional research assessing the shopping environments of 50 randomly sampled census collection districts. They found minimal or no socio-economic differences in shopping infrastructure available.

Again, outside of Australia, yet another twist to the SES-healthy food relationship was found by Krukowski et al. (2010). Their study employed the Nutrition Environment Measures Study-Store (NEMS-S) instrument to evaluate food stores (n=42) in Arkansas, USA. NEMS-S is a standardised observational survey to measure healthy food availability. They concluded that median household income was significantly associated with the NEMS-S healthy food availability score, regardless of food store size or type. This research suggests that even in supermarkets, healthier foods are less available in lower socio-economic areas. This finding was confirmed by Jetter and Cassady (2006) in an interesting assessment of variations in the cost of healthy foods in different neighbourhoods in California, USA.

There are other studies which quantify the poor accessibility to healthy food, socio-economic disadvantage and overweight/obesity prevalence. See for example Morland et al. 2002; Riedpath et al. 2002; Block et al. 2004; Rose and Richards 2004; Winkler et al. 2006; Boyle et al. 2007; Hackett et al. 2008; Hemphill et al. 2008; Lovasi et al. 2009; Moore et al. 2008; Franco et al. 2009; Hurvitz et al. 2009; Larsen and Gilliland 2009; Oreskovic et al. 2009b; Powell and Bao 2009; Sharkey et al. 2009; Zick et al. 2009; Stafford et al. 2010. The vast majority of these studies found positive relationships between poor accessibility to food, low SES and reduced health status. Most of the research was based in the USA.



Sample Policy

'Minimum WIC* Food Stock Requirements :

Retail food vendors in counties with a population of 250,000 or more... must have in stock and available for purchase the following WIC foods...

- 1) Fresh Fruits and Vegetables: Thirty pounds of WIC-allowed fresh fruits and vegetables in at least seven varieties, two of which must be bananas and carrots.'

*The "Women's Infants and Children" program is a food stamp program initiated by the Minnesota Department of Health (USA) to increase intake of healthy foods in low income families.

Sample Evidence

'This longitudinal study reinforces cross-sectional evidence of the importance of the neighborhood environment for the development of overweight and obesity in women...initiatives to tackle social inequalities in overweight and obesity should consider neighborhood-level barriers and opportunities to women's obesity-related behaviors to be at least as important as individual-level factors.'

Stafford et al. 2010 p. 137.

Land Use Around Schools

Key Message: There is convincing evidence that regulation of land use around schools can assist in reducing child and adolescent access to unhealthy food options. Nevertheless, further studies of the food environment around schools in Australia are required.

The socio-economic gradient to the obesity epidemic also applies to children (Rosenshein and Waters 2009). Research has proposed that this relationship could be related to differential exposure to food sources in school environments. 'School food environments' are conceived as the food provided within the school (Austin et al. 2005; Neumark-Sztainer et al. 2005) as well as outlets serving foods within the vicinity of schools (Frank et al. 2006). While the built environment has little sway over the interior food environment of schools,

planning processes can, through land use zoning and regulation, influence the types of uses around educational establishments, including the density of fast-food outlets. Research has concentrated on proving a relationship between density of fast-food outlets around schools and obesity in children. Kestens and Daniel (2010) sought to examine the relationship between fast-food density around schools in low income areas. Based on the aforementioned social gradient to the childhood obesity epidemic, they hypothesised that the density of food outlets stocking calorie dense foods would be higher around schools in low income areas. Their study revealed that schools of the lowest income quartile had ten times more stores within 750 metres than schools in the highest income quartile. Eighty-one percent of schools in the most deprived areas were located within 750 metres of an outlet, compared with just 12 percent in the most affluent areas.

These findings are consistent with a Canadian study that showed higher accessibility to fast-food outlets for deprived schools (Robitaille et al. 2009 as cited in Kestens and Daniel 2010). They also concur with a Los Angeles County study that used a similar design (Simon et al. 2008). In New Zealand, both proportion of commercial land and density of fast-food outlets within 800 metres of schools were significantly positively associated with area-level deprivation. In turn this was found to be associated with childhood obesity (Pearce et al. 2007).

Taking this research beyond the association between area deprivation and obesity, Daniel et al. (2009) mapped survey data for 500,000 middle and high school students. The study, set in California (USA), found that students with fast-food restaurants within 800 metres of their schools consumed fewer servings of fruits and vegetables and drank more soft drinks. In addition, the students were more likely to be overweight or obese than were children whose schools were further from fast-food restaurants. This relationship persisted after student and school level characteristics were controlled. Further, the result was exclusive to eating at fast-food restaurants, compared with other establishments in the vicinity. The research by Daniel et al. (2009) confirms the gravity of the findings of a study which examined the concentration of fast-food restaurants in areas proximal to schools in Chicago, USA (Austin et al. 2005).

The study found that 78 percent of schools had at least one fast-food restaurant within a walkable 800 metres. Fast-food restaurants were statistically significantly clustered in areas around schools (Austin et al. 2005). Research on school environments needs to be viewed, however, in the context of the proven influence of parental intake on child consumption. For example, Van der Horst et al. (2007) completed a systematic review of environmental factors that potentially influence obesity-related dietary behaviours of children and adolescents. The conclusion was that parental intake is the strongest determinant of childhood obesity. Once again, the message is that simply changing a single element of the built environment will not necessarily result in the desired health outcome.

While built environment professionals in Australia cannot regulate the use of vending machines in the vicinity of school environments, in other countries this has been identified as an important strategy to reduce unhealthy food access for children (Ashe et al. 2007; Kestens and Daniel 2010). Soft drink contracts in schools often stipulate maximising consumption either by increasing the number of vending machines or by increasing in-school advertising (Pendergrast 2000; Wiecha et al. 2006a). In a landmark review of America's changing dietary habits, French et al. (2001) reported that soft drink consumption nearly tripled among teenage boys in the USA between 1977/1978 and 1994. Over the same period, total consumption of soft drink increased 131 percent. Redesigning vending contracts alone can therefore potentially have a substantial impact on child exposure to soft drinks.

Sample Policy

'Because drive-in businesses, fast-food restaurants and automobile service stations present certain unusual problems, they are hereby required to meet the following requirements ...

Proximity to Schools, Churches, Public Recreational Areas and Residential Lots:

No drive-in business or fast-food restaurant shall be located on a site that is within four hundred (400) feet of a public, private or parochial school, a church, a public recreation area, or any residentially zoned property.'

Section 6(D)(a), Arden Hills Zoning Ordinance, Minnesota.

Sample Evidence

'...school environments or routes to and from school.. offer strategic target areas for intervention.'

Kestens and Daniel 2010 p. 38.



Farmers' Markets and Community Gardens

Key Message: The link between exposure to community gardens and farmers' markets, with increased consumption of fresh fruit and vegetables, is obvious although difficult to quantify. Markets and gardens also facilitate community interaction and physical activity. They are an extremely valuable element of a healthy built environment.

The community-based promotion and marketing of local agriculture has recently gained popular attention as demonstrated by the increasing numbers of farmers' markets and community gardens. Urban agriculture enables communities to access well priced fresh and healthy food, undertake physical activity (Mason and Knowd 2010; Thompson et al. 2007), as well as address issues such as climate change and food security (Macias 2008). Farmers' markets and community gardens also enable connections with the land and community members, which in turn are linked to health benefits (Teig et al. 2009; Maller et al. 2010; Pearson et al. 2010). The health benefits of farmers' markets and community gardens for physical activity and social interaction have been addressed previously in this Review (see Sections 5.1.4 and 5.2.4). The discussion below explores the direct physical health benefits of farmers' markets and community gardens in their capacity to provide healthy food options.

A review by McCormack et al. (2010) identified 16 studies on the implications of farmers' market programs and community gardens on nutrition-related outcomes in adults. Their review focused not only on the potential for markets and gardens to increase healthy food intake, but the ability of these programs to affect attitudes and beliefs about buying, preparing, and eating healthy food. While inconsistent study design was highlighted as an issue, the review found that attitudes toward increasing fruit and vegetable consumption and produce preparation were generally more positive post exposure to a farmers' market or community gardening experience. The study concludes that while it is possible that exposure to farmers' markets and community gardens may increase their long-term use, it is unknown

if this is sufficient to positively affect diet.

Complementing this work, a study by Larsen and Gilliland (2009) found that a farmers' market within a community meant competition for nearby food stores. In turn, this decreased the price of fresh fruit and vegetables over a three year period. A qualitative study in Canada by Macias (2008) examined the possibility of social stratification to the emerging popularity of organic food and farmers' markets. The study found support for organic produce came primarily from highly educated professionals. Further, access to markets was limited to the geographical areas that supported them. The research concluded that the class-based disparities to market participation highlight the need for local food projects to engage across a range of social groups and geographical locations.

Studying community gardens exclusively, Hynes and Howe (2004), Thompson et al. (2007) and Wakefield et al. (2007) used qualitative methods to explore the relationship between community gardens and increased access and intake of fruit and vegetables. Wakefield et al. (2007) reported greater access to fresh fruit and vegetables as the most often cited benefits of community gardens. This included increased intake, decreased cost, and increased variety and freshness. In an Australian context, Thompson et al. (2007) examined the role of community gardens in building healthy and sustainable communities in a large high rise public housing estate in inner Sydney. Their research documents that the harvest from community gardens was perceived to have medicinal as well as nutritional value. Further, gardeners used the opportunity to grow fresh produce otherwise not accessible in Australia (Thompson et al. 2007).

Sample Policy

Marrickville Council in Sydney's inner west supports five community gardens located in schools, church grounds and community areas. The gardens have been partially funded by various Council managed community grants.

Waverley Council in Sydney's eastern suburbs provides guidance and support for residents who want to plant the public nature strips along their streets with edible produce and ornamental flowers and shrubs.

Sample Evidence

‘A ...study of 144 community gardeners in Philadelphia and 67 non-gardening controls evaluated the nutrition and economic benefits of community gardens. ...gardeners ate vegetables significantly more than comparable non-gardeners and consumed significantly fewer sweet foods and drinks and milk products...’

Hynes and Howe 2004 p. 7.

The Built Environment and Larger Scale Food Production

Key Message: Urban agricultural lands play an important part in the production and supply of healthy food to urban areas in Australia and should be protected.

The importance of preserving urban agriculture, including market gardens and farming, on the peri-urban lands around large cities is increasingly recognised in the developed world, including Australia (Paster 2004; Mason and Knowd 2010). The benefits of urban agriculture are under exploration in a variety of research fields, including agriculture, climate change, sociology, economics, planning and health (Pearson et al. 2010).

As well as supplying fresh quality produce to cities, local food production is an integral component of community building. Farmers’ markets also rely on local food production. The use of viable agricultural land around Australia’s cities for low density urban development has been the focus of recent attention. Many commentators and researchers are worried about how suburban development is destroying viable agricultural lands close to cities (Sinclair 2009). Sydney’s metropolitan fringe produces a significant amount of perishable vegetables and poultry, leading rural planning expert Ian Sinclair (2009) to label these lands as one of the State’s food bowls. The region has a suitable climate for farming, with relatively good access to water, and close proximity to a major market. However, utilising the urban fringe for agriculture poses particular difficulties for planners (Merson et al. 2010). In an effort to accommodate an ever increasing population, areas of arable land are being re-zoned for residential purposes, often

at the expense of food production (Mason and Knowd 2010). The pressures of climate change, particularly the impact on oil based transportation systems, make the preservation of productive lands in close proximity to consumers an imperative for the creation of a healthy planet able to support healthy people (Knight and Riggs 2010; Pearson et al. 2010).

Sample Policy

State Environmental Planning Policy (Rural Lands) 2008

Part 4 of this NSW planning policy has explicit provision for the protection of “state significant” agricultural lands from demand for other uses, such as housing development. State significant agricultural lands are listed in a schedule to the SEPP, however in 2010 this schedule remains blank.

Sample Evidence

‘...it is clear that land-use planning, particularly with reference to lot sizes, subdivision and zoning objectives, is of paramount importance in maintaining agricultural land on the urban fringe.’

Merson et al. 2010 p. 80.

The Built Environment and Mass Media Advertising

Key Message: In light of the comparative dearth of literature, particularly in an Australian context, on the impact of advertising signage on healthy food choices, this is an area that is under researched.

Evidence shows that foods which are most heavily advertised are those that are over-consumed, while those that receive less advertising are under-consumed (French et al. 2001). Not surprisingly, children are particularly vulnerable to food advertising (Hastings et al. 2003; Wiecha et al. 2006b; Mehta et al 2010). The issue of advertising in and around schools is one of the environmental variables impacting obesity and overweight in children. There are New Zealand and Australian based studies suggesting that the advertising



landscape around schools is dominated by the promotion of unhealthy food (Maher et al. 2005; Kelly et al. 2008). If co-located with food outlets, unhealthy food advertising messages will generally reach students, thereby presenting an opportunity for immediate purchase of promoted items at the nearby outlets (Walton et al. 2009).

There is little scope for built environment professionals to moderate the actual content of advertising signage in Australia. However, through land use zoning and regulation, local governments can control the placement of signage. There are examples of local authorities banning advertising completely in the vicinity of schools in the USA, Canada and Brazil.

Research linking the prevalence of advertising signage for unhealthy food options and poor health is limited, particularly within an Australian context. In three cities in the USA, Hillier et al. (2009) used GIS to quantify clusters of advertising signage for fast-food outlets around schools. They were able to conclude that in lower SES areas, students were exposed to more fast-food advertising. This research relates to the work of Austin et al. (2005) which found fast-food restaurants to be statistically significantly clustered in areas around schools. Such research may well say more about the location of schools in the vicinity of commercial areas. This exposes one of the risks of encouraging mixed use and mixed density development. Nesting schools within the community hub of a commercial area is a land use practice encouraged by healthy planning guidelines such as the WA Liveable Neighbourhoods Code (Western Australian Planning Commission 2004). Care must be taken to ensure that the school environment is still protected from unnecessary exposure to advertising and retailing of unhealthy food options.

In an innovative New Zealand study, Walton et al. (2009) considered the impact of the food and advertising environment immediately around four schools on their efforts to encourage healthy eating. The researchers calculated the number of food outlets and advertisements passed by the students (n=792) on their way to these schools. School management personnel were also interviewed. The conclusion was that where children passed more outlets and

advertisements for unhealthy food, school management perceived that their efforts to improve the in-school food environment were less successful.

Sample Policy

São Paulo's Law No. 14223 - The Clean City (Brazil)

This controversial legislation passed in 2006 prohibits any type of outdoor advertising such as billboards, panels on the facades of buildings and advertising on moving vehicles within certain areas of the city.

Sample Evidence

'It's advertising outside the school that would prevent us from promoting [healthy nutrition more]. Go past the local dairy and it's advertised a dollar pie, and then they have got candy floss in the window and you know they are only a dollar. You put a muesli bar next to that candy floss and you know its \$2.50 for a muesli bar.'

Quote from school official as cited in Walton et al. 2009 p. 845.

5.3.5 Strengths and Weaknesses in the Research

This body of research suffers from similar limitations to the other domains. This includes a lack of standardised methodologies for measuring the built environment and a paucity of longitudinal studies to support causal inferences. However, research on healthy food provision is less developed than that linking the built environment and physical activity. This is evidenced by the small number of Australian studies.

The link between food accessibility, exposure, choice, SES and health is generally accepted. Nevertheless, research results are mixed and fail to indicate an enduringly consistent or quantifiable relationship. This is particularly so for environments outside the USA, as discussed in detail in Cummins and MacIntyre (2006). The mixed results prompt consideration of the possibility that there is a strong cultural attachment to the way food is purchased and consumed, compared with the way that people move and interact with their environment. The built environment's ability to provide healthy food options is potentially very sensitive to the specificities of cultural and social norms within place. Accordingly, reliance on an evidence base collated across geographical, legislative and social boundaries is particularly impractical and unhelpful. This suggests the need for qualitative, culturally relevant research which is more attuned to the idiosyncrasies that define our complex relationship with food – both its purchase and consumption. The lack of such studies is a major weakness in this domain and prevents recommendations for tangible policy development.

5.3.6 HBEP Opportunities for Future Research

Detailed, Contextual Research on the Impact of Healthy Food Accessibility on Health in Australia

Research is required on all aspects of the built environment's impact on healthy food exposure in Australia. While a number of large scale studies have been undertaken assessing availability of unhealthy food, their results need to be further explored

through detailed quantitative and qualitative analysis. Development of a body of culturally sensitive research undertaken in different cities and towns will allow more reliable generalisations to underpin policy.

An example of one such study is Coveney and O'Dwyer (2009). They used qualitative methods in their contextual analysis of food accessibility in Adelaide, Australia. They explored the concept of food deserts and the difficulties imposed by distance from home to shops for those without car access in a low density suburban environment. The study provides genuine insights into the practical implications of living within a non-walkable distance of a reasonable supermarket and not having access to private transport. Difficulties, such as catching a bus laden with shopping bags, or crossing a busy road to the supermarket with children in tow, make the implications of sprawling suburbs on healthy food availability very real. The main conclusion is that food access problems do not present as 'food deserts' defined elsewhere. In Adelaide there are not vast tracts of urban areas lacking the services of a supermarket or fruit and vegetable store as has been reported in the USA and UK. In many Australian cities, the lack of private transport can severely limit access to places selling healthy foods. It is therefore not that reasonably priced healthy food is unavailable to purchase in shops; rather the distances between these shops are too great to be accessed without a car. And while not part of Coveney and O'Dwyer's study, their work raises serious implications for people with mobility impairments gaining access to healthy food. Given the increasing realities of climate change and the already explored benefits of non-car reliance for health, the way the study looks at food access through the lens of car reliance is also pertinent. In addition, the recommendations for healthy built environments encouraging utilitarian physical activity, such as accessibility and mixed uses providing smaller distances between destinations, apply to healthy built environment strategies aimed at increasing access to healthy food.

Contextualised studies should incorporate analysis of smaller scale retail environments. Juxtaposed to large scale quantification of fast-food accessibility, detailed research is required on the kind of food choices available at all outlets. This research should include neighbourhood



coffee shops, restaurants, supermarkets, convenience and corner stores, as well as take away food shops and fast-food outlets. To undertake this kind of detailed analysis, further collaboration with health professionals is required to better understand and develop standardised measures of what is an unhealthy food environment.

The Impact of Lost Urban Agricultural Land

Further research is required on the impact of residential and other development on the urban fringe of Australian cities in relation to food supply and subsequent health. Food chains for fresh produce are relatively informal. Research is only just beginning to quantify the amount of fresh food produced in urban market gardens. This work needs to be drawn into the study of healthy built environments in the context of healthy food access, particularly across the socio-economic spectrum.

The Co-Location of Food Advertising and Food Outlets

Australian research is required on the impact of outdoor food advertising in relation to food choices for both children and adults. Investigations could include innovative collaborations with advertising and marketing professionals to better understand the way outdoor advertising is used to influence consumer behaviour. This research should focus on the way the built environment can influence the co-location of outdoor food advertising and food retail outlets in Australia. There is an opportunity to study the impact of such co-location, as well as monitor the success of attempts to limit outdoor advertising.

5.3.7 Policy Implications

- The most convincing literature concerns the co-location and advertising of unhealthy food options near schools. Policies to reduce fast-food exposure in the vicinity of school environments are justified. Interestingly, this research has received global attention from an array of stakeholders and is already influencing policy making in the health insurance industry (Mohan et al. 2010).
- Given the relative dearth of research on the impact of the built environment on healthy eating options in an Australian context, it is difficult to recommend further policy change beyond that already discussed for encouraging physical activity.

5.3.8 Summary of Key Messages

Food Accessibility – Generally

There is a logical link between exposure to healthy food options and healthy eating, with research suggesting that access to a supermarket or other reliable source of fresh, healthy produce will improve dietary intake. Attempts to quantify this relationship, however, have been based on mixed methods and have produced mixed results.

Food Accessibility and Socio-Economic Status

Studies have consistently shown that access to healthy food is more difficult in lower SES areas. The majority of this research has been undertaken in the USA. Detailed studies on actual accessibility to, and variety within food environments in lower SES areas in Australia are required.

Land Use Around Schools

There is convincing evidence that regulation of land use around schools can assist in reducing child and adolescent access to unhealthy food options. Nevertheless, further studies of the food environment around schools in Australia are required.

Farmers' Markets and Community Gardens

The link between exposure to community gardens and farmers' markets, with increased consumption of fresh fruit and vegetables, is obvious although difficult to quantify. Markets and gardens also facilitate community interaction and physical activity. They are an extremely valuable element of a healthy built environment.

The Built Environment and Larger Scale Food Production

Urban agricultural lands play an important part in the production and supply of healthy food to urban areas in Australia and should be protected.

The Built Environment and Mass Media Advertising

In light of the comparative dearth of literature, particularly in an Australian context, on the impact of advertising signage on healthy food choices, this is an area that is under researched.

6.0 Professional Development



Apart from the three key domains initially identified for this Review, there is an additional and emerging theme relating to the translation of research into policy. We have labelled this Professional Development. The theme encompasses case studies illustrating good practice models for policy change, research on cost benefit analysis, together with market demand to encourage appropriate policy. In addition, there is scholarship on the theoretical underpinnings of healthy built environments, such as the nature of evidence. In essence, this theme embodies literature that relates to developing healthy built environment interdisciplinary relationships.

Case Studies of Local Initiatives

There are a multitude of published articles describing case studies on built environment policy interventions to encourage health. For example, Hall et al. (2010) use qualitative methods to assess the ongoing impact of the World Health Organisation's (WHO) Healthy Cities Program in Brighton and Hove in the UK. Wooten (2010) assesses barriers to the application of health impact assessment to the planning process for various communities in northern California. Dobson and Gilroy (2009) assess the implementation of active living goals in two disparate communities in Oregon, USA as do Huberty et al. (2009) in Nebraska, McCreedy and Leslie (2009) in Orlando, and Santana et al. (2009) in Portugal. Kelder et al. (2009) present an interesting assessment of the implementation of Texas Senate Bill 19 to mandate physical activity in the State's elementary schools. Similarly, Raczynski et al. (2009) assess the implementation of legislation in neighbouring Arkansas. Providing guidance to educators, Botchwey et al. (2009) evaluate graduate-level courses in the US that address the built environment and health relationship. They then describe in detail their interdisciplinary curriculum for a locally delivered course developed to educate planners and public health officials. Thompson and Capon (2010) provide an Australian based assessment of the effectiveness of tertiary healthy built environment education for both urban planners and health students. Hess (2009)

investigates disparities between the visions of planners and the work of engineers in attempts to bring pedestrian oriented streets to Toronto.

The above mentioned are recent examples of this burgeoning body of literature. There are other studies describing and evaluating healthy built environment interventions from around the world. In addition, there are excellent locally relevant unreviewed case studies published on various Australian websites such as the NSW's Premier's Council for Active Living (PCAL) (www.pcal.nsw.gov.au) and Healthy Places and Spaces (www.healthyplaces.org.au). In the USA, there is the Active Living Research project (www.activelivingresearch.org).

Structural and Individual Behaviour Change

Influencing and Implementing Policy

This literature is based on studies that explore stakeholder perspectives of healthy built environments. The objective of the research is to understand how policy change can be enacted. Studies include interviews with relevant stakeholders: planning professionals and local government staff (Allender et al. 2009; Thomas et al. 2009); retailers (Clark et al. 2010); public health officials (Schwarte et al. 2010); legislators (Dodson et al. 2009); developers (Grant 2009); families (Withall et al. 2009) and community advocates (Richards et al. 2010). This research provides a rich understanding of some of the common barriers to, and opportunities for, implementing healthy built environments from people directly involved. The general and perhaps unsurprising conclusion is that stakeholder perspectives are diverse, and that change must be justified by fully assessing the costs and benefits. Stakeholders are most often motivated by the implications of change for budget savings, with resource constraints frequently identified as a barrier. Locally based publicity is also important, implying that change must not just be quantifiably beneficial, but demonstrably so.

A number of studies explore specific ways to develop healthy built environment policy. This research differs from the case study work mentioned above because it often tests a method across more than one location or jurisdiction.

Recognising that policy interventions depend on the policymaker's ability to identify communities most at need, Chen and Florax (2010), for example, used GIS methods to assess the economic feasibility of implementing changes to zoning regulations to encourage healthy food accessibility. Goldstein (2009) outlines a structure for the development of advocacy policy to reduce obesity in children across multiple cases in California. In an Australian context, Harris et al. (2009) developed an audit tool to assess the inclusion of health considerations in environmental impact assessment of major projects in NSW. Similarly, Barton and Grant (2008) outline a tool for more comprehensive health impact assessment in development appraisal based on their experience in the UK.

Another emerging body of scholarship explores the way that healthy built environment related research can best be used to influence policy. This work encompasses discussion on bridging gaps in understandings between built environment and health for both policy makers and researchers. For example, Moodie (2009) uses Melbourne based illustrations to develop a set of guidelines for researchers to influence health policy through the establishment of common interests and respectful relationships.

Informing policy makers is also the subject of studies examining methods for reviewing healthy built environment literature. McCall and Connor (2010) emphasise the need for systematic, rather than narrative reviews in public health research. Weaver et al. (2002) developed a specific methodology for conducting healthy built environment literature reviews. Their study assessed varying systematic reviews that investigated aspects of the built environment and public health up to 2002. Disconcertingly, they reveal that more than 25 percent of these reviews had entirely ignored relevant built environment literature.

Theorising Processes of Change

Also related to facilitating healthy built environments is a body of literature that applies traditional theories of behavioural and structural change to bring this about. Dunton et al. (2009), for example, look at the application of behavioural change theories to prioritisation of policies encouraging physical activity. Their main conclusion is that successful built environment

interventions have to be accompanied by other educational and incentive based programs. This is affirmed by Sallis et al. (2006) in their application of ecological theories of behaviour to encourage active living. Filion (2010) applies structuration theory to identify characteristics of urban structure and human function within that structure, which act as barriers to the transition from low-density, automobile-dependent environments to healthier built forms. Filion concludes that when compared to other periods of significant urban change (such as the post industrial shift to separate land uses or the post World War II movement to low density), there is an insufficient critical mass of institutional and financial motivation to implement healthy built environments.

Cost Benefit Analysis and Market Incentives

Fulfilling the need to effect policy change is an emerging body of research on cost-benefit analysis of healthy built environment interventions. Convincing recent Australian evidence of the cost of ill health related to the lack of physical activity is revealed in a study by Colagiuri et al. (2010). This research used data for 6,140 participants from the Australian Diabetes, Obesity and Lifestyle study, collected in 2004-2005. It was concluded that in 2005 the total annual direct cost of overweight and obesity for Australia was \$21 billion – substantially higher than previous estimates.

Also with a focus on incentivising the development of healthy built environments is a body of research analysing market demand for, and developer perspectives of these environments. Carnoske et al. (2010), for example, surveyed 4,950 real estate agents and 162 developers in the USA. The aim was to assess factors influencing homebuyers' decisions, as well as incentives and barriers to developing healthy built environments. The researchers concluded that there is a perception of increased residential demand for healthy built environments. However, developers, in particular, perceive significant barriers to creating these communities (Carnoske et al. 2010). The limitations of local government politics and regulations perceived by developers were also confirmed by other literature (see for example Levine and Inam 2004). In a larger scale study of actual consumers, Handy et

al. (2008) analysed data from two surveys from 2003 (n= 5,873) and 2005 (n=12,630) to assess changes in consumer support for 'Traditional Neighbourhood Design' (TND). Surveys described a traditionally designed neighbourhood and asked respondents 'how much would you support the development of communities like this in your area?' The study concluded that support for TNDs had increased from 44 to 59 percent from 2003 to 2005.

In summary, Professional Development scholarship is emerging as a forum for the interdisciplinary exchange of examples, ideas and commentary. It is imperative that these innovative lines of communication remain open. The fact that tangible discussions on policy relevant research are only just emerging is indicative that this discipline area is in its infancy. It is often remarked that health and planning have been successful partners in the past. However, it is worth remembering that this partnering was not within the existing neo-liberal framework of academic, political and policy silos. Care must be taken to develop the healthy built environment profession as truly interdisciplinary through continued exchange that promotes understanding, respectful relationship building, together with fruitful engagement for effective and lasting change.



7.0 Conclusion

This Review reveals a burgeoning literature on healthy built environments across the three domains of Getting People Active, Connecting and Strengthening Communities and Providing Health Food Options. Key messages from the evidence have been summarised in reference to each of these domains and are not further elaborated here. Rather, the Conclusion discusses the essential attributes of the relationship between health and the built environment that need to be recognised and enacted to progress both the research and its translation into effective policy.



The Introduction highlighted that the impact of the built environment on health and well-being is contextual. Accordingly, policy responses will differ in relation to spatial context, demographic character, environmental quality and temporality. Recommendations for standardised measurements risk underestimating the diversity of people and place, particularly when attempts are made to compare results between and across populations and locations. And while there is a role for standardising some variables (such as the use of BMI as a way to define the healthy weight range), standardised measures should not be viewed as a prerequisite to 'prove' the relationship between the built environment and health.

Acknowledging contextuality in relation to research into the health determinants of place must not be viewed as an impediment to the search for elements of commonality. It needs to be taken seriously in both the application of research to policy, and the design of future research agendas. Various studies reported here discuss ways to avoid the excuse of context, with the strongest recommendation being that methods should be transparent and at least situated within, but not necessarily echoing, the existing research agenda. This implies that future research should build on the findings of previous work, and comprehensively detail the measures and methods used.

Early in this Review it was established that modifications to the built environment need to be part of a policy mix to be successful in getting people active, connecting and strengthening communities and providing healthy food options. The importance of the policy mix is encompassed by Ewing and Cervero's (2010) 'elasticity' theory. This states that active transport is unresponsive to small scale built environment

modifications but responsive to an integrated range of built environment modifications, educational programs, incentives and restrictions. To be successful, behavioural change encouraged by a policy mix requires consistent and meaningful interdisciplinary collaboration. This necessitates seeking new, potentially more comprehensive ways of understanding the impacts of policy development, amendment and implementation. It also demands that both researchers and practitioners from the built environment and health recognise that their accepted wisdoms and assumptions are not necessarily shared, nor understood, beyond their own disciplinary boundaries. Successful healthy built environment partnerships rest on deliberative interdisciplinary engagement. At its heart is an eagerness to listen and learn about the other. This extends from disciplinary culture to ways of collecting and measuring data, reporting results and the subsequent translation into policy.

As collaboration ensues, the contested nature of places and the qualities of people who live, work, travel and interact within and between them will become apparent. There will never be a single set of 'rules' for managing health outcomes in the built environment. The most achievable and acceptable healthy built environment may not be the most economically productive, the most politically expedient or even the most environmentally friendly. Akin to the challenging nature of interdisciplinary collaboration, the demands and desires of competing stakeholders will have to be managed through negotiation, willingness to explore new solutions and, ultimately, an acceptance of compromise.

An exciting and useful body of research is emerging, focusing on the way the healthy built environment



profession can develop to work together in the future. This research is discussed in Section 6 and includes case studies on excellent practice models for policy development, research on cost benefit analysis and market demand to encourage policy change. Research on the theoretical underpinnings of healthy built environment relationship building is also included. This is an emerging forum for interdisciplinary exchange of ideas, examples and commentary. It is imperative that this be pursued as a research agenda concurrent with empirical explorations.

This Review brings together an evidence base of existing research to inform healthy built environment policies and actions. It also contributes to the identification of areas of research evidence paucity. The Review's key message is that there is a strong relationship between people's health and the built environment and that this relationship is complex and contextual. This needs to be recognised as we work together in understanding how best to ensure that the places where people live and work support physical activity, social connection and access to healthy food as cornerstones of everyday living.

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Appendices

1. **Diary of Database Searches**
2. **Glossary**
3. **Annotated Bibliography**





South Equipment

South Equipment

IM&F

IM&F

WINNER

Appendix 1: Diary of Database Searches



Method of Data Collection:

The following major Boolean Query was developed using relevant key terms sourced from other reviews. The terms were then applied in various ways to the databases as listed in the review diary table below.

basic built environment terms (built composition, infrastructure and planning processes/themes, not use):

('built environment' OR sprawl OR neighbourhood* OR neighborhood* OR metropolitan OR rural OR urban* OR 'urban form' OR facilities OR architecture OR destination* OR location OR feature OR distance* OR density OR access* OR planning OR plan* OR 'urban design' OR 'neighborhood development' OR 'neighbourhood development' OR 'smart growth' OR outdoor OR indoor OR connectivity OR 'new urbanism' OR building* OR school OR 'land use' OR amenity OR amenities OR safety OR 'green space' OR 'public space' OR 'open space' OR 'mixed use*' OR housing OR landscape OR 'grid street' OR street OR 'cul-de-sac' OR playground* OR stair* OR park OR parks OR trails OR path OR sidewalk OR equipment OR trail OR 'rail-trail' OR street* OR greenway OR greenways)

AND (#1) – physical activity terms (motion and movement, not resultant health outcomes)

('active living' OR inactivity OR inactive OR fit OR fitness OR leisure OR television OR TV OR walk OR walking OR cycle OR cycling OR bike OR bikers OR biking OR bicycle OR bicycling OR sedentary OR exercise OR exercising OR exerciser* OR 'physical activity' OR 'physically active' OR play OR playing OR recreation*)

AND (#2) – transport terms (related to mobility and use, not infrastructure)

('non motorized' OR NMT OR 'multimodal transportation' OR 'active transport*' OR driving OR car OR cars OR automobile OR journey OR travel* OR walk OR walking OR cycle OR cycling OR bike OR bikers OR biking OR bicycle OR bicycling OR commut* OR vehicle OR pedestrian OR pedestrians

OR transit OR route OR routes OR walkab* OR congestion OR traffic OR 'transit oriented development')

AND (#3) – health terms (mental, physical and community health)

(health OR 'public health' OR obese OR obesity OR weight OR overweight OR 'mental health' OR soci* OR community OR communities OR obesogenic OR crime OR 'body mass index' OR BMI OR cancer OR 'heart disease' OR 'non communicable disease' OR anxiety OR stress OR depression OR diabetes OR equity OR diversity OR 'neighbourhood interaction' OR alcohol*)

AND (#4) – common terms/catch phrases

('healthy places' OR 'healthy communities' OR 'community gardens' OR 'healthy built environments' OR 'transit oriented development' OR 'new urbanism' OR 'healthy places' OR 'healthy communities' OR 'smart growth')



Search	Database	Keywords	Comments
1	Scopus	'built environment' and 'mental health'	Too many hits (>1000)
2	Scopus	'built environment' and 'chronic disease'	Too many hits
3	Scopus	'built environment' and soci*	Too many hits
4	Scopus	mobility and disease	Too many hits
5	Scopus	transport*and disease	Too many hits
6	Scopus	'built environment' and (mobility or transport* or transit of 'active transport')	Too many hits
7	Scopus	'healthy places'	Too many hits
8	Scopus	'healthy communities'	Too many hits
9	Scopus	'community garden'	Too many hits
10	Scopus	'transit oriented development'	Too many hits
11	Scopus	'healthy built environments'	Too many hits
12	Scopus	('built environment' OR plan* OR sprawl OR density OR 'open space') AND (active* OR inactive* OR walk* OR cycle* exercise* OR 'physical activity' OR recreation*)	Aim: to search for built environment and physical activity. Many relevant refs, manageable hits.
13	Scopus	('built environment' OR plan* OR sprawl OR density OR 'open space') AND ('active transport*' OR journey OR transport OR walk* OR cycle OR commut* OR congestion)	Aim: to search for built environment and transport.
14	Scopus	('built environment' OR plan* OR sprawl OR density OR 'open space') AND (health OR obes* OR 'mental health' OR 'body mass index' OR BMI OR cancer OR 'heart disease' OR 'non communicable disease' OR anxiety OR stress or depression OR diabetes)	Not enough hits
15	Scopus	('built environment' OR plan* OR sprawl OR density OR 'open space') AND (health OR depression OR obesity OR 'mental health' OR cancer OR diabetes)	Too many hits
16	Scopus	('built environment' OR plan* OR sprawl OR density OR 'open space') AND (health OR depression OR obesity OR 'mental health' OR cancer OR diabetes) AND (crime OR soci* OR community OR communities OR equity OR diversity OR 'neighbourhood interaction' OR alcohol*)	Aim: to search for built environment and physical health and social health.
17	Scopus	((('built environment' OR plan* OR sprawl OR density OR 'open space') AND (health OR depression OR obesity OR 'mental health' OR cancer OR diabetes)) AND (('built environment' OR plan* OR sprawl OR density OR 'open space') AND (health OR depression OR obesity OR 'mental health' OR cancer OR diabetes) AND (crime OR soci* OR community OR communities OR equity OR diversity OR 'neighbourhood interaction' OR alcohol*)))	Combined searches #15 and #16 with AND, narrowed hits to 200.

Search	Database	Keywords	Comments
18	Informit Databases: Health Collection Humanities & Social Sciences Collection ARA-FT - Australian Public Affairs APAIS-Health - Australian Public Affairs Information Service - Health ATRI - Australian Transport Index Health & Society Database RURAL - Rural and Remote Health D'base	('built environment' OR 'town plan' OR 'urban sprawl' OR 'urban design' OR 'open space' OR 'land use mix' OR destinations) AND (active* OR inactive* OR walk* OR cycle* exercise* OR 'physical activity' OR recreation*) In 'subject' fields	Aim: to search for built environment and physical activity
19	As above	('built environment' OR 'town plan' OR 'urban sprawl' OR 'urban design' OR density OR 'open space') AND (active transport* OR journey OR transport OR commut* OR congestion OR traffic) In 'subject' fields	Aim: to search for built environment and transport Too many hits.
20	As above	('built environment' OR 'town plan' OR 'urban sprawl' OR 'urban design' OR density OR 'open space') AND (active transport* OR journey OR transport OR commut* OR congestion OR traffic) AND Health (in all fields)	As per search #19 but with 'health' added in 'all fields'. Narrowed search to 200.
21	As above	('built environment' OR 'town plan' OR 'urban sprawl' OR 'urban design' OR 'open space' OR 'land use mix' OR destinations) AND (health OR depression OR obesity OR 'mental health' OR cancer OR diabetes OR 'heart disease') (crime OR soci* OR community OR communities OR equity OR diversity OR 'neighbourhood interaction' OR alcohol*) (built environment' OR 'town plan' OR 'urban sprawl' OR 'urban design' OR density OR 'open space')	Aim: to search for built environment and health. About 50 hits, 75% retained as relevant.
22	As above	('built environment' OR 'town plan' OR 'urban sprawl' OR 'urban design' OR 'open space' OR 'land use mix' OR destinations) AND (public transport' OR journey OR transport OR commut* OR congestion OR traffic)	Aim: to search for built environment and social health.
23	As above	(health OR walk* OR cycling OR 'active transport' OR 'physical activity')	Aim: to search for built environment and transport and health. About 50 hits, 65% relevant.

Search	Database	Keywords	Comments
24	Medline	neoplasms/ or cardiovascular diseases/ or 'nutritional and metabolic diseases'/ or 'disorders of environmental origin'/ or 'behavior and behavior mechanisms'/ or 'psychological phenomena and processes'/ or mental disorders/ or demography/ or 'quality of life'/ or food/ AND 'cost of illness'/ or age distribution/ or family characteristics/ or health status/ or health transition/ or local government/ or minority groups/ or social environment/ or social isolation/ or 'activities of daily living'/ or automobile driving/ or exercise/ or physical fitness/ or travel/ or work/ or 'food and beverages'/ or running/ or swimming/ or walking/ or Exercise/ AND environment design/ or city planning/ or urban renewal/'facility design and construction'/ or 'elevators and escalators'/ or 'location directories and signs'/or cities 'built environment' OR plan* OR sprawl OR density OR 'open space' AND (health OR depression OR obesity OR 'mental health' OR cancer OR diabetes)	Used Medline thesaurus to search for 1. Disease AND 2. Activity/movement or social/demographic/political environments AND 3. Built environment characteristics. Narrowed to 150 refs, about 60% relevant.
25	Urban Studies Abstracts	'built environment' OR plan* OR sprawl OR density OR 'open space' AND (health OR depression OR obesity OR 'mental health' OR cancer OR diabetes)	Aim: to search for built environment and health
26	Urban Studies Abstracts	'built environment' OR plan* OR sprawl OR density OR 'open space' AND (crime OR soci* OR community OR communities OR equity OR diversity OR 'neighbourhood interaction' OR alcohol*) AND Health	Aim: to search for built environment and social health Some really good historical references.
27	Urban Studies Abstracts	{activeN2transport* OR journey OR transport OR commut* OR congestion OR traffic OR transitN1orientedN1development OR walking OR cycling} AND (builtN2environment OR townN2 plan* OR urbanN2sprawl OR urbanN2design OR density OR openN2space OR cities OR land) AND (exercise OR health)	Aim: to search for built environment and mobility and health
28	Web of Knowledge	(built environment OR plan OR sprawl OR density OR open space) AND =(crime OR social OR community OR communities OR equity OR diversity OR neighbourhood interaction OR alcohol AND health OR depression OR obesity OR 'mental health' OR cancer OR diabetes AND 'public transport' OR journey OR transport OR commut* OR congestion OR traffic	Aim: to search built environment, social health/community, health and transport. Mistakes in Boolean phrase.
29	Web of Knowledge	density+housing OR built+environment OR sprawl OR open+space OR urban+environment OR town+planning AND public+transport OR journey OR transport OR congestion OR traffic OR active+transport OR walking OR walk OR cycling	Aim: to search built environment and transport including active transport.

Search	Database	Keywords	Comments
30	Web of Knowledge	density+housing OR built+environment OR sprawl OR open+space OR urban+environment OR town+planning AND crime OR social OR community OR communities OR equity OR diversity OR neighbourhood+interaction OR alcohol OR social+capital OR neighbourhood OR neighborhood transit+oriented+development OR community+garden OR healthy+planning OR healthy+built+environment OR new+urbanism OR smart+growth	Aim: to search built environment and social health. Saturation reached, many references retrieved however nothing new.
31	Web of Knowledge	public transportation OR active commuting school OR active transport OR active commuting OR cycling exercise OR walking AND built environment OR obesity built environment OR built environment physical activity	Aim: to search relevant key phrases in a health context. Many good references added.
32	Pubmed	neighborhood OR neighbourhood OR neighborhood safety OR community OR crime OR equity OR social capital AND built environment OR obesity built environment OR built environment physical activity Community gardens	Aim: to search built environment/health and transport/physical activity.
33	Pubmed	neighborhood OR neighbourhood OR neighborhood safety OR community OR crime OR equity OR social capital AND built environment OR obesity built environment OR built environment physical activity Community gardens	Aim: to search built environment/health and social health.
34	Pubmed	Community gardens	No new hits
35	Incorporated all refs from 'Linking Health and the Built Environment' – Ontario Healthy Communities Coalition		
36	Incorporated all refs from NSW Health review in draft 'Urban Design and Health'		
37	Incorporated all refs from 'Accessibility to Resources and its Links to Health Behaviours.'		

Appendix 2: Glossary





Term	Definition
Accelerometer	A monitoring device that measures the intensity of an activity. (TRB Report 2005)
Active Frontage	Street frontages where there is active visual engagement between those in the street and those on the ground floors of buildings. This quality is assisted where the front facade of buildings, including the main entrance, faces and opens towards the street.
Active Travel	Walking, cycling and/or using public transport.
Amenity	The qualities, characteristics and attributes people value about a place which contributes to their quality of life. These include the physical landscape or streetscape; areas of vegetation and public and private open space for recreation; urban design, including the scale and dominance of buildings; historic and cultural heritage; public views and outlooks; privacy; physical safety; and the accessibility of places.
Behavioral Risk Factor Surveillance System (BRFSS)	The Behavioral Risk Factor Surveillance System (BRFSS) is the world's largest, on-going telephone health survey system, tracking health conditions and risk behaviours in the United States yearly since 1984.
Biophilia	The hypothesis that humans have an inherent inclination to affiliate with Nature has been referred to as Biophilia. Biophilia implies affection for plants and other living things. (Grinde and Patil 2009)
Body Mass Index (BMI)	A measure of someone's weight in relation to height. The calculation of one's BMI entails dividing one's weight in kilograms by the square of one's height in centimetres. (TRB Report 2005)
Built Environment (BEnv)	Defined broadly to include land use patterns, the transportation system, and design features that together provide opportunities for travel and physical activity. Land use patterns refer to the spatial distribution of human activities. The transportation system refers to the physical infrastructure and services that provide the spatial links or connectivity among activities. Design refers to the aesthetic, physical, and functional qualities of the built environment, such as the design of buildings and streetscapes, and relates to both land use patterns and the transportation system. (TRB Report 2005)
Case-control Studies	Studies in which exposure to an acknowledged risk factor is compared between individuals from the same population with and without a condition. For example, individuals could be sorted on the basis of their activity level (e.g., active versus sedentary) into case and control groups to see whether there are statistically significant differences in environmental characteristics that may influence the propensity of the two groups to be physically active. (TRB Report 2005)
Commute	To commute is to travel back and forth regularly. In planning literature the commute generally refers to the regular trip from home to work and vice versa.
Connectivity	The directness of travel between destinations, which is influenced by the kind of intersections and their density in a given area. (Gebel et al. 2005)
Cost-Benefit Analysis (CBA)	An analysis in which the economic and social costs of medical care and the benefits of reduced loss of net earnings due to preventing premature death or disability are considered. (Pencheon et al. 2006)
Crime Prevention Through Environmental Design (CPTED)	A crime prevention strategy that focuses on the planning, design and structure of cities and neighbourhoods. It reduces opportunities for crime by using design and place management principles that reduce the likelihood of essential crime ingredients (law, offender, victim or target, opportunity) from intersecting in time and space. (Lette and Wiggins 2010)

Term	Definition
Critical Mass	A socio-dynamic term to describe the existence of sufficient momentum in a social system, such that the momentum becomes self-sustaining and fuels further growth.
Cross-Sectional Studies	Studies that examine the relationship between conditions (e.g. physical activity behaviours) and other variables of interest in a defined population at a single point in time. Cross-sectional studies can quantify the presence and magnitude of associations between variables. Unlike longitudinal studies, however, they cannot be used to determine the temporal relationship between variables, and evidence of cause and effect cannot be assumed. (TRB Report 2005)
Cul-de-sac	A street that is closed at one end. This is a typical feature of the suburban-style street layout and contributes to lower levels of connectivity. (Gebel et al. 2005)
Curvilinear Street Networks	Street networks characterised by cul-de-sacs and not based on a grid (see also Dendritic Street Networks).
Decentralisation	Movement of population and employment away from city centres. (TRB Report 2005)
Dendritic Street Networks	Street networks characterised by cul-de-sacs and not based on a grid (see also Curvilinear Street Networks).
Density, Diversity and Design or 'The Three Ds'	The three 'Ds' of Neighbourhoods are Density, Diversity and Design. <ul style="list-style-type: none"> • 'Density' is usually measured in terms of population, or residential housing units within a given urban area. • 'Diversity' refers to the extent of mix of different land uses within a neighbourhood. • 'Design' within a neighbourhood includes street network characteristics such as dense grids of highly interconnected streets to sparse suburban networks of curvilinear non-connecting streets. (Mead et al. 2006)
Derived Travel	Travel individuals do to engage in activities in other places, such as work, recreation, shopping and health services. (Krizek et al. 2009)
Dose-Response Relationship	The relationship between the amount of exposure (dose) to an intervention and the resulting changes in health (response).
Ecological Model	Based on social cognitive theory, which explains behaviour in terms of reciprocal relationships among the characteristics of a person, the person's behaviour, and the environment in which the behaviour is performed. Ecological models emphasise the role of the physical as well as the social environment. (TRB Report 2005)
End-of-Trip Facility	Items required at a destination to facilitate the use of walking and cycling as an alternative means of transport. This includes facilities which cater for the needs of both the cyclist and their equipment (e.g. bike racks). (Lette and Wiggins 2010)
Energy Expenditure	Represents the sum of three factors: <ul style="list-style-type: none"> (a) resting energy expenditure to maintain basic body functions (approximately 60 percent of total energy requirements); (b) processing of food, which includes the thermic effect of digestion, absorption, transport, and deposition of nutrients (about ten percent of total requirements); and (c) non-resting energy expenditure, primarily in the form of physical activity (about 30 percent of total requirements). (TRB Report 2005)

Term	Definition
Energy Imbalance	The situation that occurs when energy intake (calories consumed) exceeds or is less than total daily energy expenditure. Weight gain occurs when energy intake exceeds total daily energy expenditure for a prolonged period. (TRB Report 2005)
Evidence-Based Health Care/ Medicine/ Public Health	Systematic use of evidence derived from published research and other sources for management and practice (Pencheon et al. 2006)
Exercise	A subcategory of physical activity defined as that which is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is the objective. (TRB Report 2005)
Experimental Studies	Studies in which subjects are randomly assigned to the exposures of interest and followed for the outcome of interest. The most persuasive scientific evidence of causality usually is derived from experimental studies of individuals. The important advantages of experimental studies are that researchers have considerable control over all aspects of the study, including the type of exposure, the selection of subjects, and the assignment of exposure to the subjects. (TRB Report 2005)
Focus Group	A small, convenient sample of people brought together to discuss a topic or issue with the aim of ascertaining the range and intensity of their views, rather than arriving at a consensus. (Pencheon et al. 2006)
Geographic Information Systems (GIS)	Automated systems for the capture, storage, retrieval, analysis, and display of spatial data. (TRB Report 2005)
Global Positioning System (GPS)	A worldwide radionavigation system comprising a constellation of 24 satellites and their ground stations. GPS uses these satellites and ground stations as reference points to calculate positions accurate to a matter of meters. (TRB Report 2005)
Greenness	A measure of the amount and quality of vegetated areas, such as parks, open space and playgrounds, in an area. (Sugiyama et al. 2008)
Grey Literature	Grey literature is information which has not been published or which, although published, cannot be found through readily accessible sources. Grey literature can take many forms across multiple disciplines, including conference proceedings, theses and dissertations, research and technical reports, census information, and ongoing research. (The Community Guide, 2010)
Hard Measures	Physical factors directly affected by policy changes. May include development patterns, street layout, bicycle lanes, foot paths, intersections, bicycle parking, etc. (Krizek et al. 2009)
Health	A state of complete physical, mental, and social well-being, not merely the absence of disease or infirmity. (TRB Report 2005)
Health Impact Assessment (HIA)	An assessment process to look at the impact of government policies or other actions, completed or projected, on health. (Pencheon et al. 2006)
Healthy Built Environment	A healthy built environment is an environment that is supportive of people's health as part of everyday living.

Term	Definition
Incidental Physical Activity	Physical activity undertaken as part of day to day activity. Physical activity that is associated with a specific purpose other than to be active, for example, walking to a destination for a purpose, climbing the stairs in a building or undertaking domestic tasks. Also referred to as Utilitarian Physical Activity.
Land Use Mix	Diversity or variety of land uses (e.g., residential, commercial, industrial and agricultural). A diverse land use mix is associated with shorter travel distances between places of interest and activities. (Gebel et al. 2005)
Legibility	The extent to which people can understand the urban layout and find their way, including from different types of cues. (Lette and Wiggins 2010)
Local Environment Plan (LEP)	The principal legal document for controlling development of land at the local government level in NSW, Australia.
Longitudinal Studies	Studies in which individuals are known to have various levels of exposure and are followed over time to determine the incidence of outcomes. Quasi-experimental designs and natural experiments are two categories of longitudinal studies. Quasi-experimental designs are those in which the exposure is assigned, but not according to a randomised experimental protocol. Investigators lack full control over the dose, timing, or allocation of subjects, but conduct the study as if it were an experiment. Natural experiments are situations in which different groups in a population have differing exposures and can be observed for different outcomes. A study gathering data at one time point only is called a cross-sectional study. (Gebel et al. 2005)
Master Planned Community (MPC)	A form of development usually organised around a complete and manicured living package of house, land, open space and community facilities.
Meta-Analysis	A quantitative approach in which individual study findings addressing a common problem are statistically integrated and analysed to determine the effectiveness of interventions. (The Community Guide 2010)
Metabolic Equivalent (MET)	A unit used to estimate the metabolic cost (oxygen consumption) of physical activity. Activities that raise the rate of energy expenditure are frequently expressed as the ratio of working to resting metabolic rate. (TRB Report 2005)
Metabolic Syndrome	When several conditions occur together, including obesity, insulin resistance, diabetes or pre-diabetes, hypertension and high lipids. (The Australian Diabetes Council 2010)
Mixed Use	'Mixed Use' development refers to a mix of activities within a geographic location. An example of this would be residential apartments located above retail outlets, neighbouring an office block. (Mead et al. 2006)
Multiple Regression Technique	A statistical technique that predicts values of one variable on the basis of two or more other variables.
Multivariate Analysis	A generic term for any statistical technique used to analyse data from more than one variable.

Term	Definition
Neotraditional Developments	Developments whose design is characterised by land use and street patterns that encourage walking and cycling. These include such features as interconnected street networks, sidewalks, walking and cycling paths, mixed land uses, and higher densities than those of more typical suburban developments. Also known as new-urbanist developments. (TRB Report 2005)
New Urbanism	An approach to development and redevelopment championed by a group of architects, planners, and urban designers that has similar goals to Smart Growth. Towns and cities developed before widespread use of the automobiles are seen as having multiple environmental, social, and health benefits when compared to the sprawling, suburban developments that have dominated land use decisions in the United States since the 1940s (see http://www.cnu.org). (Saelens et al. 2003)
Non-motorised Travel	Travel by non-motorised means, including walking, cycling, small-wheeled transport (e.g., skates, skateboards, push scooters, hand carts), and wheelchair. (TRB Report 2005)
Nutrition	All the factors which are part of, and/or influence, the food system and population eating habits and behaviours. (Burke et al. 2008)
Obesity and Overweight	Adults are defined as being obese if they have a Body Mass Index (BMI) of 30 or greater, and as being overweight if they have a BMI of over 25 but less than 30. BMI varies with age and sex during childhood and adolescence. The International Obesity Task Force recommends that children and adolescents be categorised as overweight or obese based on age and sex specific centile curves that pass through the adult values of 25 and 30 at age 18. This definition is intended for use in epidemiological research. Alternatively, young people may be considered overweight if they have a BMI above the 85th centile on BMI-for-age charts, and obese if their BMI is above the 95th centile. (Gebel et al. 2005)
Pedometer	A monitoring device that counts steps and measures distance. (TRB Report 2005)
Peri-urban	Areas immediately adjoining an urban area, situated on the periphery or borders of large towns and cities.
Physical Activity (PA)	Physical activity is all human movement in everyday life including work, recreation, exercise and sporting activities. Physical activity may be either recreational or utilitarian in nature, demand either a moderate or a vigorous amount of exertion from the participant, and require varying amounts of leisure time, financial resources, and equipment. (Burke et al. 2008)
Physical Environment	The 'physical environment' comprises elements of the built and natural environment that are influential in the choices and patterns of physical human activity. (Mead et al. 2006)
Physical Fitness	The ability to carry out daily tasks with vigour and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and to respond to unforeseen emergencies. Attributes of physical fitness include such characteristics as cardiorespiratory endurance; flexibility; balance; body composition; and muscular endurance, strength, and power. (TRB Report 2005)
Proximity	The straight-line distance between different land uses such as residential, office, retail, and commercial activities. (Saelens et al. 2003)
Public Health	The science and art of preventing disease, prolonging life, and promoting health through the organised efforts and informed choices of society, organisations, public and private, communities and individuals. (Pencheon et al. 2006)

Term	Definition
Public Open Space	Land used or intended to be used for recreational purposes by the public and includes parks, public gardens, foreshore reserves, playgrounds and sports fields. (WA Liveable Neighbourhoods Code 2004)
Public Transport	All transport systems in which passengers do not travel in their own vehicles or under their own exertion. Public transport is often referred to as public transit or mass transit. While it is generally taken to mean rail and bus services, wider definitions would include scheduled airline services, ferries and taxi services.
Recreational Travel	Travel individuals do for the sake of travel such as a walk around the park. (Krizek et al. 2009)
Refereed Publication	An article is defined as refereed by this Review if it is identified as such by Ulrich's Periodicals Directory. This global source for periodicals information applies the term refereed to a journal that has been peer-reviewed. Refereed serials include articles that have been reviewed by experts and respected researchers in specific fields of study.
Residential Density	The number of residential dwelling units per unit of land area (e.g. hectare). (Saelens et al. 2003)
Rural	In Australia, census districts which have a population density of 200 or more persons per square kilometre are classified as urban and census districts which have a population density of less than 200 persons per square kilometre are classified as rural.
Self-selection	The phenomenon in which people choose a neighbourhood or employment area based partially on the amenities that area provides for their given travel preferences. (Krizek et al. 2009)
Self-selection Bias	The need to distinguish the roles of personal attitudes, preferences, and motivations from external influences on observed behaviour. For example, do people walk more in a particular neighbourhood because of pleasant tree-lined sidewalks, or do they live in a neighbourhood with pleasant tree-lined sidewalks because they like to walk? If researchers do not properly address this issue by identifying and separating these effects, their empirical results will be biased in the sense that features of the built environment may appear to influence physical activity more than they in fact do. (TRB Report 2005)
Setback	The horizontal distance which a wall or window is from a property boundary.
Smart Growth	An approach to neighbourhood development that considers impacts on environmental quality, social interactions, population diversity, and transportation choices. Smart Growth is often contrasted with suburban sprawl that assumes automobile dependence. Smart Growth advocates promote development that is higher in density, built around public transit, contains a mixture of residential and commercial uses, and provides housing for a range of income levels. Smart Growth is the efficient usage of transportation infrastructure (e.g. roads and railways) and therefore encourages growth to be located in areas served by existing transportation investments (see http://www.epa.gov/livability). (Saelens et al. 2003)
Social Capital	Features of social organisation such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit.

Term	Definition
Socio-Ecological Model	A framework to examine the multiple effects and interrelatedness of social elements in an environment. This model allows for the integration of multiple levels and contexts and recognises the interwoven relationship that exists between individuals and their environment. In the context of a healthy built environment research, socio-ecological models recognise that while individuals are responsible for instituting and maintaining the lifestyle changes necessary to reduce risk and improve health, individual behaviour is determined to a large extent by the external environment, for example community norms and values, regulations, and policies.
Socio-Economic Status	A way of looking at how individuals or families fit into society using economic and social measures including income, level of education, and occupation.
Street Connectivity	The way streets connect together to enable people to get to where they want to with ease. (Gebel et al. 2005)
Structuration Theory	The theory of structuration holds that all human action is performed within the context of a pre-existing social structure. (Bakewell 2010)
Systematic Review	A process by which a body of literature is reviewed and assessed using systematic methods which are intended to reduce bias in the review process and improve understandability. (The Community Guide 2010)
Town Planning	The profession that studies physical, social, and political systems and how the interactions between these systems can create urban environments that have desired effects on people, communities, and economies. (Saelens et al. 2003)
Traditional Neighbourhood Design (TND)	Traditional Neighbourhood Design (or TND) is much the same as New Urbanism and, as the name implies, TND deliberately attempts to recreate the characteristics of the older parts of cities and, simultaneously, to reject the design principles that dominate more recent suburban developments. (Radbone and Hamnett 2003)
Traffic Calming	Measures the attempt to slow traffic speeds in residential neighbourhoods and near schools and pedestrian ways through physical devices designed to be self-enforcing. These include vertical deflections (speed humps and bumps, and raised intersections); horizontal deflections (serpentines, bends, and deviations in a road); road narrowing (via neckdowns and chokers); and medians, central islands, and traffic circles. (TRB Report 2005)
Transit-Oriented Developments (TOD)	Projects that involve mixed-use development (i.e. residential and commercial) near public transport stations. (TRB Report 2005)
Urban	Settlements are usually designated as urban once they have grown large enough to support industries which are not rural in nature. No common figure can be put on the size of an urban area as settlements function differently in different areas due to local circumstances. However, in Australia, census districts which have a population density of 200 or more persons per square kilometre are classified as urban.
Urban Agriculture (UA)	The producer, processor and market for food, plant- and animal-sourced pharmaceuticals, fibre and fuel on land and water dispersed throughout the urban and peri-urban areas, usually applying intensive production methods. It encompasses greenhouse cropping and intensive animal industries and is distinguished from rural agriculture by its integration into the urban economic and ecological system. (Pearson et al. 2010)

Term	Definition
Urban Consolidation	<p>Infill development that occurs in established areas is referred to as urban consolidation. This type of development is viewed as containing population growth within an existing area to take advantage of the existing infrastructures and amenities. Urban consolidation policies advocate denser populations, a mix of land uses, activity centres and high quality public transport. (Mead et al. 2006)</p>
Urban Sprawl	<p>A metropolitan development pattern that typically comprises single-use residential development with a widely dispersed population, few urban centres and ill functioning open spaces. Road networks demark large block sizes, which contributes to poor accessibility. Given its predominant residential component 'urban sprawl' is often referred to as suburban sprawl. (Mead et al. 2006)</p>
Utilitarian Physical Activity	<p>Physical activity undertaken as part of day to day activity. Physical activity that is associated with a specific purpose other than to be active, for example, walking to a destination for a purpose, climbing the stairs in a building or undertaking domestic tasks. Also referred to as Incidental Physical Activity.</p>
Vehicle Hours Travelled (VHT)	<p>The time measured in hours spent for all travel via motorised means (e.g. auto, motorcycle). (Krizek et al. 2009)</p>
Vehicle Kilometres Travelled (VKT) / Vehicle Miles Travelled (VMT)	<p>The distance for all travel via motorised means (e.g. auto, motorcycle). (Krizek et al. 2009)</p>
Walkability	<p>Walkability is a measure of how friendly an area is to walking. It is generally calculated as a composite which includes at least net residential density, street connectivity and land use mix.</p>
Zoning	<p>Land 'zoning' is a method used by regulatory bodies to confine certain activities and land uses to specific localities within geographic jurisdictions. The practice of 'zoning' was introduced to separate activities believed to be detrimental to health. (Mead et al. 2006)</p>

Appendix 3: Annotated Bibliography

An Important Note

The 'HBEP Policy Implications for Practice' provided at the end of each reference are the interpretations of the authors. They relate to the policy implications that emerge from the research findings of the particular paper under which they appear. The policy implications are not necessarily applicable in all built environment contexts and need to be read in relation to the findings of that particular paper.





THIS MEMORIAL DRIVE
IS DEDICATED TO
THE MEMORY OF
THOSE MEN AND WOMEN WHO
LOST THEIR LIVES IN THE
DEFENSE OF THEIR COUNTRY
1914, 1918 AND 1944-1945

Abraham, A., Sommerhalder, K. and Abel, T. (2010). 'Landscape and well-being: A scoping study on the health-promoting impact of outdoor environments'. *International Journal of Public Health* 55(1): 59-69.

Key Words: Landscape; wellbeing; health-promoting behaviour; resources; scoping study.

Location: The authors are from Switzerland; the study focus is worldwide.

Aim: To conceptualise and discuss how different characteristics of the natural and human-made landscape can be used as a health resource to promote physical, mental, and social wellbeing.

Method: This article is based on a scoping study which represents a special kind of qualitative literature review. Over 120 studies have been reviewed in a five-step-procedure, resulting in a heuristic device.

Conclusions: The results are divided into three subsections each focusing on mental, physical, and social wellbeing.

- *Mental wellbeing: landscape as a restorative.* Public open spaces used for public entertainment and sports have an intermediate restorative effect in contrast to natural settings (which have a high restorative potential) or urban settings (which have a low restorative potential).
- *Physical wellbeing: walkable landscape.* The way the urban landscape and environment is designed and built is crucial for the level of physical activity in daily life, work and leisure time.
- *Social wellbeing: landscape as a bonding structure.* Urban parks and other public places can enhance social integration if they facilitate social contacts, exchange, collective work, community building, empowerment, social networks and mutual trust.
- The relationship between landscape and health shows two main features: first, health-promoting landscapes contribute to healthy lifestyles in terms of physical activity and mental and emotional relaxation. Second, health-promoting landscapes promote the acquisition of resources for health such as social support, concentration and emotional stability.

Recommendations for Future Research:

- More research in this field is needed to better understand the health-promoting impacts of different landscape

characteristics. Future studies should address issues concerning variations in landscape needs in different social groups. To better understand the user needs, more participative designed studies and interventions are needed.

- To explore the issues around access to health-promoting landscapes by different social groups and not be limited to descriptions of the presence or absence of health-promoting landscape resources in socially deprived areas.
- To investigate the quality of health-promoting landscape resources, their social meaning and people's perception of their accessibility and relevance.

HBEP Policy Implications for Practice:

- Actively incorporate the provision of a variety of public open spaces into masterplans and strategic plans.
- Ensure public open space is not forfeited to other development agendas.
- Encourage the provision of walking and cycling trails.
- Reserve and manage spaces for organised community activities and casual social interactions.

Ashe, M., Feldstein, L. M., Graff, S., Kline, R., Pinkas, D. and Zellers, L. (2007). 'Local venues for change: Legal strategies for healthy environments'. *Journal of Law, Medicine and Ethics* 35(1): 138-147.

Key Words: Legal strategies; social norm; healthful behaviour.

Location: The authors are from the USA; the study focus is on the USA.

Aim: To assess and recommend legal strategies to help to de-normalise unhealthy behaviour and normalise healthy eating and physical activity.

Method: Existing research was systematically assessed with a focus on the following areas of community health: the school environment, the built environment, community facilities, the point of sale environment, and the use of taxes or fees to pay for nutritional health policies and reduce the consumption of unhealthy products.

Conclusions:

- Schools should implement district wide healthy food and beverage policies that



establish nutrition standards, regulate vending machines and create a healthy vending program.

- Communities can use local laws or polices to change zoning requirements, expand access to community facilities for recreational use, limit or ban the sale of non-nutritious food, and impose fees and taxes to dedicate funds towards obesity prevention.
- Financial resources generated from taxing non-nutritious food should be spent in low-income areas to help reduce the disadvantage and disproportionate burden of overweight and obese health issues in these communities. This involves introducing measures such as farmers' markets, grocery stores, physical education programs, and increased access to parks and recreation facilities in low-income areas.

Recommendations for Future Research: No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- Advocate for schools to adopt healthy food and drink policies, including the regulation of vending machines.
- Advocate for policies that restrict the sale of non-nutritious food, particularly in close proximity to schools.
- Prioritise the development of parks, recreational facilities and farmers' markets, especially in low-income areas.

Badland, H. and Schofield, G. (2005). 'Transport, urban design, and physical activity: An evidence-based update'. *Transportation Research Part D: Transport and Environment* 10(3): 177-196.

Key Words: Urban design; urban environment; physical activity behaviour.

Location: The authors are from New Zealand and USA; the literature reviewed is mostly from USA and Australia.

Aim: To develop an understanding of built environment influences on physical activity modalities. To systematically draw together the evidence surrounding neighbourhood differences and traffic calming effects based on urban design fundamentals, the

impact of the localised environment for at risk populations, non-motorised travel characteristics, and measurement issues associated with merging physical activity, urban design, and transport research. To build on previous reviews on physical activity (Humpel et al. 2002 and Owen et al. 2004) and transport (Saelens et al. 2003 and Sallis et al. 2004).

Method: The article reviewed a total of 24 studies. The method for sourcing literature was not articulated.

Conclusions: The article lists several conclusions from the research, addressing neighbourhood differences, traffic calming measures, at-risk populations, non-motorised transport and measurement issues. Key urban design elements attributable to transport related physical activity are density, sub-division age, street connectivity and mixed land use.

Recommendations for Future Research: Consistent use of transport and health management tools, enhanced understanding of traffic calming measures and further collaboration between health, transport and urban design sectors.

HBEP Policy Implications for Practice:

- Promote higher residential densities in areas well serviced by public transport.
- Ensure street connectivity and mixed uses to encourage take-up of active transport modes.

References:

Humpel, N., Owen, N. and Leslie, E. (2002). 'Environmental factors associated with adults: Participation in physical activity'. *American Journal of Preventive Medicine* 22(3): 188-199.

Owen, N., Humpel, N., Leslie, E., Bauman, A. and Sallis, J. F. (2004). 'Understanding environmental influences on walking: Review and research agenda'. *American Journal of Preventive Medicine* 27(1): 67-76.

Saelens, B. E., Sallis, J. F. and Frank, L. D. (2003). 'Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures'. *Annals of Behavioral Medicine* 25(2): 80-91.

Sallis, J. F., Frank, L. D., Saelens, B. E. and Kraft, M. K. (2004). 'Active transportation and physical activity: Opportunities for collaboration on transportation and public health research'. *Transportation Research Part A: Policy and Practice* 38(4): 249-268.

Bartolomei, L., Corkery, L., Judd, B. and Thompson, S. M. (2003). *A bountiful harvest: Community gardens and neighbourhood renewal in Waterloo*. NSW Department of Housing and University of New South Wales, Sydney, Australia.

Key Words: Community garden; neighbourhood renewal; public housing.

Location: The authors are from Australia; the study focus is on Sydney, Australia.

Aim: To understand the role of community gardens in fostering community development and neighbourhood improvement in a public housing context.

Method: The study used observation, in-depth individual interviews and focus group approaches. The available documentary evidence from the records of the various stakeholder groups was reviewed, as was the literature on community gardens in Australia and overseas to ascertain their roles, especially in disadvantaged communities.

Conclusions:

- Community gardens can make a positive contribution to community development in public housing estates.
- The community garden provides a place for friendship and generosity, cultural connection and understanding.
- People from different ethnic and cultural backgrounds work side-by-side, sharing garden practices, produce and recipes has helped to break down cultural barriers between tenants of the Estate, forge new friendships, as well as providing cultural continuation of gardening traditions from previous countries of residence.
- Leadership within and beyond the garden can be an important path through difficulties, as can garden management protocols and the development of cultural understandings.
- The community garden enabled tenants to reduce their food costs through growing and eating their own produce. It also provided access to produce which can be difficult to obtain.
- The garden produced health benefits through physical activity and reducing stress through providing purpose with ongoing participation and as a relaxing activity.
- The gardens made a significant contribution to the beautification of the open spaces around the residential tower blocks, and became an important part

of the daily lives of those involved in gardening activities.

Recommendations for Future Research: No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- Pursue development of community gardens in public housing estates.
- Ensure community garden projects are well resourced and managed.
- Collaborate with other agencies to establish community gardens. (Other agencies might include local councils; schools; TAFE colleges; botanical gardens; gardening groups; recycling and sustainability groups).
- Involve the community in the planning, establishment and management of gardens.



Barton, H. (2009). 'Land use planning and health and well-being'. *Land Use Policy* 26S: S115-S123.

Key Words: Spatial planning; healthy urban planning; healthy towns; physical activity and planning.

Location: The author is from the World Health Organization (WHO) Collaborating Centre for Healthy Urban Environments, University of the West of England, Bristol, UK. The review focuses on research from the USA, UK, Europe and Australia.

Aim: The article is a review commentary on the state of research into land use planning and its relationship to health. Barton generally discusses the impact of planning on health on various policy areas such as active commuting, lifestyle and physical activity, economic and market influences, and mental wellbeing.

Method: The methodology used was not systematic but the article provides a good generalised commentary, which concludes with some positive predictions on where the discipline is heading.

Conclusions: The relationship between land use planning and health is extremely complex however there is research suggesting that the land use patterns exhibited in the UK, USA and Australia (low density, poor connectivity, spatial segregation, etc.) is impacting on mental and physical health. Barton makes an interesting point that the research in the UK and USA seems to somehow be 'missing the point' – citing comparative studies of

UK experience with specific cities and neighbourhoods in Germany, France, the Netherlands and Scandinavia. Such studies are showing experimental evidence of behaviour which contrasts with that found in the UK, amongst populations that are in other ways quite similar.

Recommendations for Future Research:

'My belief is that the inter-linkage of health and spatial planning research literature will continue apace, and progressively leave little excuse for inaction. A major shift in political priorities, however, will be necessary if action is to be effective. Part of that shift will be increased autonomy and financial muscle for local authorities, so that they can innovate and shape the future of their communities to a much greater degree, as we see in continental European examples. Also necessary is a shift in the control of land for development, so that vested interests do not dominate over the common good' (Barton 2009, p. S121).

Barton goes on to predict the following developments in the discipline:

- *Integrated settlement theory:* Current research is hampered by the inadequacy of human settlement theory. Each discipline provides its own perspective but they are not integrated. Various attempts have been made to integrate them, none yet fully convincing. The next 40 years will see the development of an integrated theory of settlement function, form and evolution. It will be based in eco-system theory, linking human activity and wellbeing with development processes, the structure of the built environment and the natural bioregion.
- *Normative planning strategies:* Partly as result of the integrated theory, and partly as a result of gathering comparative evidence from around the globe, clear normative principles will be identified in relation to the processes of urban governance and decision-making and the spatial structures that are successful at delivering healthy, sustainable human settlements. These principles are already being articulated but not are widely accepted.
- *Health well-being and spatial planning:* Much more research will be undertaken to help us understand the links between health and urban land use, including strategic policies for housing, commerce and transport. This is still a new research arena. The areas of uncertainty will be progressively reduced, and the more significant determinants of health will be separated from less critical factors. The relative significance of, and dynamic relationship between, social, cultural, environmental and economic drivers of personal behaviour will be much better understood.
- *Population, social mix and health inequalities:* The evidence will become compelling that if long-term productivity, health and quality of life for all (avoiding the crippling societal costs of poor health) are priorities, then the social structure of population within a neighbourhood or town is a matter of central policy concern. The socially polarised geographies in the UK which result from current housing mechanisms and urban forms will be condemned as exacerbating social and health inequalities and for their high cost to society.
- *Lifestyle: Physical activity and the built environment:* the growing but still contended evidence that urban form, settlement patterns and local environments have a major impact on behaviour, especially the levels of physical activity and therefore obesity, will be full and clear. The significance and dangers of obesogenic environments – again with a cost tag which will influence the Treasury – will be accepted. Local greenspace, retail, social and educational facilities, and the cycling routes and walkways which give access to them, will become recognised as important for public health and wellbeing.
- *Community networks, mental wellbeing:* The still uncertain relationship between community networks, the physical environment and mental wellbeing will have been sorted. There will be a recognition that it is impossible to generalise about this topic, because of the increasingly diverse patterns of social connection which people have. Nevertheless, for those who are obliged, or choose, to live locally, the importance of local facilities and casual pedestrian meetings will be established. In an ageing population, with more retired people, this will be especially important.
- *Children, education and locality:* The crisis brought on by a generation of obese children becoming adults, with consequent health problems, will focus the minds of politicians and academics. There will be research showing that it is vital for children to experience their environment, engage in active play and free socialising, and learn about the world, in the context of a more holistic

educational approach, if they are to be happy and healthy. The dangers of exaggerated fear of strangers, fortress schools and car-dependence will be accepted – though the aftermath of the current situation will still impede progress.

HBEP Policy Implications for Practice:

- Advocate for adequate resourcing of local government to enact effective healthy built environment policy and action.
- Modify land use patterns to enable greater accessibility to local facilities.
- Support local destinations through provision of attractive, safe, connected and direct walking and cycling routes.
- Ensure equitable access to natural open space.



Bauman, A. E. and Bull, F. C. (2007). *Environmental correlates of physical activity and walking in adults and children: A review of reviews.* National Institute of Health and Clinical Excellence, London, UK.

Key Words: Environmental correlates; physical activity; adults; children; physical environment.

Location: The authors are from the UK; the study focus is international.

Aim: To identify papers which report factors associated with physical activity in children and adult populations.

Method: The methodology involved a search of literature from multiple databases to identify published papers reporting on factors associated with physical activity in children and adult populations. Only 13 papers met the inclusion criteria and were used in the study. Reviews were excluded if their focus was not on physical activity.

Conclusions:

- Understanding the correlates and determinants of physical activity is essential in the development of a comprehensive population-based approach to the promotion of physical activity.
- This study indicates there is less review-level evidence on the associations between walking and physical environments than the evidence base for

overall physical activity.

Recommendations for Future Research: No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- Encourage inter-disciplinary collaboration between academics, policy makers and professional staff from health and built environment backgrounds.
- Work to reach consensus about standardised but adaptable measurement of the built environment and physical activity.

Berry, H. (2007). ‘“Crowded suburbs” and “killer cities”: a brief review of the relationship between urban environments and mental health’. *NSW Public Health Bulletin* 18(11-12): 222-227.

Key Words: Urban environments; mental healthy psychosocial stressors; concentrated disadvantage; social drift.

Location: The author is from the Australian National University (ANU) Canberra, Australia; the study reviews literature from around the world, however, there is a focus on Australia.

Aim: To briefly review studies linking disadvantaged urban environments with poor mental health and to propose an explanatory model to guide future research.

Method: This is a general, non-systematic review/commentary on existing literature.

Conclusions: The article discusses the physical and social ‘incivilities’ that can impact on mental health in city environments. Physical incivilities include derelict buildings, graffiti, litter, excessive traffic and dirty streets. Social incivilities include over-crowding, unemployment, gangs and crime. Berry concludes there are three explanations for the direct and indirect associations between urban environments and mental health: psychosocial stressors (for example, diminished feelings of safety and security in one’s home can be considered stressors leading to strain which can erode positive self concepts), concentrated disadvantage (this suggests that the density of city populations concentrates physical and social problems, intensifying their effects and inflating pressures on mental health) and social drift (the socio-economic circumstances of people with severe and enduring mental health problems gradually

deteriorates, necessitating relocation into progressively disadvantaged neighbourhoods and lower quality accommodation – it is almost like self selection for the mentally ill – disadvantaged by their illness results in having to live in sub-standard neighbourhoods which in turn results in further stress etc.). This three pronged approach is after Galea (2005).

Recommendations for Future Research:

- A systematic investigation and development of sophisticated conceptual models that describe how features of the social and built environments of Australian cities may be related to mental health is required.
- Frameworks must (a) be theory based, empirically tested and continuously refined, (b) be constructed within a population health approach, with prevention in mind, and with interventions evaluated via ‘report card[s]’ that are not reliant on primary data collection and are ‘grounded’ in local realities, and (c) include health-promoting features of built environments, such as contact with nature and easy access to parks and walking.
- The fields of social ecology and community psychology, together with social capital theory, could contribute to an understanding of how cities influence mental health.

HBEP Policy Implications for Practice:

- Pursue policies to eliminate graffiti, litter, dirty streets and derelict buildings.
- Promote casual surveillance of streets to ensure safety.

References:

Galea, S., Ahern, J., Rudenstine, S., Wallace, Z. and Vlahov, D. (2005). ‘Urban built environment and depression: A multilevel analysis’. *Journal of Epidemiology and Community Health* 59(10): 822-827.

Black, J. L. and Macinko, J. (2008). ‘Neighborhoods and obesity’. *Nutrition Reviews* 66(1): 2-20.

Key Words: Built environment; food availability; neighbourhood; obesity.

Location: The authors are from the USA; the literature reviewed is from around the world.

Aim: To comprehensively assess the literature

on neighbourhood determinants of obesity in high-income countries while exploring the following questions:

- Is obesity associated with neighbourhood level factors such as Socio-Economic Status (SES), income inequality, racial composition, food availability, or physical activity resources?
- Is neighbourhood SES associated with access to health promoting resources (e.g. access to healthy food, opportunities for physical activity) or obesity-promoting exposures (e.g. high calorie foods, promoters of sedentary behaviours)?
- What theoretical and empirical gaps remain in the literature on neighbourhoods and obesity?

Method: The literature review was conducted from August 2005 through March 2007 by systematically searching the PubMed and PsychInfo databases. The inclusion criteria consisted of:

- Outcome variables including a measure of body weight, physical activity, or diet.
- Independent variables including a neighbourhood-level measure or assessment of a social, behavioural, or demographic predictor of obesity, and
- The study was conducted in a human population in an industrialised country.
- Only English-language articles were reviewed.

Conclusions:

- Even after controlling for individual-level SES, the literature consistently demonstrates that living in an economically deprived neighbourhood increases one’s odds of being obese or having higher Body Mass Index (BMI).
- Three studies found that area-SES was significantly associated with weight status for women but not for men, suggesting a potential mediating role of gender.
- Nine studies in the United States have demonstrated that access to stores selling healthy food is worse for low-income neighbourhoods. However, the existence of ‘food deserts’ has been challenged.
- Evidence from studies conducted in the United States, Britain, and Australia suggests that lower-SES neighbourhoods, and those with larger minority populations have greater exposure to fast-food restaurants and fewer healthy choices in local eateries.
- Individuals with a lower SES and level

of education are more likely to be sedentary, but decreased neighbourhood opportunities for physical activity could contribute to these trends.

- Land use, improved access to fitness facilities, and neighbourhood 'walkability' have all been linked to improved physical activity behaviours and reduced body weight.
- Those who can easily walk from home to commercial areas (i.e., in neighbourhoods with 'mixed land use') demonstrate lower BMI and increased walking and physical activity.
- Access to facilities is associated with increased physical activity for children, adolescents, adults, and the elderly. Increased walking and physical activity have also been reported for those with better access to high-quality open and green space. These factors are also significantly associated with body weight.
- Perceived hazards, such as fear of crime or violence and traffic may also have deleterious effects on fitness and BMI.
- The study goes on to propose a framework, based on the literature, for understanding how neighbourhoods influence body weight and obesity.

Recommendations for Future Research:

- Macro-level social factors, especially neighbourhood level SES, are among the most commonly studied predictors.
- Study multiple neighbourhood predictors: Few studies have tested a comprehensive model of the determinants of obesity at the neighbourhood level. Instead, most have assessed single items or at best a limited set of either 'good' (e.g. access to healthy foods and walkability) or 'bad' characteristics (e.g. poverty, exposure to fast food and crime). As a consequence, the overall neighbourhood effect on obesity may have been over- or underestimated.
- The potential impact of proximity of schools to fast food outlets on children's future attitudes and intake remain unstudied.
- While different theories have been applied to explain dietary and exercise behaviours, little empirical work has assessed how neighbourhood characteristics help to shape residents' knowledge, attitudes, norms, expectancies or intentions to be active or to make healthy food choices.

- Cross sectional study design does not facilitate establishment of true causality between risk factors and outcomes. These inconsistencies have led some to posit that the observed associations between the health of neighbourhoods and the health of people living in them are not factual.
- Many of the studies reviewed used secondary data and these often ended up with inadequate measures of outcomes and exposures. For example, two-thirds of the studies reviewed used self-reported measures of weight and height, but these have been shown to under-estimate obesity in most populations.
- Improved rationale is needed to justify how neighbourhoods are defined. Although the terms neighbourhood, area, context, and community are often used synonymously, defining a neighbourhood or relevant geographic area to study is complex and varies widely in the literature. Explicit rationale for the choice of neighbourhood metric will improve study comparability and clarify the meaning of different neighbourhood boundaries and measures.
- Further work is needed to parse out the interactions among individual-level characteristics and neighbourhood context. Are some individuals or groups more susceptible or more resilient to neighbourhood influences than others?
- Additional work is needed to understand how food-insecure and low-income individuals actually obtain food.
- Acquiring adequate, nutritious food requires an input of resources, including time, transport and money. It is unclear how people make tradeoffs for the competing demands on these resources. The complexity of these tradeoffs and how people make decisions about where, when, and how often they will purchase food and the choices they make in stores remains relatively under investigated and could benefit from integration of theories and methods from other fields such as economics and psychology.
- Although the studies described here support the argument that a number of contextual factors are associated with obesity, questions remain about which neighbourhood factors would be the most efficacious targets for intervention. Improved theory and targeted empirical work will be needed to translate research findings into more effective public health interventions.



HBEP Policy Implications for Practice:

- Focus obesity interventions on economically deprived areas.
- Ensure equitable access to fresh and healthy food.
- Use land use regulation to avoid concentration of fast-food outlets.
- Ensure equitable access to high-quality open and green space.
- Promote programs aimed at encouraging safe streets.

Brownson, R. C., Haire-Joshu, D. and Luke, D. A. (2006). 'Shaping the context of health: A review of environmental and policy approaches in the prevention of chronic diseases'. *Annual Review of Public Health 27*: 341-370.

Key Words: Policy; diet; exercise; physical activity; tobacco.

Location: The authors are from the USA; the articles reviewed are from around the world.

Aim: To describe (a) effective and promising interventions to address tobacco use, physical activity, and healthy eating and (b) lessons learned from the literature and practice experience in applying environmental and policy approaches. The review focuses on primary prevention of chronic diseases – that is, risk reduction among asymptomatic persons to reduce the likelihood of development of chronic disease.

Method: A total of 17 interventions were reviewed and categorised into three domains affecting the physical environment/access, economic environment and communication environment. The paper goes on to discuss tobacco use, physical activity and healthy eating in the context of these three domains.

Conclusions: The paper concludes that change is best pursued as follows:

- *Start with Environmental and Policy Interventions:* Policy and environmental change is key to initiating and sustaining systematic change. In many cases, control of chronic diseases is most effective if environmental and policy approaches are the earliest focus of change. These approaches can be low cost, high reach, and tend to provide supportive environment for later targeted interventions. Before implementing an array of individual-level programs to

prevent chronic diseases, practitioners should consider the power of environmental and policy approaches to set the stage for other interventions.

- *Think Comprehensively and Across Multiple Levels:* Comprehensive interventions that address multiple levels of an ecological framework are more effective.
- *Make Use of Economic Evaluations:* In one of the few economic evaluations in physical activity, Wang et al. 2004 examined the cost of trail development per trail user in Lincoln, Nebraska. The annual cost per user was \$235 (range = from \$83 to \$592), whereas per capita annual medical cost of inactivity was \$622. Studies like these supply powerful information for health advocates and policy makers.
- *Understand Local Context:* To better understand feasibility, assessment of local context is essential. The local context for an intervention should be assessed in conjunction with local data and with information on how to apply interventions found in systematic reviews (like the US Government's Community Guide).
- *Build New and Non-traditional Partnerships:* Successful implementation of environmental and policy interventions will require new skills and non-traditional partnerships with people and organisations not working directly in public health. For example, to address the major structural barriers to physical activity in US cities, urban planners, transportation experts, and persons working in parks and recreation are essential collaborators in developing the environment and the political will for activity-friendly communities.
- *Address Health Disparities:* Most of the existing intervention literature has been conducted among ethnic majority populations and higher-income populations. A challenge for the application of environmental and policy strategies involves a better understanding of how interventions apply within populations with large health disparities.

Recommendations for Future Research:

- Many communities lack the local data on chronic diseases and their risk factors for priority setting and program evaluation. This issue is beginning to be addressed (e.g. state wide risk factor data) but remains a serious constraint at the county, city, and neighbourhood levels.

- Opportunities for policy research may take a number of forms: (a) identifying relevant policies (surveillance); (b) understanding the determinants of establishing policy; (c) exploring the process of developing and establishing policy; and (d) assessing the outcomes of policy implementation. In these studies, the policy can be either the independent or dependent variable.
- In mainstream epidemiology, the most rigorous design for hypothesis testing is the randomised controlled trial. However, a randomised design is seldom useful in policy research because the scientist cannot randomly assign exposure (the policy). Therefore, quasi-experimental designs (e.g. ecologic studies and time-series designs) are likely to be more useful for many policy-relevant issues. Policy research can still be sophisticated in the absence of randomised designs.



HBEP Policy Implications for Practice:

- **Pursue a social ecological approach to encourage physical activity, community connections and healthy eating.**
- **Including modifications to the built environment with other policy innovations such as educational programs.**
- **Support interdisciplinary collaborations between health and built environment professionals.**

References:

Wang, G., Macera, C. A., Scudder-Soucie, B., Schmid, T., Pratt, M., Buchner, D. and Heath, G. (2004). 'Cost analysis of the built environment: The case of bike and pedestrian trails in Lincoln, Neb'. *American Journal of Public Health* **94**(4): 549-553.

Brownson, R. C., Hoehner, C. M., Day, K., Forsyth, A. and Sallis, J. F. (2009). 'Measuring the built environment for physical activity: State of the science'. *American Journal of Preventive Medicine* 36(4): S99-S123.

Key Words: Built environment; physical activity; public health; built environment measures.

Location: The authors are from the USA; the article reviews studies from around the world.

Aim: To assist in developing an understanding of the best ways to measure the impact of the built environment on physical activity. To understand the influences of the built environment on physical activity, a wide range of environmental measures is needed. There are currently three categories of built environment data being used: (a) perceived measures obtained by telephone interview or self-administered questionnaires; (b) observational measures obtained using systematic observational methods (audits); and (c) archival data sets that are often layered and analysed with Geographical Information Systems (GIS). This review provides a critical assessment of these three types of built-environment measures relevant to the study of physical activity.

Method: Instruments were identified through searches of the literature, expert input, and feedback from a 2007 workshop. A critical assessment is provided of perceived measures, observational (audit) approaches, and GIS-derived metrics.

Conclusions: The study presents a comprehensive listing of the main tools and studies using (a) perceived measures obtained by telephone interview or self-administered questionnaires; (b) observational measures obtained using systematic observational methods (audits); and (c) archival data sets that are often layered and analysed with GIS. Recommendations are listed to improve the data collected by each different method.

The general conclusion of the study is that while there have been considerable advances in the development of measurement of the built environment for physical activity in all three categories, numerous challenges are identified in the study which will only be overcome by continued research effort which will require dedicated funding.

Recommendations for Future Research:

- *Simplifying the task by a process of elimination:* The complexity of the built environment constructs targeted by these first-generation measures and the resulting long lists of variables is a major impediment to widespread use and efficient analysis. Before current measures can be simplified they must be used in multiple studies and variables repeatedly unrelated to outcomes or found to be redundant with other variables can be deleted.

- *Standardisation of scales:* The measures reviewed here use a variety of geographic scales. For example, definitions of neighbourhood or community vary, and different GIS-based buffer sizes. For GIS measures, it would be useful if more investigators evaluated and reported results using multiple geographic scales (e.g. 0.5-, 1-, 2-, 3 kilometre buffers).
- *The detail required to assess built environment quality:* A specific limitation of observed and GIS-derived measures is the difficulty of assessing the quality of environmental features. The difficulty of obtaining reliable reports of simple indicators of quality of such attributes as playground equipment, trail conditions, and street crossing aids illustrates a need for further development of existing measures.
- *Need to factor in minority groups:* It is not clear to what extent the existing environment measures are sensitive to the needs of various population groups and settings. It is likely that physical activity barriers and facilitators vary by age, physical abilities, and culture. The lack of relevance of existing measures to rural environments has been acknowledged, and environmental attributes may have different meanings in low and high-income communities and in youth versus adults. It is most important to ensure that environmental measures are relevant to populations at highest risk of inactive lifestyles and resulting diseases, such as low-income, racial/ethnic minority, older adult, and rural populations.
- *Policy development:* In contrast to the rapid development of built environment measures, there is a void in published measures of policies that govern built environments (note 172 – Librett et al. 2003). This policy relevant information is a clear research need.
- *Consensus on evidence and data required:* Spatial measures require different statistical approaches than do familiar public health data, and the complexity of the measures creates additional challenges, so training and consensus development about the most appropriate analytic approaches are needed.
- *Maximising the potential of GIS:* Geographic Information Systems data have the potential to be a useful public health surveillance tool, but that potential is largely unrealised. Some public health departments will not have the capacity to collect even the most basic data, so partnerships with transportation, planning, parks and recreation, law enforcement, and housing agencies will likely be required to provide access to data.
- *Practical measures for community groups:* Creating practical measures for community groups should be a goal for researchers. The incorporation of reliable and valid observational measures into health advocacy efforts should be encouraged to provide an evidence base for advocacy.

HBEP Policy Implications for Practice:

- Support interdisciplinary collaborations between health and built environment professionals aimed at reaching consensus about standardised but adaptable measurement of the built environment and physical activity.

References:

Librett, J.J., Yore, M.M., and Schmid, T.L. (2003). 'Local ordinances that promote physical activity: A survey of municipal policies.' *American Journal of Public Health* **93**: 1399-1403.

Burke, M., Hatfield, E. and Pascoe, J. (2008). *Urban planning for physical activity and nutrition: A review of evidence and interventions. Research Paper 22. Urban Research Program, Griffith University, Brisbane, Australia.*



Key Words: Urban planning; physical activity; nutrition, built environment.

Location: The authors are from Brisbane, Australia; the study focus is on Australia.

Aim: To assess the relationships between active transport/incidental activity, nutrition and individual/community health and the role of environmental attributes in influencing these relationships. To explore how can governments use policy and legislation to influence positive physical activity and nutrition outcomes.

Method: The study uses existing research to discuss the environmental determinants of physical activity and nutrition. This research paper explores in detail the complex relationship of urban form and health, urban access to nutritional food, changes to the built environment to improve health and government's role in creating healthy environments.

Conclusions:

- The built environment can be modified to improve health through a comprehensive approach to changing policy and practice. Examples include more compact development patterns by clustering development at transport nodes and improving urban streets and public spaces by offering a quality walking a cycling environment.
- In order to address access to healthy, nutritious food, community based options such as community gardens, food cooperatives and edible landscapes should be explored and encouraged. Land use planning to limit the number of fast-food outlets and increase the number of fresh

food retailers would also function to improve access to fresh food.

- Governments should look for ways to encourage active transport and incidental physical activity as this presents an opportunity to embed physical activity in to the daily lives of urban populations.

Recommendations for Future Research: Research is required to review of the effectiveness of government interventions in the built environment that target nutrition. Are restrictive policies, such as limiting densities of fast-food outlets, an effective approach for improving community health in the Australian context? Trials of these policies are required to ensure they are worthwhile.

Monitoring and evaluation of current projects such as bicycle share schemes or increasing pedestrian-only zones and shared streets should also be undertaken to assess whether they are having an impact on the health of the population.

HBEP Policy Implications for Practice:

- Encourage community based initiatives that support higher rates of physical activity and access to healthy food.
- Carefully encourage more compact development patterns, particularly around transport nodes.
- Promote community gardens, food cooperatives and edible landscapes in urban settings.

Burns, C. M. and Inglis, A. D. (2007). 'Measuring food access in Melbourne: Access to healthy and fast foods by car, bus and foot in an urban municipality in Melbourne'. *Health and Place* 13(4): 877-885.

Key Words: Food; fast-food; mapping; socio-economic disadvantage.

Location: The authors are from Australia; the study focus is on Melbourne, Australia.

Aim: To assess the access to healthy and unhealthy foods throughout a municipality in Melbourne using a Geographic Information Systems (GIS) accessibility program. To assess the access to healthy and unhealthy foods throughout a municipality in Melbourne using a Geographic Information Systems (GIS) accessibility program.

Method: The study was carried out in the City of Casey, a municipality located in South-east Melbourne, Australia. The City has a population of 180,000 and covers 395 square kilometres including urban, semi-rural, rural and coastal areas. The study included three major supermarket chains and several major fast-food chains, resulting in a total of 15 supermarkets and 33 fast-food outlets. Accessibility of these food outlets was modelled through a GIS program from information sourced from the City of Casey Council. The GIS program used multiple layers to model costs and distances for walking, public transport and car use to access food.

Conclusions:

- This method for assessing food access could be applied to a range of health related behaviours to describe community food access.
- The study indicated that access to healthy food in the City of Casey is acceptable provided a resident has a car. To ensure all residents of Casey have good access to healthy food, improvements to the public transport system are required, as is increased support for residents without cars or those with disabilities.
- Obesity prevention strategies in Casey should concentrate on making healthy and affordable food choices available at fast-food outlets and town planning to ensure a mix of food outlets to maximise the likelihood of healthy food choices.

Recommendations for Future Research: To understand variations in fast-food availability across areas of high and low socio-economic disadvantage. Their methodology offers a good contextual basis for further socio-cultural

research and examining the socio-cultural processes around urban development.

HBEP Policy Implications for Practice:

- Improve public transport accessibility to healthy food destinations including supermarkets.
- Introduce measures to increase availability of healthy food at fast-food outlets.
- Employ land use regulation to avoid the concentration of fast-food outlets.

Butterworth, I. (2000). *The relationship between the built environment and wellbeing: A literature review.* Victorian Health Promotion Foundation, Melbourne, Australia.

Key Words: Built environment; wellbeing; urban health; community.

Location: The author is from Australia; the review has a specific focus for the Victorian (Labor) government of the time but cites an array of literature from other around the world.

Aim: The overarching aim of the review is unclear. It is a general review written by an environmental and community psychologist for the Victorian Health Promotion Foundation. The review is old but puts some interesting perspectives on the relationships between social health, the built environment and health. The review is not systematic, and organises data under the headings of: aesthetics of place, the psychological impact of loss of place, the need for interventions to foster sense of place, legibility and orientation, built form and sense of community, transport and physical activity, safety and danger, privacy and crowding, participation and empowerment.

Method: The study employs a general, not systematic methodology.

Conclusions: Enhanced citizen participation and leadership is required to revitalise the social and physical quality of our urban spaces. There is room for children to learn and be educated about their urban environment, so that they in turn can participate in the process of managing and living in their urban environment. It is also suggested that education for adults is equally if not more pressing, given adults' ability to vote and their greater potential to influence decision-making.

Recommendations for Future Research: No specific recommendations were provided.

HBEP Policy Implications for Practice:

- Involve children and the community in the design of urban spaces.

Cao, X. Y., Mokhtarian, P. L. and Handy, S. L. (2009). 'Examining the impacts of residential self-selection on travel behaviour: A focus on empirical findings'. *Transport Reviews* 29(3): 359-395.

Key Words: Travel behaviour; traditional neighbourhood; built environment.

Location: The authors are from the USA (Cao is from the University of Minneapolis; Handy and Mokhtarian are from the University of California, Davis). The review mostly focuses on US based research, however, some articles are also cited from Europe to provide comparison.

Aim: Previous studies have consistently found a significant association between the Built Environment (BEnv) and Transport Behaviour (TB) (the most commonly cited is Ewing and Cervero 2001 – a meta analysis of 50 studies exploring influences of the built environment on travel behaviour). However, association itself is insufficient to establish causality. To robustly infer causality, scientific research generally requires at least four kinds of evidence (Schutt 2004; Singleton and Straits 2005): association (a statistically significant relationship), non-spuriousness (a relationship that cannot be attributed to another variable), time precedence (cause precedes effect) and causal mechanism (a logical explanation for why the alleged cause should produce the observed effect) (refer to Cao et al. 2008 for a detailed discussion on the requisites for causal inference in the context of the BEnv and TB). The goal of research regarding self-selection is to rule out 'spuriousness' in the establishment of a causal relationship between the BEnv and TB, and ultimately to determine the magnitude of this relationship. Such evidence provides a basis for the adoption of policies that aim to change TB by changing the BEnv. The existence of self-selection doesn't mean that the BEnv is irrelevant, but it must be accounted for in estimating the effect of the BEnv on TB if we want to be able to produce valid estimates of the impact of land use policies on behaviour.

Method: The article reviews 38 empirical studies, which collectively have taken nine different approaches to assessment of residential self-selection. The identification of

the studies was based on the knowledge of the authors.

Conclusions: 'If the key question is, 'Does the BEnv have a distinct influence on TB after self-selection is accounted for?', then based on the empirical evidence to date, the answer would have to be a simple and resounding 'yes' (Cao et al. 2009, p. 389). Virtually every quantitative study reviewed, after controlling for self-selection, identified a statistically significant influence of one or more BEnv measures on the TB variable of interest.

In summary, once a walking-oriented person moves to a walking-oriented environment, we would expect them to walk more. But it is also good to know, from a policy standpoint, that when an auto-oriented person moves to a walking-oriented environment, we can expect them to walk somewhat more as well. It is more difficult, however, to assess the strength of the autonomous influence of the BEnv relative to the influence of self-selection, or even to ascertain whether that autonomous influence is 'large enough to matter' on its own terms. Self-selection is, however, still an important factor that needs to be taken into account in any empirical study. 'It is misleading to present empirical results that do not take that impact into account. Such faulty findings are likely to result in flawed policies, and/or an overestimation of their effectiveness' (Cao et al. 2009, p. 390).

Recommendations for Future Research:

Two types of studies are important (both of them ideally to include comparison groups of unaffected individuals similar in other relevant ways): (1) True panel studies of residents who move from one type of neighbourhood to another, with measurements of attitudes as well as socio-demographic traits and TB before and after, and further exploration of the reasons behind the move; and (2) Natural experiments that examine the impact on TB in response to a change in the BEnv, such as the implementation of a traffic calming programme. The conceptual ideal is the longitudinal structural equations modelling approach, which can combine most of the strengths of the other methods: measurement of attitudes, allowance of multiple directions of causality and measurement at multiple points in time. The study also indirectly infers that more research needs to concentrate on the impact of the BEnv at the regional scale (as opposed to the neighbourhood scale) inferring that this scale is most likely more influential on TB.



HBEP Policy Implications for Practice:

- Design streets that are navigable, have safe and well maintained foot paths and are shaded to encourage walking.

References:

Cao, X., Mokhtarian, P. L. and Handy, S. L. (2008). 'Examining the Impacts of Residential Self-Selection on Travel Behavior: Methodologies and Empirical Findings'. Research Report No. UCD-ITS-RR-08-25. University of California – Davis, California, USA. Available at: http://pubs.its.ucdavis.edu/publication_detail.php?id=1194 (accessed 1 August 2008).

Ewing, R. and Cervero, R. (2001). 'Travel and the built environment: a synthesis'. *Transportation Research Record* 1780: 87-113.

Schutt, R. K. (2004). 'Investigating the Social World: The Process and Practice of Research'. 4th edn. Pine Forge Press, Thousand Oaks, California, USA.

Singleton Jr., R. A. and Straits, B. C. (2005). 'Approaches to Social Research'. 4th edn. Oxford University Press, New York, USA.

Cavill, N., Kahlmeier, S., Rutter, H., Racioppi, F. and Oja, P. (2008). 'Economic analyses of transport infrastructure and policies including health effects related to cycling and walking: A systematic review'. *Transport Policy* 15(5): 291-304.

Key Words: Economic; health; walk; cycle.

Location: The authors are from a UK consulting group and the World Health Organization (WHO) Regional Office for Europe; the articles reviewed are from the UK and Europe with just two studies from the USA included. No studies from Australia were reviewed.

Aim:

- To review published and unpublished studies that present the findings of an economic evaluation of an aspect of transport infrastructure or policy and included data on walking and/or cycling and health effects in the evaluation. Studies had to be in the public domain, all age groups were included and papers from languages other than English were translated.
- To propose options for the further development of a more harmonised methodology as guidance for Member States (European) on approaches to the inclusion of health effects through transport-related physical activity

in economic analyses of transport infrastructure and policies.

Method: The method is well detailed in the article. The authors searched multidisciplinary databases using combinations of search terms well documented in Appendix D of the review. Sixteen studies were selected for inclusion. Studies needed to be an economic evaluation of an aspect of transport infrastructure or policy and include data on walking and/or cycling and health effects in the evaluation. Studies also had to be in the public domain. All age groups were included and papers from languages other than English were translated. Studies not included were listed in the review with reasons given as to why they were not included.

Conclusions:

- Economic analysis to incorporate health outcomes into the standard cost-benefit analyses undertaken by transport and other infrastructure planners are required to justify policy change. In 2006, the WHO Regional Office for Europe undertook a project on economic valuation of health effects from cycling and walking building on extensive work by the WHO and partners on cost effectiveness. One of the main conclusions of this work has been that 'there is a serious lack of cost-effectiveness studies for all types of environmental health interventions, and therefore decision makers have limited information on the relative cost-effectiveness of health interventions from which to make evidence-based decisions' (WHO 2002, p. vi).
- The studies reviewed were very heterogeneous and presented a wide variety of results using different outcome measures, making it difficult to summarise the findings. However, there were two measures that were frequently reported: benefit-cost ratios and the value attributed to each new cyclist or walker on a trail or as a result of a policy.
- The review concludes that cost-benefit analyses of cycling and walking infrastructure generally produce positive benefit-cost ratios – eight authors produced 16 benefit-cost ratios for various cycling/walking projects, and only one was negative. In other words, many of the studies were able to clearly demonstrate benefits outweighing costs associated with walking and cycling and this is obviously very powerful data. There were no studies reviewed from Australia. It is possible such studies have been conducted in Australia since this article was published.



Recommendations for Future Research:

- The methods for conducting economic analyses of cycling and walking projects should be sound and transparent: it is only when they are evaluated using the same methods as used on other transport projects that their high value becomes apparent.
- One of the most significant challenges is the relationship between observed cycling or walking and total physical activity. Ideally, models should refer to continuous data on energy expenditure regardless of how it was accrued. Such data are rarely available. One study by Rutter (2006), overcame this obstacle by using relative risks for cycling which controlled for leisure time physical activity. This neatly avoids the issue of activity substitution (the notion that additional activity in one domain such as cycling may be associated with reduced activity in another) and means that any model can focus on the benefit accruing from the activity of cycling itself.
- There is a need for a more harmonised approach to the inclusion of health effects related to physical activity through cycling and walking in economic analyses of transport infrastructure and policies.
- 'Since transport policy decisions are taken every day and sometimes on approaches that often lack transparency and scientific rigour, an approach based on the best available evidence seems opportune at this stage' (Cavill et al. 2008, p. 298). The study by Rutter (2006) has identified an approach that appears to have the greatest potential thus warranting further development to lead to a more uniform approach. Follow-up work to this review has focused on developing guidance and a model based on this approach using relative risks for cycling which controlled for leisure time physical activity as best available evidence to date in the absence of models based on energy expenditure (WHO Regional Office for Europe, 2007).

HBEP Policy Implications for Practice:

- Use the results of cost benefit analysis to justify policies facilitating walking and cycling.

References:

Rutter, H. (2006). *Mortality Benefits of Cycling in London*. Transport for London, London, UK.

World Health Organization (WHO) (2002). *Considerations in evaluating the cost-effectiveness of environmental health interventions*. World Health Organization, Geneva, Switzerland.

World Health Organization (WHO) Regional Office for Europe (2007). *Economic assessment of transport infrastructure and policies: Methodological guidance on the economic appraisal of health effects related to walking and cycling*. WHO Regional Office for Europe, Copenhagen, Denmark. Available at: http://www.euro.who.int/transport/policy/20070503_1S (accessed 1 November 2007).

Cohen, D. A., Inagami, S. and Finch, B. (2008). 'The built environment and collective efficacy'. *Health and Place* 14(2): 198-208.

Key Words (from reference): Collective efficacy; alcohol outlets; parks; fast-food; Health disparities; built environment.

Location: The authors are from the USA; the study focus is on Los Angeles, USA.

Aim: To assess whether environmental features are the foundation for or the etiology of personal reports of neighbourhood collective efficacy.

Method:

- The study analysed data from the Los Angeles Family and Neighbourhood Study (LAFANS) together with geographical data from Los Angeles County to determine which social and environmental features were associated with personal reports of collective efficacy.
- Multi-level modelling was used when controlling for age, education, annual family income, sex, marital status, employment and race/ethnicity at the individual level.
- At the tract level, disadvantage, the number of off-sale alcohol outlets per roadway mile, the number of parks and the number of fast-food outlets within the tract and within half a mile of the tract's boundaries, were all controlled.

Conclusions:

- Increased alcohol outlet store density showed an association with lower levels of collective efficacy, but because density of off-sale alcohol outlets is highly correlated with tract disadvantage, the independent association of alcohol outlets to collective efficacy could not be teased out in the hierarchical model.

- Living in a neighbourhood with more parks is strongly associated with higher levels of reported efficacy.
- There is an association between features of the environment and perceptions of neighbourhood social functioning that may indirectly influence health outcomes.
- The number of fast-food establishments and number of elementary schools were not linearly associated with levels of collective efficacy.
- By improving social and neighbourhood conditions such as social disadvantage and increasing the number of parks this will result in an increase in collective efficacy and potentially lead to reductions in premature deaths.

Recommendations for Future Research: No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- Employ land use regulation to control concentrations of alcohol outlet stores.
- Provide well managed and safe public open spaces.

Coveney, J. and O'Dwyer, L. A. (2009). 'Effects of mobility and location on food access'. *Health and Place* 15(1): 45-55.

Key Words: Food desert; car use; food shopping; qualitative research; health inequalities.

Location: The authors are from Australia; the study focus is on Adelaide, Australia.

Aim: To explore the extent to which the combination of not having a car and the location of households impose on inequalities to food access. The study was set within the context of food security, which includes the 'ready availability of nutritionally adequate, safe foods, and the assured ability to acquire them in socially acceptable ways' (Kendall and Kennedy 1998 cited in Coveney and O'Dwyer 2009, p. 46). The authors aimed to compare households that were located within a food desert with those living outside a food desert and to examine the imposition placed on households by not having access to a car.

Method: In-depth interviews with respondents without private transport living within and outside food deserts in Adelaide, South Australia. Food deserts were identified using Geographic Information Systems (GIS) to measure availability and accessibility of major

chain supermarkets in four Local Government Areas (LGA) in Adelaide. Sixteen households without cars were recruited for the study. Interviews were conducted in participants' homes by one of a team of three interviewers during 2005. The interviews were audio-taped and transcribed. The respondents in the total sample came from a variety of socio-economic positions and family situations, ranging from single-member households, single-parent and two-parent households, with or without children of a variety of ages. Respondents were aged between 20 and 70.

Conclusions:

- The research found that living in a food desert did not, by itself, impose food access difficulties. Far more important was access to independent transport to shops.
- A number of features were identified including reliance on supermarkets, difficulties with public transport, and the provision of government schemes and systems that for some made food shopping much easier.
- The research suggests that food access problems in Adelaide are not necessarily the product of geographic distance between home and shop, more so the social or welfare networks that allow people to access private transport.
- The use of neighbourhood volunteers, carers, and taxi voucher systems which compensate for a lack of private transport for the disabled or infirm was an unexpected outcome from this research, and there are lessons that may be learned from this that can be applied to other disadvantaged groups.

Recommendations for Future Research:

Research into how compensatory factors such as taxi vouchers, volunteers and carers (of the disabled) can help to overcome the disadvantage of living without viable transport to access healthy food.

HBEP Policy Implications for Practice:

- Ensure widespread access to a variety of food shops via public transport systems.

Crawford, D. A., Timperio, A. F., Salmon, J. A., Baur, L., Giles-Corti, B., Roberts, R. J., Jackson, M. L., Andrianopoulos, N. and Ball, K. (2008). 'Neighbourhood fast food outlets and obesity in children and adults: The CLAN Study'. *International Journal of Pediatric Obesity* 3(4): 249-56.

Key Words: Access; availability; adults; children; energy-dense foods; fast-foods; foods outside home.

Location: The authors are from Australia; the study is based in Australia.

Aim: To examine associations between density of and proximity to fast-food outlets and body weight in a sample of children and their parents.

Method: Children's measured and parents' self-reported heights and weights were used to calculate Body Mass Index (BMI). The locations of major fast-food outlets were geocoded. Bi-variate linear regression analyses examined associations between the presence of any fast-food outlet within a two-kilometre buffer around participants' homes, fast-food outlet density within the two-kilometre buffer, and distance to the nearest outlet and BMI. Each independent variable was also entered into separate bi-variate logistic regression analyses to predict the odds of being overweight or obese.

Conclusions: Among older children, those with at least one outlet within two-kilometres had lower BMI z-scores. The further that fathers lived from an outlet, the higher their BMI. Among 13-15 year old girls and their fathers, the likelihood of overweight/obesity was reduced by 80 percent and 50 percent, respectively, if they had at least one fast-food outlet within two-kilometres of their home. Among older girls, the likelihood of being overweight/obese was reduced by 14 percent with each additional outlet within two-kilometres. Fathers' odds of being overweight/obese increased by 13 percent for each additional kilometre to the nearest outlet. While consumption of fast-food has been shown to be associated with obesity, this study provides little support for the concept that exposure to fast-food outlets in the local neighbourhood increases risk of obesity.

Recommendations for Future Research: No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- There are no conclusive policy implications from this research.

Davison, K. K., Werder, J. L. and Lawson, C. T. (2008). 'Children's active commuting to school: Current knowledge and future directions'. *Preventing Chronic Disease* 5(3): A100.

Key Words: Walking; cycling; children; school; physical activity.

Location: The studies sourced are from the USA, Australia and UK but the data is interpreted from a USA perspective.

Aim: 1) to examine research on the health consequences of active commuting to school, 2) to summarise pertinent studies on predictors of children's active commuting to school, and 3) outline and evaluate programs specific to children's active commuting to school.

Method: Literature on children's active commuting to school published before June 2007 was compiled by searching PubMed, PsycINFO, and the National Transportation Library databases; conducting internet searches on program-based activities; and reviewing relevant transportation journals published during the last four years. The inclusion criteria consisted of: a study sample composed of children 18 years or younger and published in English in the four years prior to 2007. Grey literature search methods were used to fulfil goal three of the review (to evaluate children's active commute to school programs).

Conclusions:

- Children who walk or bicycle to school have higher daily levels of physical activity and better cardiovascular fitness than do children who do not actively commute to school. There is evidence that this is linked to school days (Tudor-Locke et al. 2003 and Sirard et al. 2005), indicating that children who actively commute to school are not necessarily more active on other days. Possible health benefits for children of walking and bicycling to school illustrate the need to further examine ways to promote active commuting in this population.
- A wide range of predictors of children's active commuting behaviours was identified, including demographic factors, individual and family factors, school factors, and social and physical environmental factors. School and community factors associated with school location, such as distance to school, population density in the immediate area of a school, and school enrolment levels, have been consistently linked



with active commuting rates. Research examining characteristics of the physical environment suggests that children are more likely to walk or bicycle to school when the route to school is direct (Timperio et al. 2006), navigation of steep roads is minimal (Timperio et al. 2006), and neighbourhoods in which children live are deemed 'walkable' (as measured by residential density, retail floor area ratio, intersection density, and land use mix) (Kerr et al. 2006, McMillan 2007). In contrast to characteristics of road and sidewalk infrastructure, most studies find no association between perceived traffic safety and children's active commuting (Timperio et al. 2006, Kerr et al. 2006). In terms of social environment, mixed results have been identified for studies assessing perceived crime and safety, however studies show that children are more likely to walk or bicycle to school when parents perceive that other children in the area actively commute (Timperio et al. 2006).

- Safe Routes to School and the Walking School Bus are two public health efforts that promote walking and bicycling to school. Although evaluations of these programs are limited, evidence exists that these activities are viewed positively by key stakeholders and have positive effects on children's active commuting to school.

Recommendations for Future Research:

- Future efforts to promote walking and bicycling to school will be facilitated by building on current research, combining the strengths of scientific rigor with the predesign and postdesign provided by intervention activities, and disseminating results broadly and rapidly.
- This could be facilitated by development of standardised instruments and variable definitions to allow for comparative studies, provide a repository for the data (e.g. a secure Web site hosted by an academic institution), and develop a reporting platform that will make 'lessons learned' available as quickly as possible.
- Few studies have examined the effects of extreme cold and heat on children's commuting patterns.
- Little research has focused on social environmental predictors of children's active commuting to school.
- Continued dialogue among public health professionals, local planners, and community members is required.
- Limits: All studies on predictors of active

commuting used a cross-sectional design. There is a lack of standardised definition and measurement of active commuting. The issue of poorly conceptualised predictor variables is highlighted by a large number of studies that found significant associations between commuting patterns and the variables classified as 'other,' indicating that important variables may be at play that have yet to be addressed and that research techniques, such as the use of focus groups, may be an important first step in determining which variables are important for further analysis. Finally, many of the predictor variables were assessed only in a single study, thereby limiting the conclusions.

HBEP Policy Implications for Practice:

- Provide well marked, aesthetically pleasing, safe and direct routes to schools.
- Avoid steep slopes in designing routes to schools.
- Co-locate schools with other destinations such as community facilities, shops and services.
- Involve key stakeholders, including public health professionals, planners and the community, in the development of policies.

References:

Kerr, J., Rosenberg, D., Sallis, J. F., Saelens, B. E., Frank, L. D. and Conway, T. L. (2006). 'Active commuting to school: Associations with environmental and parental concerns'. *Medicine and Science in Sports and Exercise* 38(4): 787-794.

McMillan, T. E. (2007). 'The relative influence of urban form on a child's travel mode to school'. *Transportation Research Part A* 41(1): 69-79.

Sirard, J. R., Riner, W. F. Jr., McIver, K. L. and Pate, R. R. (2005). 'Physical activity and active commuting to elementary school'. *Medicine and Science in Sports and Exercise* 37(12): 2062-2069.

Timperio, A., Ball, K., Salmon, J., Roberts, R., Giles-Corti, B., and Simmons, D. (2006). 'Personal, family, social, and environmental correlates of active commuting to school'. *American Journal of Preventive Medicine* 30(1): 45-51.

Tudor-Locke, C., Ainsworth, B. E., Adair, L. S. and Popkin, B. M. (2003). 'Objective physical activity of Filipino youth stratified for commuting mode to school'. *Medicine and Science in Sports and Exercise* 35(3): 465-471.

Dunton, G. F., Kaplan, J., Wolch, J., Jerrett, M. and Reynolds, K. D. (2009). 'Physical environmental correlates of childhood obesity: A systematic review'. *Obesity Reviews* 10(4): 393-402.

Key Words: Adolescents; children; environment; obesity.

Location: The authors are from the USA; the study focus is on the USA.

Aim: To report on the results of a systematic review of quantitative research examining built and biophysical environmental variables associated with obesity in children and adolescents through physical activity.

Method: Relevant quantitative studies examining the relationship between built and biophysical environments and childhood obesity were identified through literature searches using PubMed, PsychInfo and Geobase. Searches consisted of at least one of 20 selected environment terms and one of 11 obesity related terms. All combinations of pairs (consisting of obesity and environment terms) were searched. After the selection criteria were applied only 15 studies were available for review.

Conclusions:

- For children, associations between physical environmental variables and obesity differed by gender, age, socio-economic status and population density.
- Access to equipment and facilities, neighbourhood pattern and urban sprawl were associated with obesity outcomes in adolescents.
- Targeting specific areas for intervention such as the physical characteristics of school environments is important for reducing the prevalence of obesity in young people as children spend a significant amount of time in this setting.
- The research found a weak association with children's use of community features, such as parks and recreational facilities, with obesity outcomes. The authors suggest using promotional strategies to enhance the use of these resources.
- The focus should be on identifying modifiable environmental factors that can be readily translated into population-level interventions and policies.
- A systematic review of the literature on the built and biophysical correlates of obesity in youth revealed a small but diverse number of studies representing a broad range of study populations, designs, measures and outcomes.

Recommendations for Future Research:

The authors found the current research is inconsistent across most of the environmental variables considered. Consequently, future research should strive for consistency in the types of variables, measures, buffer sizes and control variables used.

They recommend incorporating the impact of the qualitative environmental characteristics and considering the joint contributions of available facilities and travel routes to those locations. Also, future studies should attempt to utilize longitudinal, quasi-experimental and experimental research designs in order to better sort out the direction of causality between environments and obesity outcomes. Lastly, mediators and moderators of the relationship between physical environments and obesity need to be explored (including interactions between different levels of the environment) in order to guide more theoretically sound and hypothesis-driven research in this area.



HBEP Policy Implications for Practice:

- Allow access to playgrounds and other open spaces in school grounds outside of school hours.
- Tailor playground spaces to different ages and genders and different neighbourhood characteristics.
- Ensure quality equipment is installed in children's playgrounds.
- Involve children in the development of spaces for recreation.

Evans, S. (2009b). ' "That lot up there and us down here"; Social interaction and a sense of community in a mixed tenure UK retirement village'. *Ageing and Society* 29(2): 199-216.

Key Words: community; retirement village; diversity; older people.

Location: The author is from the UK; the study focus is on the UK.

Aim: This article reports a study of a retirement village that has attempted to integrate residents from a range of socio-economic backgrounds by making various tenures available in the same development.

Method:

- The study was carried out between October 2004 and March 2006 using a case study methodology.

- Data was collected in three ways from different sets of informants. Invitations to be interviewed were delivered to all the village residents apart from 15 people living in the specialist dementia unit in the care home.
- Of the 37 who agreed to be interviewed, 27 lived in lease-purchase apartments, six in the extra-care housing, and four in the care home. Those who agreed to take part were also asked to complete an adapted version of the *How is Your Home?* questionnaire.
- Additional data was collected to measure a broad range of health and social care needs.
- The interviews were transcribed and the content analysed by coding phrases into categories themes and sub-themes.

Conclusions:

- There was a strong sense of belonging among the residents but most identified with their own section rather than the development as a whole.
- Social interaction was the most important factor in a sense of community. For many residents, this centred on a range of organised events and activities as well as the use of communal facilities in the village.
- The fact that tenures occupied separate physical areas of the village exacerbated the differences in social backgrounds and interests.
- Casual, everyday social interactions amongst residents are an important element in people's sense of community.
- The built environment was a key element in the development of social networks among residents.
- Physical barriers such as the villages' design to separate areas through socio-economic backgrounds resulted in residents identifying a sense of community in relation to the area of the village in which they lived rather than the overall village.

Recommendations for Future Research: No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- Promote social interaction through community events.
- Provide communal facilities for incidental and organised interactions.

Ewing, R. and Cervero, R. (2010). 'Travel and the Built Environment: A Meta Analysis'. *Journal of the American Planning Association* 76(3): 265-294.

Key Words: Vehicle miles travelled (VMT); walking; transit; built environment; effect sizes.

Location: The authors are from the USA; the literature reviewed is from around the world.

Aim: To conduct a meta-analysis of the built environment-travel literature existing at the end of 2009 in order to draw generalisable conclusions for practice – to generalise the effect of land use planning and urban design strategies on reductions in automobile use and related social and environmental costs. The study aimed to quantify effect sizes, update earlier work, include additional outcome measures, and address the methodological issue of self-selection. The study claims to focus on non-work related travel.

Method: This is an update of the landmark 2001 study by the same authors (Ewing and Cervero 2001). The 2001 study only looked at VMT and vehicle trips as outcomes whereas this more recent study adds walking and transit use as outcomes of interest. Studies linking the built environment to travel were identified through various multidisciplinary databases using the keywords 'built environment,' 'urban form,' and 'development,' coupled with keywords 'travel,' 'transit,' and 'walking.' In addition, data from the of the Transportation Research Board's annual programs were reviewed for relevant papers, leading researchers in the subject area were contacted for copies of their latest research and a call for built-environment/travel studies on academic online forums was made.

Inclusion criteria were that studies needed to quantitatively analyse effects of the built environment on travel choices, control statistically for confounding influences on travel behaviour, apply statistical tests to determine significance of various effects, be based on sizeable samples and contain numerical data available for computing effect sizes. Fifty articles were selected for inclusion and the study went on to compute actual elasticities for individual studies and pooled them to produce weighted averages.

Conclusions: At least 38 studies using nine different research approaches have attempted to control for residential self-selection. Nearly all of them found 'resounding' evidence of statistically significant associations between the built environment and travel behaviour, independent of self-selection influences. However, nearly all of them also found that residential self-selection attenuates the effects of the built environment on travel.

There are at least 12 surveys of the literature on the built environment and travel. There are 13 other surveys on the built environment and physical activity, including walking and bicycling. There is considerable overlap among these reviews, particularly where they share authorship. The literature is now so vast it has produced two reviews of the many reviews.

Travel variables are generally inelastic with respect to change in measures of the built environment. Of the environmental variables considered here, none has a weighted average travel elasticity of absolute magnitude greater than 0.39, and most are much less. Still, the combined effect of several such variables on travel could be quite large. Consistent with prior work, we find that vehicle miles travelled (VMT) is most strongly related to measures of accessibility to destinations and secondarily to street network design variables. Walking is most strongly related to measures of land use diversity, intersection density, and the number of destinations within walking distance. Bus and train use are equally related to proximity to transit and street network design variables, with land use diversity a secondary factor. Surprisingly, we find population and job densities to be only weakly associated with travel behaviour once these other variables are controlled. Several variables that often go hand-in-hand with population density have elasticities that are well above that of population density — in other words, it is not density itself that leads to a decrease in VMT or increase in walking but the land use mix and accessibility that this density justifies.

Recommendations for Future Research:

The elasticities derived in this meta-analysis may be used to adjust outputs of travel or activity models that are otherwise insensitive to variation in the built environment, or be used in sketch planning applications ranging from climate action plans to health impact assessments. However, because sample sizes are small, and very few studies control for residential preferences and attitudes, planners should generalise broadly from the results of this study. While these elasticities are as accurate as currently possible, they should be understood to contain unknown error and have unknown confidence intervals. They provide a base, and as more built-environment/travel studies appear in the planning literature, these elasticities should be updated and refined.

HBEP Policy Implications for Practice:

- Provide local destinations by allowing mixed uses.
- Support grid like streets with high intersection densities.
- Improve regional access to public and active transport infrastructure.
- Coordinate built environment modifications with other programs and policy changes.

References:

Ewing, R. and Cervero, R. (2001). 'Travel and the built environment: a synthesis'. *Transportation Research Record* 1780: 87-113.

Ewing, R. and Dumbaugh, E. (2009). 'The built environment and traffic safety: A review of empirical evidence'. *Journal of Planning Literature* 23(4): 347-367.

Key Words: Traffic safety; built environment; urban sprawl; street design.

Location: The authors are from the USA; the literature reviewed is mostly US based.

Aim: A non-systematic (but comprehensive) review of the impact of the built environment on traffic safety.

Method: The method used was non-systematic but based on the comprehensive knowledge of the authors.

Conclusions: The key finding of the review is that more compact regional forms have the ability to reduce VMT to levels that also reduce population-level crash incidence. Further, the review concludes that research has consistently found inverse relationships between the Four D's (Density, Diversity, Design and Destination Accessibility) and traffic accidents (i.e. >D's = <accidents). The review is helpful in that it proves that 'healthy built environments' are essentially also safe traffic environments.

Recommendations for Future Research:

- Develop an understanding of how regional development patterns influence total travel and trip making, and how the resulting travel patterns in turn influence population-level crash exposure.
- Re-examine how the design and configuration of individual communities may influence crash incidence. The prevailing theory of community design aims to increase safety via disconnected



residential subdivisions that eliminate neighbourhood cut-through traffic. It is likely that the safety gain achieved through the elimination of neighbourhood traffic is offset by crash increases on arterial thoroughfares however this hypothesis needs to be researched.

- Develop an understanding of how design influences the behaviour of specific roadway users, and how these behaviours in turn influence crash incidence. Modifications in the built environment can profoundly influence vehicle speeds and traffic conflicts, which in turn have a profound effect on crash incidence. Yet there has been little research aimed at relating specific pre-crash behaviours to the environments in which they occur, and almost no attempt to understand how the characteristics of the built environment may encourage, or discourage, these behaviours from occurring in the first place.

HBEP Policy Implications for Practice:

- Consider the future amenity of residents in the design and location of increases in density.
- Support the development of co-location policies for residential, commercial and employment uses, while considering residential amenity. This includes provision of privacy, reductions in exposure to noise, and access to natural open spaces.

Faulkner, G. E. J., Buliung, R. N., Flora, P. K. and Fusco, C. (2009). 'Active school transport, physical activity levels and body weight of children and youth: A systematic review'. *Preventive Medicine* 48(1): 3-8.

Key Words: Active transportation; school; physical activity; body weight.

Location: The authors are from Canada; the literature reviewed is from the USA, Europe, New Zealand, Australia and the Philippines.

Aim: To review studies of active transport to schools and establish whether active transport results in lower bodyweight and increased physical activity among students.

Method: The authors conducted a systematic review of published research on whether children who actively commute to school also have a healthier body weight. Online searches

of five electronic databases were conducted. Potential studies were screened on the basis of objective measures of physical activity. Thirteen studies met the criteria for inclusion and were reviewed.

Conclusions:

- Active transport to school supplements overall physical activity levels among children, with active commuters reporting significantly higher levels of physical activity than those who travel by motorised transport. However there was little evidence to suggest a relationship between active transport to school and healthier body weight/Body Mass Index (BMI) among children. The studies including measures of body weight/ BMI reveal that the difference in body weight/BMI between active and passive commuters was seldom significant and not supported in the long term.
- While there is insufficient evidence to link active transport to school with healthy body weights for children and youth, a focus on active school transport is still appropriate given that adequate participation in physical activity during childhood and adolescence could be critical to the prevention of chronic disease later in life.

Recommendations for Future Research: A focus on active school transport is appropriate given that adequate participation in physical activity during childhood and adolescence could be critical to the prevention of chronic disease later in life. Research is required to assess how active transport to school can facilitate increased changes in daily physical activity over the long term.

HBEP Policy Implications for Practice:

- Encourage children's active transport to school.

Feng, J., Glass, T. A., Curriero, F. C., Stewart, W. F. and Schwartz, B. S. (2010). 'The built environment and obesity: A systematic review of the epidemiologic evidence'. *Health and Place* 16(2): 175-190.

Key Words: Built environment; contextual effects; food environment; land use; obesity.

Location: The authors are from the USA; the literature reviewed is from the USA, Australia, Canada and Europe.



Aim: To present a systematic and quantitative assessment of an updated body of literature focusing on conceptual, methodological and inferential issues associated with the built environment and obesity. The study seeks a particular emphasis on evaluating associations across studies and aims to shed light on key methodological challenges.

Method: Fifty three papers were sourced from a database search. The search was restricted to English language studies only with studies using diet or physical activity only as outcomes or examining only demographic or social characteristics as exposure variables excluded (i.e. studies needed to have a built environment metric and a weight related outcome). The 53 papers were then classified by various variables (built environment domain examined, location, population, context, way of defining context (e.g. use of census tracts or use of individually defined geographic areas), cross sectional/longitudinal). The focus was then narrowed to 22 studies which defined 'place' as either: 'contextual' studies (looking at specific variables within specific geographic units) or 'geographic buffer' studies (which defined place by geographic buffers using distances deemed to be behaviourally relevant – e.g. walkable distance).

Conclusions: Built environment metrics reported by three or more studies were density, fast-food density, walkability, land use mix and 'county sprawl index'. There is very little consistency in measures of the built environment in particular – 'the most striking feature of this study is the absence of agreement on how the built environment should be measured and modelled' (Feng et al. 2010, p. 180). 'Lack of heterogeneity in place could explain the absence of associations' (Feng et al. 2010, p. 180) – in other words, places are different and therefore associations will be different.

Recommendations for Future Research:

- Greater understanding of the role of the built environment needs to be facilitated before the 'supportive environment with accessible and affordable healthy food choices and opportunities for regular physical activity' (Burdette and Whitaker 2004 cited in Feng et al. 2010, p. 186) required to decrease overweight and obesity can be provided. A better understanding of the 'metrics' of the built environment needs to happen through inter- and cross-disciplinary collaborations. This will enable systematic evaluation across studies.
- The study also mentions the 'black box of place' (after Macintyre et al. 2002) and suggests that the biggest

obstacle to health and place research is inappropriate spatial scale – too often obesity literature takes the easy way out by using administratively defined spatial units rather than more sociologically valid places.

- Longitudinal studies need to be pursued.
- Further collaboration across disciplines needs to be supported to 'narrow in on the key features of the built environment that are contributing to the obesity epidemic' (Feng et al. 2010, p. 187).

HBEP Policy Implications for Practice:

- Support interdisciplinary collaborations between health and built environment professionals.

References:

Macintyre, S., Ellaway, A. and Cummins, S. (2002). 'Place effects on health: How can we conceptualise, operationalise and measure them?'. *Social Science and Medicine* 55 (1), 125-139.

Ferreira, I., van der Horst, K., Wendel-Vos, W., Kremers, S., van Lenthe, F. J. and Brug, J. (2007). 'Environmental correlates of physical activity in youth – a review and update'. *Obesity Reviews* 8(2): 129-154.

Key Words: Adolescents; children; environment; physical activity.

Location: The authors are from the Netherlands; the literature reviewed is primarily from the USA.

Aim: To review literature on environmental factors associated with physical activity (PA) in youth.

Method: The authors undertook a systematic semi-quantitative review of 150 studies on environmental correlates of youth PA published in the past 25 years. The Analysis Grid for Environments Linked to Obesity (ANGELO) framework was used to classify the environmental correlates studied (see Kirk et al. 2010 for an explanation of ANGELO).

Conclusions: Most studies retrieved used cross-sectional designs and subjective measures of environmental factors and PA. Variables of the home and school environments were especially associated with children's PA. Most consistent positive correlates of PA were father's PA, time spent outdoors and school PA-related policies (in children), and support

from significant others, mother's education level, family income, and non-vocational school attendance (in adolescents). Low crime incidence (in adolescents) was characteristic of the neighbourhood environment associated with higher PA. Convincing evidence of an important role for many other environmental factors was, however, not found.

Recommendations for Future Research:

Further research should aim at longitudinal and intervention studies, and use more objective measures of PA and its potential (environmental) determinants.

HBEP Policy Implications for Practice:

- Consider the importance and influence of parental physical activity levels in designing programs for children's physical activity.
- Provide well managed public open spaces for physical activity.
- Ensure spaces for children's physical activity are safe from traffic and crime.

References:

Kirk, S. F. L., Penney, T. L. and McHugh, T. L. F. (2010). 'Characterizing the obesogenic environment: The state of the evidence with directions for future research'. *Obesity Reviews* 11(2): 109-117.

Frost, S. S., Goins, R. T., Hunter, R. H., Hooker, S. P., Bryant, L. L., Kruger, J. and Pluto, D. (2010). 'Effects of the Built Environment on Physical Activity of Adults Living in Rural Settings'. *American Journal of Health Promotion* 24(4): 267-283.

Key Words: Built environment; physical activity; rural; walking; prevention research.

Location: The authors are from the USA; the study focus is on the USA.

Aim: To conduct a systematic review of the literature to examine the influence of the built environment (BEnv) on the physical activity (PA) of adults in rural settings.

Method: The authors conducted key word searches of Academic Search Premier, PubMed, CINAHL, Web of Science, and Sport Discus. Some of the search terms were: 'rural built environment', 'rural adults', 'physical environment'. Studies included in the research were published prior to June 2008 and assessed one or more elements of

the BE. The studies were required to examine the relationships between the BE and PA, and focused on rural locales. Objective(s), sample size, sampling technique, geographic location, and definition of rural were extracted from each study. The methods of assessment and outcomes were extracted from the quantitative literature, and overarching themes were identified from the qualitative literature.

Conclusions:

- Research in this area is limited. Associations among elements of the BE and PA among adults, however, appear to differ between rural and urban areas.
- The elements of the environment which appear to positively influence PA in the rural environment include: aesthetics, safety from crime and traffic, and presence of recreational facilities, trails or parks.
- When comparing urban and rural studies, urban areas showed a positive relationship between parks, sidewalks and walkable destinations with PA.

Recommendations for Future Research:

Considerations for future studies should include the identification of parameters to define rural as well as longitudinal research, incorporating diverse geographic sampling. The development and refinement of BE assessment tools specific to rural locations are also required.

HBEP Policy Implications for Practice:

- In rural areas prioritise provision of safe and aesthetically pleasing recreational facilities, trails and parks.
- In urban areas, prioritise provision of a variety of parks, well maintained footpaths and walkable destinations.

Galvez, M. P., Pearl, M. and Yen, I. H. (2010). 'Childhood obesity and the built environment'. *Current Opinion in Pediatrics* 22(2): 202-207.

Key Words: Active commuting; BMI; diet; built environment; childhood obesity; neighborhood; physical activity.

Location: The authors are from the USA; the articles reviewed are from around the world.

Aim: To examine neighbourhood factors for their role in childhood obesity. To apply Ecological Systems Theory to the analysis of the impact of the built environment on childhood obesity.



Method: A search was conducted in PubMed, PsychInfo, Web of Science, and CINAHL using search terms related to the paediatric population, built environment, obesity measures, and obesity-related behaviour measures such as diet and physical activity. Articles were included that provided data on paediatric populations aged under 18 years, measured built environmental variables such as physical structures, walkability, or safety, and had specific outcome measures of childhood obesity or obesity-related behaviour such as diet or physical activity. Articles were excluded if they described future studies or methodological tools, were not relevant to developed countries, examined only large-scale geographic trends, or compared areas solely by urban and rural categories rather than at the individual child level. This left 48 recent articles measuring built environmental variables and obesity outcomes in children for analysis.

Conclusions: The review summarises articles on neighbourhood influence on childhood obesity under the categories of diet, physical activity, active commuting, neighbourhood walkability, obesity (general) and neighbourhood safety with a diverse array of findings – see article for more details.

Recommendations for Future Research:

- Interdisciplinary approach.
- Research into the impact of the built environment on children's dietary behaviours.
- Research into the impact of the built environment on childhood obesity on populations that vary by key socio-demographics including sex, race/ethnicity, income, while combining individual level dietary and physical activity behaviours, as well as subjective and objective measures of neighbourhood across urban, suburban and rural areas.

HBEP Policy Implications for Practice:

- There are no conclusive policy implications from this research.

Gebel, K., Bauman, A. E. and Petticrew, M. (2007). 'The physical environment and physical activity: A critical appraisal of review articles'. *American Journal of Preventive Medicine* 32(5): 361-369.

Key Words: Physical environment; physical activity; literature review.

Location: The authors are from Australia and the UK.

Aim: This paper systematically appraises methodologic aspects of literature reviews examining the relationship between physical activity and the physical environment published in peer-reviewed journals between 2000 and 2005. Eleven reviews and their antecedent source papers were examined. The observational evidence base on the physical environment and physical activity is substantial, and growing rapidly. Decision-making based on observational evidence is particularly difficult, given lack of guidance on what constitutes a good enough study in the absence of experimental evidence (Ogilvie et al. 2006).

Method: A literature search for systematic and narrative review papers published in English between 2000 and 2005 was conducted using the databases Medline, CINAHL, DARE/EBMR, PsycLit, Pub Med, Avery, and Transportation, along with hand searching of reference lists of identified studies. Also, reference lists compiled by the Active Living Research group were analysed. Reviews were included when authors investigated the relationship between any aspect of the physical environment (built and natural) and any form of physical activity for the adult population.

Conclusions: The majority of these reviews omitted between one third and two thirds of the studies that could have been eligible for inclusion at the time they conducted the review. Methodologic information on how the review was conducted was not always provided. Furthermore, in some cases results of a study were reported incorrectly, or physical environmental aspects were conflated with social environmental or cognitive factors. Moreover, when results were reported incorrectly, physical environmental variables were almost always reported as significantly associated with physical activity, when these associations were non significant, or were not assessed as part of the primary study.

Recommendations for Future Research:

Greater standardisation in the reporting of review methods may assist with future efforts to summarise studies of the relationship between physical environments and physical activity.

HBEP Policy Implications for Practice:

- Encourage inter-disciplinary collaboration between academics, policy makers and professional staff from health and built environment backgrounds.
- Work to reach consensus about standardised but adaptable measurement of the built environment and physical activity.

References:

Ogilvie, D., Mitchell, R., Mutrie, N., Petticrew, M. and Platt S. (2006). 'Evaluating health effects of transport interventions: Methodologic case study'. *American Journal of Preventive Medicine* 31(2): 118-126.

Gebel, K., King, L., Bauman, A., Vita, P., Gill, T., Rigby, A. and Capon, A. (2005). *Creating healthy environments: A review of links between the physical environment, physical activity and obesity*. NSW Department of Health and NSW Centre for Overweight and Obesity, Sydney, Australia.

Key Words: Physical environment; physical activity; obesity.

Location: The authors are from the New South Wales Department of Health and the New South Wales Centre for Overweight and Obesity, both of which are located in Sydney, Australia; the articles reviewed are from around the world.

Aim: To review existing studies and summarise existing systematic reviews supporting associations between urban environments, physical activity and obesity.

Method: The article reviews nine review papers which in turn examined 81 original source papers. The review also contains a comprehensive discussion on the links between the physical environment, physical activity and obesity and groups the discussion and the literature into the areas of: (a) development of an ecological framework for understanding on how environments influence physical activity, nutrition and weight status, (b) links between the physical environment and nutrition, and (c) links between the physical environment and physical activity. The review also has a comprehensive glossary.

Conclusions: Research into links between physical activity and health should not lose

sight of the fact that any change resulting from modifications to the built environment will only be seen if other changes occur to, for example, social norms and community understanding. Recent research has led to a better understanding of the kinds of environments likely to be associated with physical activity and improved measurement of these environments. There is also consistent evidence across countries, environments and settings, supporting the notion that the links between health and the environment are causal.

Recommendations for Future Research: Take advantage of opportunistic evaluations of the impacts of new urban development, new road and track systems and new housing estates in order to contribute to the evidence base required to support policy change.

HBEP Policy Implications for Practice:

- Pursue a social ecological approach to encouraging physical activity by including modifications to the built environment with other policy innovations such as educational programs.

Guite, H. F., Clark, C. and Ackrill, G. (2006). 'The impact of the physical and urban environment on mental well-being'. *Public Health* 120(12): 1117-1126.

Key Words: Physical environment; urban environment; built environment; housing; mental health.

Location: The authors are from the UK; the study focus is on London, UK.

Aim: To examine the strength of association between physical and social factors in the built environment and mental wellbeing, and to determine which factors are the most important.

Method: A postal survey based on a theoretical model of domains that might link the physical and urban environment with mental wellbeing was sent to 2,696 adults aged 18 years or over, in four areas of Greenwich, London. Participants were selected on the basis of living in a property in Greenwich that was currently or had previously been council owned or managed. Mental health was measured using the SF36 subscales for mental health and vitality. Additional household and area level data were appended for each respondent from a range of sources.



Conclusions: A total of 12 significant factors were identified within the environmental domains analysed. It was found that dissatisfaction with damp in the home, the aesthetic quality of the estate or road, neighbour noise, overcrowding in the home, access to green open spaces, access to community facilities, local social and entertainment facilities, safety in the neighbourhood (both during the day and at night), the presence of needles and syringes in the local neighbourhood, the number of places to stop and chat, and the number of social events in the community were associated with poor mental health. Further statistical analysis revealed that five of these factors remained significant when analysed across the domains and against confounding factors that could also influence mental health. These five factors included dissatisfaction with neighbour noise, overcrowding in the home, access to green open spaces, access to community facilities and daytime safety. 'This study confirms an association between the physical environment and mental well-being across a range of domains' and 'highlights the needs to intervene on both design and social features of residential areas to promote mental well-being' (Guite et al. 2006, p. 1118). Many of the study's findings are supported by other recent reviews, which are identified in the article.

Recommendations for Future Research:

- The authors highlight the inherent deficiencies of cross-sectional study designs and call for prospective studies of interventions to address the significant factors identified in the study.

HBEP Policy Implications for Practice:

- Devise a comprehensive policy framework to address all of the domains that influence mental health. Prioritise actions to reduce neighbour noise, alleviate household overcrowding, improve access a variety of green open spaces and community facilities, and address safety (both real and perceived).

Handy, S., Cao, X. and Mokhtarian, P. (2009). *Active travel: The role of self-selection in explaining the effect of built environment on active travel.* Robert Wood Johnston Foundation, Princeton, USA.

Key Words: Built environment; physical activity; active travel; neighbourhood design; walking; biking.

Location: The authors are from the USA; the research reviewed is mainly from the USA.

Aim: To detail findings of an array of studies on the effect of residential self-selection on active travel (i.e. walking and cycling for transport).

Method: This is an Active Living Research (ALR) general review, mainly of findings of previous studies done by the authors (in particular, see Cao, Mokhtarian and Handy 2009).

Conclusions: People who prefer to walk for transport live in 'Traditionally Designed Neighbourhoods' (TND) (i.e. with features of a healthy built environment including mixed use, grid like streets, open frontages and well maintained, safe places to walk). Regardless, people who live in TNDs still walk more than those living in suburban neighbourhoods. The study concludes that neighbourhood design has an impact on walking regardless of self-selection. The study also cites evidence to conclude that the demand for TNDs is increasing.

Recommendations for Future Research:

- Pursue longitudinal 'before and after' studies of the travel behaviour and attitudes of people moving from driving to walking oriented neighbourhoods.
- Examine how factors such as age, income and familial status impact people's ability to choose a walking oriented neighbourhood.

HBEP Policy Implications for Practice:

- Support traditional neighbourhood designs. These include mixed uses, mixed densities, grid like and navigable streets, open frontages, and well maintained and safe places in which to walk and cycle.

References:

Cao X., Mokhtarian P. and Handy S. (2009). 'Examining the impacts of residential self-selection on travel behavior: A focus on empirical findings.' *Transport Reviews* 29(3): 359-395.

Heath, G., Brownson, R. C., Kruger, D. J., Miles, R., Powell, K. E. and Ramsey, L. T. (2006). 'The effectiveness of urban design and land use and transport policies and Practices to Increase physical activity: A systematic review'. *Journal of Physical Activity and Health* 3: 243-253.

Key Words: Exercise; leisure activities; physical fitness; physical endurance; decision making, evidence-based medicine; economics; preventive health services; public health practice; meta-analysis; review literature; urban planning.

Location: The authors are from the USA; the literature reviewed is mostly US based.

Aim: To review environmental and policy interventions to promote physical activity under three broad category headings: community-scale urban design and land use policies and practices to increase physical activity; street-scale urban design and land use policies to increase physical activity; and transportation and travel policies and practices.

Method: The review is based on the methods of the independent 'Task Force on Community Preventive Services' (the Task Force). A multidisciplinary team developed a conceptual framework for organising and selecting each of the interventions under consideration and for choosing how to define the success of each intervention. A systematic search for evidence was performed using standard computer-based search engines. Each study that met the inclusion criteria was evaluated using a standard 'abstraction form' and assessed for suitability in terms of study design and validity of results. On the basis of the number of threats to validity, studies were characterised as having good, fair, or limited execution. Studies with limited execution were not included. Net intervention effects were calculated for all reported measurements of a given outcome. Often, different variables were used within a study to assess changes affecting the same outcome (e.g., changes in physical activity might be calculated by measuring times per week in physical activity, self-reported physical activity score, minutes per week in physical activity, or all three). Multiple measurements of the same outcome were examined for consistency. Medians were calculated as summary effect measures for each type of measurement and were compared across outcomes for consistency. Bodies of evidence of effectiveness were characterised as strong, sufficient, or insufficient on the basis of the number of available studies, the suitability of study designs for evaluating

effectiveness, the quality of execution of the studies, the consistency of the results, and the effect size.

Conclusions:

- *Community-scale urban design and land use policies, and practices in promoting physical activity* (defined as: interventions that use policy instruments such as zoning regulations and building codes, and environmental changes brought about by government policies or builders' practices. For example, policies encouraging transit-oriented development, addressing street layouts, the density of development, the location of more stores, and jobs and schools within walking distance of where people live). Twelve studies were identified. Weaknesses were that they were generally cross sectional studies, however, the review concludes there is sufficient evidence that community-scale urban design and land use regulations, policies, and practices can be effective in increasing walking and bicycling. Barriers to using community scale urban design and land use policies to promote physical activity include: (1) changing how cities are built given that the urban landscape changes relatively slowly, (2) zoning regulations that preclude mixed-use neighbourhoods, (3) cost of remodelling/ retrofitting existing communities, (4) lack of effective communication between different professional groups (i.e. urban planners, architects, transportation engineers, public health professionals, etc.), and (5) changing behavioural norms directed towards urban design, lifestyle, and physical activity patterns.
- *Street-Scale Urban Design and Land Use Policies and Practices to Increase Physical Activity* (defined as: policy instruments and practices to support physical activity in small geographic areas, generally limited to a few blocks. These policies and practices include features such as improved street lighting or infrastructure projects that increase sidewalk continuity). Six studies were identified. Each measured different types of interventions however based on the fact that each intervention related to either safety, aesthetics or access, the study was able to draw common conclusions. Most notably, that there is sufficient evidence that street-scale urban design and land use policies in small geographic areas (generally limited to a few blocks) is effective in increasing levels of physical activity. Barriers to

using street scale urban design and land use policies to promote physical activity include cost, coordination between authorities and professionals and in addition, community input is often required.

- *Transportation and Travel Policies and Practices* (defined as: interventions that strive to improve pedestrian, transit and light rail access, increase pedestrian and cyclist activity and safety, reduce car use, and improve air quality). Only one study with fair execution was found and the review concluded that there was not sufficient evidence to determine effectiveness of transportation and travel policy interventions in increasing physical activity or improving fitness.

Recommendations for Future Research:

Recommendations for future research were summarised under the following headings:

- **Measurement:**
 - What are the relationships between 'objective' and 'perceived' neighbourhood characteristics?
 - How should the built environment be conceptualised and what is the best way to measure or quantify components of the built environment (e.g., accessibility, aesthetics, safety, walkability)?
 - What is the optimal method for collecting self-reported data on physical activity and do those vary by domain (e.g., recreational vs. transport activity)?
 - How can existing GIS-derived data and other technologies such as movement sensors be used to improve the measurement abilities of future studies?
 - How best can we design longitudinal studies that account for the temporal sequence between 'exposure' to the environment and behaviour change?
- **Urban Design and Land Use Characteristics:**
 - What is the geographic scale(s) at which the neighbourhood environment is most strongly correlated with physical activity?
 - What are differences in the effectiveness of urban practices and policies, based on whether they are macro-level changes or micro-level changes (e.g., zoning changes in a community vs. adding street lights or sidewalks)?
- **Interaction of the Social and Physical Environment:**
 - How do these interventions apply in less populated or rural areas?
 - What characteristics of the built environment (e.g., land use mix, walkability, bike paths, improved street lighting, ease and safety of street crossing, sidewalk continuity, landscaping) best facilitate physical activity?
 - What effect does urban redevelopment have on physical activity levels of inner city residents?
 - What leads to effective collaboration across sectors as communities seek to promote physical activity?
 - Does multivariate adjustment for potential confounding factors (e.g., age, income, gender) change the relationship between the built environment, policies, and physical activity? If so, what potential confounders are most important?
 - What factors lead to an enhanced likelihood that policies friendly toward physical activity will be enacted and enforced?
 - Among elected officials, what are the key drivers in moving forward an agenda that supports activity-friendly communities?
 - How best can the various sectors (e.g., public health professionals, urban planners, travel behaviour researchers) collaborate to implement policies and practices that promote activity?
 - Does the built environment have similar effects on PA among the majority population, among diverse racial/ethnic, low SES, and various age and ability groups?
 - How well does perceived safety from crime coincide with objective measures of safety from crime? What explains any observed differences? How important are they in influencing physical activity? How should physical activity interventions address erroneous perceptions?
- **Economic Issues:**
 - What is the cost-effectiveness of each of these interventions and how can it be increased?
 - How can effectiveness in terms of health outcomes or quality-adjusted health outcomes be better measured, estimated, or modelled?



- Does making cities more walkable improve economic development?

HBEP Policy Implications for Practice:

- Policies encouraging physical activity should be embedded within a hierarchy of geographical scale. For example, policies encouraging walking at the neighbourhood scale need to connect to regional scale networks and programs.

HBEP Policy Implications for Practice:

- Promote behavioural change interventions based on educational programs to encourage cycling.
- Tailor cycling infrastructure to the local environment. For example, workplace showers are imperative in warmer climates and under cover cycle parking is crucial in climates where it snows.

Heinen, E., van Wee, B. and Maat, K. (2010). 'Commuting by bicycle: An overview of the literature'. *Transport Reviews* 30(1): 59-96.

Key Words: Transport; cycling; commuting; work; built environment.

Location: The authors are from the Netherlands; the research reviewed is from Europe, the USA, Canada and Australia.

Aim: To offer an overview of the academic literature on bicycle commuting.

Method: A general review of relevant literature was undertaken by the authors.

Conclusions: There are many determinants for whether people will commute by bicycle, not all of which are addressed by conventional mode choice studies and models. This suggests that predicting and influencing bicycle use needs to be grounded in other kinds of knowledge than those currently available for motorised forms of transport.

Recommendations for Future Research:

- Some environmental factors seem to have been left out of research into bicycle commuting — including the impact of slope, wind, pavement quality and infrastructure provision.
- Longitudinal studies are required.
- The importance of attitudes to cycling have been underestimated: 'From current research, it would appear that individuals in identical situations and in the same socio-economic groups choose to commute using different transport modes. This implies that an individual will base his or her choice not on an objective situation, but on their perception of that situation' (Heinen et al. 2010, p. 83).

Hillsdon, M., Foster, C. and Thorogood, M. (2005). 'Interventions for promoting physical activity'. *Cochrane Database of Systematic Reviews* 1.

Key Words: Physical activity; cardio-respiratory fitness; interventions.

Location: The authors are from the UK writing for the then UK Department of Health Services; the literature reviewed is from around the world but mostly relevant to the UK context (e.g., the USA, UK, Australia, other European countries).

Aim: This evidence briefing is a review of reviews about the effectiveness of public health interventions for increasing physical activity among adults. This is a review as part of the development of an evidence base of effective health improvement interventions related to physical activity. This briefing joins many other topic-based papers on the Health Development Agency (HDA) Evidence Base website. This briefing is intended to inform policy and decision makers, National Health Service (NHS) providers, public health physicians and other public health practitioners in the widest sense.

Method: This evidence briefing is a synthesis of high quality systematic reviews and meta-analyses to increase physical activity among adults. The briefing is not a systematic review of primary data. It employed the following parameters to identify the reviews included in the briefing:

- English language
- 1996 to November 2001
- Human studies
- Systematic reviews and meta-analyses
- Public health and primary care interventions to increase physical activity
- Adult populations (≥16 years old).

Ten systematic reviews and meta-analyses met this criterion.



Conclusions: There is no review-level evidence of the effectiveness of interventions aimed at changing policy or the built environment to promote physical activity. This review was limited to experimental or quasi-experimental study designs and excluded a substantial amount of literature from consideration. This lack of review level evidence does not mean there is absolutely no evidence of the effectiveness of policy and environmental modification, just that no evidence was found from systematic reviews that met the inclusion criteria. Prior to including other types of study designs into reviews such as this there will need to be an agreed method for systematically synthesising or reviewing such work.

Recommendations for Future Research: Due to the clinical and statistical heterogeneity of the studies, only limited conclusions can be drawn about the effectiveness of individual components of the interventions. Future studies should provide greater detail of the components of interventions.

HBEP Policy Implications for Practice:

- Support interdisciplinary collaboration to develop accepted standards of evidence and ways to analyse existing evidence to justify policy change.

Kaczynski, A. T. and Henderson, K. A. (2007). 'Environmental correlates of physical activity: A review of evidence about parks and recreation'. *Leisure Sciences* 29(4): 315-354.

Key Words: Active living; literature review; physical activity; social ecological models.

Location: The authors are from Canada and the USA; the study focus is on North America.

Aim: To review and critically examine evidence related to parks and recreation as features of the built environment and the relationship of these settings to physical activity.

Method: The authors identified peer-reviewed literature which presented a relationship between parks and recreation services (PRS) and physical activity. The search extracted 1,120 relevant articles; this was refined through the authors selecting only empirical studies that undertook quantitative research where physical activity was a dependent variable and specifically related to parks and recreation. This reduced the number of articles to 50 which the authors reviewed.

Conclusions:

- The future for examining parks and recreation as features of the built environment that enhance physical activity appears boundless. Until now, the tools and methods for studying parks and recreation within the built environment have been limited.
- Collaborations and partnerships have been lacking. Leisure scholars as well as all other related disciplinary scholars can contribute a variety of approaches and strategies to promote this line of study. For example, case studies could be helpful in examining the processes that occur in designing PRS and promoting their use for physical activity. Policy research relative to how parks and recreation is funded and how these settings and amenities fit into a broader community plan would be useful.
- The interesting aspect of this dilemma is that parks and recreation providers have been concerned with physical activity as one important dimension of their work for more than 100 years. However, as is true with most types of previous public health interventions, the focus has been on the individual and not on the park and recreation policies. These attempts to support and invest in parks and recreation will require public support and political advocacy as well as time, energy, money, and creativity. Physical activity as well as parks and recreation will need to become higher social priorities.
- Evidence-based research that shows an empirical relationship between the presence and characteristics of PRSs and the physical activity and health of community members is wide open for exploration. As is apparent from this literature analysis, efforts are underway.

Recommendations for Future Research:

- Transdisciplinary research which focuses on parks and recreational use that cuts across a number of fields as well as community-based research to improve public health is necessary.
- Longitudinal studies might be valuable in examining the use of recreational facilities over time.
- Emphasis on the participation and influence of non-academic researchers in the process of creating a knowledge base such as practitioners in parks and recreation have an important role to play in addressing the specifics of how built environments can promote physical activity.

- Greater inquiry into settings and amenities is needed such as the reciprocal relationships between leisure and health, including issues related to the design of areas and facilities, as well as the leadership, equipment, aesthetics, and participant developmental abilities.

HBEP Policy Implications for Practice:

- Support the provision of recreational open spaces for physical activity.
- Avoid standardising the development and management of open spaces.
- Ensure open space provisions are tailored to the locality.

Kahn, E. B., Ramsey, L. T., Brownson, R. C., Heath, G. W., Howze, E. H., Powell, K. E., Stone, E. J., Rajab, M. W., Corso, P., Briss, P. A. and Task Force Commun Prevent, S. (2002). 'The effectiveness of interventions to increase physical activity: A systematic review'. *American Journal of Preventive Medicine* 22(4): 73-108.

Key Words: Exercise; leisure activities; physical fitness; physical endurance; decision making; evidence-based medicine; economics; preventive health services; public health practice; meta-analysis; review literature.

Location: The authors are from the USA; the study focus is on the USA.

Aim: To evaluate the effectiveness of various approaches to increasing physical activity: informational, behavioural and social, and environmental and policy approaches.

Method: The Guide to Community Preventive Service's methods for systematic reviews was used and changes in physical activity behaviour and aerobic capacity were used to assess effectiveness.

Conclusions: Two informational interventions ('point-of-decision' prompts to encourage stair use and community-wide campaigns) were effective, as were three behavioural and social interventions (school-based physical education, social support in community settings, and individually-adapted health behaviour change) and one environmental and policy intervention (creation of or enhanced access to places for physical activity combined with informational outreach activities). Additional information about applicability, other effects, and barriers to implementation

are provided in the review for these interventions.

Recommendations for Future Research: No specific recommendations were provided, however, the review did conclude that evidence is insufficient to assess a number of interventions: classroom-based health education focused on information provision and family-based social support (because of inconsistent findings), and mass media campaigns and college-based health education and physical education (because of an insufficient number of studies).

HBEP Policy Implications for Practice:

- Provide access to parks, walking trails and recreational facilities.
- Incorporate point-of-decision prompts in stairwells.
- Promote community engagement with the planning process.

Kestens, Y. and Daniel, M. (2010). 'Social inequalities in food exposure around schools in an urban area'. *American Journal of Preventive Medicine* 39(1): 33-40.

Key Words: Dietary energy density; pedestrian walking speeds; Body-Mass Index; physical-activity; neighbourhood deprivation; retail environment; obesity; access, restaurants; overweight.

Location: The authors are from Canada; the study focus is on Montreal, Canada.

Aim: To evaluate the relationships between food sources around schools, neighbourhood income, and commercial density.

Method: A Geographic Information System (GIS) was used to derive measures of exposure to fast-food outlets, fruit and vegetable stores, and full-service restaurants near primary and secondary schools in Montreal, Canada, in 2005. Food source availability was analysed in 2009 in relation to neighbourhood income for the area around schools, accounting for commercial density.

Conclusions:

- Schools in the lowest income areas had the highest concentration of fast-food outlets within a 750 metre radius.
- Food source exposure around schools is inversely associated with neighbourhood income, but commercial density partly accounts for this association.

- Having food retailer options within one to five kilometres of the home had a negative association with obesity.
- School environments or routes to and from school offer strategic target areas for intervention.

Recommendations for Future Research:

- Further research is necessary to document food consumption among youth attending schools in relation to nearby food source opportunities.
- To understand the link between dietary intake and spatial food accessibility, while accounting for social and economic dimensions of food consumption.

HBEP Policy Implications for Practice:

- Regulate land use around schools to limit student access to fast-food.



Kingsley, J., Townsend, M. and Henderson-Wilson, C. (2009). 'Cultivating health and wellbeing: members' perceptions of the health benefits of a Port Melbourne community garden'. *Leisure Studies* 28(2): 207-219.

Key Words: Health; wellbeing; urban and community garden.

Location: The authors are from Australia; the study focus on Melbourne, Australia.

Aim: To report on a research project undertaken with members of a community garden in Port Melbourne, Australia, to investigate the ways in which such a facility contributes to the enhancement of health, wellbeing and contact with nature for urban dwellers.

Method: Ten members from an urban community garden were interviewed using qualitative semi-structured questions exploring perceptions of health and wellbeing benefits associated with membership.

Conclusions:

- Many members saw the garden as a supportive and an easy place to discuss issues going on in their lives, with spirituality featured in the way members described their gardening experience.
- Gardening allows for a greater connection with and enjoyment of their community; enabling people to achieve goals they did not think they were capable of.
- Working in the gardens improved their

physical fitness and overall health through consuming the produce from their gardens.

- That community gardens have individual health and wellbeing benefits, not least through offering an escape from daily stresses and a social outlet in our urban environment.

Recommendations for Future Research:

- To explore the membership profile of a range of Australian community gardens to identify the potential for capitalising to a greater degree on the community cohesion possibilities.
- To study the effects of community gardens on different socio-economic groups, cultures and age groups.

HBEP Policy Implications for Practice:

- Support the provision of neighbourhood community gardens.

Kirk, S. F. L., Penney, T. L. and McHugh, T. L. F. (2010). 'Characterizing the obesogenic environment: The state of the evidence with directions for future research'. *Obesity Reviews* 11(2): 109-117.

Key Words: ANGELO framework; obesogenic environment; policy; scoping review.

Location: The authors are from Canada; the literature reviewed is mostly from the USA and Australia.

Aim: This is a scoping review to discuss a cohesive definition of framework for characterisation of an 'obesogenic' environment. Currently the characteristics of an obesogenic environment are defined differently depending on the context of the research. This study aims to discuss how these characteristics can be standardised as well as to characterise primary relevant studies and highlight gaps in the literature and directions for future research.

Method: One hundred and forty six primary studies were identified for the review with inclusion based on examination of the influence of an environmental characteristic on some measure of Body Mass Index (BMI), diet or physical activity. Intervention studies were excluded. These 146 studies were then characterised using a matrix developed by Swinburn et al. 1999 called the 'Analysis Grid for Environments Linked to Obesity' (ANGELO)

to determined 'themes' of research. ANGELO dissects the environment according to size (micro or macro) and type (physical, economic, political and socio-cultural), for measures related to obesity. Various research area themes were then identified.

Conclusions: The environment may play a critical role in obesity development, prevention and management, however, it is impossible to consider every possible environmental contribution to energy balance. Obesogenic environments are therefore very difficult to define or characterise and we have yet to determine the best method for measuring the impact of the environment accurately or consistently.

Recommendations for Future Research: Fundamental research on measurement and theorisation of the elements of the environment that facilitate or encourage obesity is relatively under developed. An appropriate theory to encompass this complex and dynamic system is required.

HBEP Policy Implications for Practice:

- Support interdisciplinary collaboration to develop accepted standards of evidence and ways to analyse existing evidence to justify policy change.

References:

Swinburn B., Egger G. and Raza F. (1999). 'Dissecting obesogenic environments: The development and application of a framework for identifying and prioritizing environmental interventions for obesity'. *Preventive Medicine* 29(6): 563-570.

Lavin, T., Higgins, C., Metcalfe, O. and Jordan, A.(2006). *Health impacts of the built environment: A review.* Institute of Public Health, Dublin, Ireland.

Key Words: Built environment; health; buildings; public spaces and networks.

Location: The authors are from Ireland and study was funded by the Irish government; the review focuses on research from around the world.

Aim: This review is the third in a series (other reviews were on the health impacts of transport and employment) and it illustrates how the built environment impacts on health. The review aims to highlight the unequal distribution of these impacts on different sections of the population. It is aimed at a wide audience and is not intended to be a

systematic review of all the available evidence but rather a summary document.

Method: This is not a systematic review of the literature, but a generalised discussion across very broad areas of 'Buildings' (Air quality, Temperature, Humidity, Noise, Light, Safety, Space, Accessibility, Immediate surroundings, Locality, Housing improvements) and 'Public Spaces and Networks' (Physical activity, Air quality, Social networks, Safety, Attractiveness, Accessibility).

Conclusions: The review puts forward a range of broad conclusions.

- Children and the elderly are identified as vulnerable population groups.
- Moving forward requires recognition that health and planning disciplines and policy makers need to work together and that a robust policy framework is required.

Recommendations for Future Research: No recommendations were reported.

HBEP Policy Implications for Practice:

- Support interdisciplinary collaboration to develop locally specific policy change.
- Develop inclusive policies for vulnerable groups such as children, the elderly and people with disabilities.

Leck, E. (2006). 'The impact of urban form on travel behavior: A meta-analysis'. *Berkeley Planning Journal* 19: 37-58.

Key Words: Built environment; urban form; travel behaviour; meta-analysis; density; land use.

Location: The author is from the Israel Institute of Technology, however, the review is of papers only published in the USA.

Aim: To estimate the overall impact of built environment characteristics on travel behaviour. This is an empirical (meta) analysis to assess the impact of urban form on travel behaviour following Crane's (1996) recommendation to organise data through characterisation and measures of urban form (street layout, composite measures of density, mixed use, etc.).

Method: The article follows on from two previous meta analysis of data related to healthy built environments/transportation (Ewing and Cervero 2001 and Ewing 2005). 'Meta-analysis is a package of statistical

procedures designed to accumulate and integrate experimental results across independent studies that address a related set of research questions' (Leck 2006, p. 42). Five urban form variables (residential density, employment density, land use mix, sidewalk ratio, and grid percentage) and seven travel variables (vehicle miles travelled, vehicle hours travelled, vehicle trips, non-work vehicle trips, probability of commuting by automobile, transit, or by walking) were included in the meta-analysis. Seventeen different primary studies were included in the analysis. Studies were included in the meta-analysis if they were published in the last fifteen years in the United States and assessed any of the three characteristics of the built environment.

Conclusions:

- The article presents a comprehensive critique/explanation on the pros and cons the meta analysis methodology.
- The influence of mixed land use on travel was found to be overwhelmingly significant.
- Residential density is the most important built environment element which influences travel choices. Residential densities were found to be negatively correlated with vehicle miles travelled/ vehicle kilometres travelled, vehicle hours travelled, total vehicle trips, and with the probability of commuting to work by automobile. The density element was also found to be statistically significant and positively correlated with the probability of commuting to work by transit, or by walking and cycling. Employment density was found to exert a strong influence on travel behaviour.
- The linkage between street pattern and travel behaviour was not found to be significant.

Recommendations for Future Research:

- Future studies should combine the methods used by Ewing and Cervero (2001) meta-analysis and this study to be able to predict elasticities between travel behaviour and built environment variables. The former study is good in that it is able to measure elasticities, however, this study has been able to incorporate more travel variables. This recommendation was followed in Ewing and Cervero's 2010 meta-analysis.
- A normalised index for the density, diversity and design attributes used to measure the built environment should be constructed to narrow discrepancies caused by the different methodologies and quantification methods used in the various primary studies.

HBEP Policy Implications for Practice:

- Promote mixed land uses.
- Consider cautious increases in density of employment and residential uses. The future amenity of residents in the design of increased densities is of paramount importance to this recommendation.

References:

- Crane, R. (1996). 'Cars and drivers in the new suburbs: Linking access to travel in neotraditional planning'. *Journal of the American Planning Association* 62(1):51-65.
- Ewing, R. (2005). 'Can the physical environment determine physical activity levels?'. *Exercise and Sport Sciences Reviews* 33(2): 69-75.
- Ewing, R. and Cervero, R. (2001). 'Travel and the built environment: A synthesis'. *Transportation Research Record* 1780: 87-113.
- Ewing, R. and Cervero, R. (2010). 'Travel and the built environment: A meta analysis'. *Journal of the American Planning Association* 76(3): 265-294.

Mead, E., Dodson, J. and Ellway, C. (2006). *Urban environments and health: Identifying key relationships and policy imperatives*. Research Monograph 10. Urban Research Program, Griffith University, Brisbane, Australia.

Key Words: Urban environment; health; urban form; transport; health services; planning policy.

Location: The authors are from Griffith University, Brisbane, Australia; however, the papers examined are from the USA, Europe, UK, Canada and Australia.

Aim: '...to map out issues and areas that are well understood and to identify those parts that are poorly comprehended' (Mead et al. 2006, p. 6). This is a Research Monograph to investigate the general relationships between urban environments and health. The project examines the empirical evidence for relationships between urban environments and health outcomes, focusing on three specific aspects of the urban environment: urban form, transport systems and the location of health services. The research was a collaborative project of Griffith University's Urban Research Program and Queensland Health.

Method: The parameters for the review included a focus on causes of increased morbidity and mortality from chronic diseases. The review does not include the impact of



toxins or substances on health, such as vehicle emissions or other forms of pollution – ‘such factors have been well-covered by the health literature and the processes of causality are well appreciated’ (Mead et al. 2006, p. 14).

Conclusions: While research projects have examined particular health impacts of urban form, no single study has assessed the complete spectrum of health impacts that are conceivably influenced by urban factors. In fact, ‘the very enormity of such a task makes it doubtful it could be undertaken successfully’ (Mead et al. 2006, p. 14).

The main finding of the study is that the evidentiary base for many expected relationships between urban form, transport systems, health services location and eventual health outcomes is underdeveloped. While some associations between urban environments and behavioural outcomes have been identified, there is insufficient evidence to identify specific causal relationships. This finding indicates that a much greater research effort is required into both health and urbanity to identify urban-health relationships.

There is a relatively undeveloped research base that demonstrates connections between urban built form and health outcomes. While some associations have been found between urban form and individual behaviour (such as greater levels of physical activity), social health outcomes remain uncertain. Some statistical associations have been identified at the metropolitan scale, but at the local level there is insufficient research to support strong conclusions about the relationship between urban form and health. This insufficiency, in part due to the low number of studies that have been conducted, is also a consequence of the weak conceptual and methodological frame of such studies.

Compared to urban form, the impact of transport systems on urban health outcomes has received little attention. Those studies that have been completed tend to focus on pedestrian travel, typically in relation to land-use destinations and route quality. The study claims that links between public transport and public health are very hard to find in the research literature. ‘There is, in sum, an urgent need to study the relationship between transport systems and health outcomes’ (Mead et al. 2006, p. 1).

Recommendations for Future Research:

- *Expansion of Urban Health Research:* There is a need to improve the evidence base for perceived or assumed urban health relationships. The study states that the current literature lacks coherent conceptual and methodological

frameworks. There is also a dearth of research studies available to support assumed relationships; while inter-jurisdictional research, too, is very limited. Researchers, policy makers and governments need to expand the quantity and quality of research into the relationship between urban environments and health outcomes.

- *Collaboration Between Urban and Health Researchers:* The overall lack of an extensive and coherent research base and the divide that has emerged between health and planning researchers and professionals during the 20th Century needs urgent redress. It is essential that health and urban researchers engage intensively and extensively to build the research and evidence base for urban health investigations.

HBEP Policy Implications for Practice:

- Support interdisciplinary collaboration to develop accepted standards of evidence and ways to analyse existing evidence to justify policy change.

Mehta, V. (2007). ‘Lively streets: Determining environmental characteristics to support social behavior’. *Journal of Planning Education and Research* 27(2): 165-187.

Key Words: Environment behaviour and perceptions; streets as social space; design of neighbourhood commercial streets.

Location: The author is from the USA; the study focus is on Boston, USA.

Aim: Through an empirical examination this article seeks to understand the behavioural responses of people to the environmental quality of neighbourhood commercial streets.

Method: Structured and semi-structured observations are used to study stationary, lingering, and social activities on three neighbourhood commercial streets in Boston, Massachusetts. Eleven land use and physical characteristics of buildings and the street are identified based on the literature review and extensive observations. These are measured and tested to understand which characteristics support stationary, lingering, and social activities.

Conclusions:

- The findings of this study clearly indicate that a physically well-designed street for

people, with generous sidewalks, ample seating and other street furniture, tree cover and other landscape elements, articulated street façades of buildings built to the sidewalk, and so on, becomes much more useful and meaningful for people when there are community gathering places and a variety of activity-supporting stores and other land uses at the street, and vice versa.

- The two comparative examples of street configurations drastically differ in their Liveliness Indices though very similar in their physical characteristics. The difference in the businesses affects the perception and significance of the street for the users at these two locations and in ways that certain physical characteristics are manifest and utilised. The first building is a coffee shop and is recognized as a community gathering place for a variety of people in the neighbourhood, as it provides seating to use the sidewalk as a place to relax, interact, and socialise. The second is a bank and provides no such opportunities, and as a result, the same area of sidewalk and the benches are seldom used. The differences in these two very similar physical conditions at the same neighbourhood commercial street further illustrate how the engagement between the behavioural patterns and patterns of the physical environment is important to support stationary and social activities on the street.

Recommendations for Future Research: No recommendations were articulated in the references.

HBEP Policy Implications for Practice:

- Promote community spaces in residential areas.
- Promote mixed land uses that provide destinations for incidental social interactions.



Mehta, N. K. and Chang, V. W. (2008). 'Weight status and restaurant availability: A multilevel analysis'. *American Journal of Preventive Medicine* 34(2): 127-133.

Key Words: Fast-food access; weight status; obesity; healthful eating environment.

Location: The authors are from Philadelphia, USA; the study focus is on the USA.

Aim: To assess how the local food environment, particularly access to fast-food and restaurants, impacts on the weight status of residents.

Method: This study analysed the relationship between the restaurant environment and weight status across counties in the United States. Individual data from the 2002–2006 Behavioural Risk Factor Surveillance System (BRFSS) were linked with restaurant data from the 2002 US Economic Census. Fast-food and full service restaurant density, along with restaurant mix (the ratio of fast-food to full-service restaurants), were assessed.

Conclusions:

- The mix of restaurants to fast-food outlets had an association with weight status, with the availability of fast-food relative to other away-from-home choices increasing the likelihood of unhealthy weight outcomes.
- Areas with a high density of full service restaurants were indicative of a more healthful eating environment, suggesting a need for research into the comparative healthfulness of foods served at different types of restaurants.
- Future prospective studies are required to delineate causal pathways. This study found that the restaurant environment was independently associated with weight status, including individual-level demographic and behavioural characteristics and county-level structural factors.
- While a higher mix of fast-food to full service restaurants may contribute to an obesogenic environment, the availability of full service restaurants may also contribute to a more healthful eating environment.

Recommendations for Future Research:

- Future research delineating the causal processes associated with restaurant availability and weight status could benefit from combining individual and contextual longitudinal data to model the change in weight status and the change in restaurant density over time and to

treat underlying eating and weight status preferences as unmeasured fixed-effect characteristics that cancel out of the regression equation.

- Future studies should consider the restaurant mix as a pathway through which more general area level factors can affect weight status differences. Future studies should also consider how actual eating behaviours are shaped by the availability of different types of restaurants.

HBEP Policy Implications for Practice:

- Employ land use regulation to ensure equitable access to healthy fresh food.

Ogilvie, D., Foster, C. E., Rothnie, H., Cavill, N., Hamilton, V., Fitzsimons, C. F. and Mutrie, N. (2007). 'Interventions to promote walking: Systematic review'. *British Medical Journal* 334(7605): 1204-1207.

Key Words: Walking; interventions; physical activity; systematic review.

Location: The authors are from the UK; the study reviews literature from around the world.

Aim: To assess the effects of interventions to promote walking in individuals and populations.

Method: Published and unpublished reports in any language were identified by searching 25 electronic databases, by searching websites, reference lists, and existing systematic reviews, and by contacting experts. Studies needed to be controlled before and after studies of the effects of any type of intervention on how much people walk, the distribution of effects on walking between social groups, and any associated effects on overall physical activity, fitness, risk factors for disease, health, and wellbeing. The systematic review included 19 randomised controlled trials and 29 non-randomised controlled studies.

Conclusions: Interventions tailored to people's needs, targeted at the most sedentary or at those most motivated to change, and delivered either at the level of the individual (brief advice, supported use of pedometers, telecommunications) or household (individualised marketing) or through groups, can encourage people to walk more, although the sustainability, generalisability, and clinical benefits of many of these approaches are uncertain. Evidence for the effectiveness of

interventions applied to workplaces, schools, communities, or areas typically depends on isolated studies or subgroup analysis.

Recommendations for Future Research:

Interventions need to be better evaluated, particularly large scale community level interventions, both planned health promotion activities and natural experiments involving major changes to the built environment (also called for in Foster and Hillsdon 2004, Petticrew et al. 2005, Ogilvie et al. 2006). Future intervention studies should include the capacity to investigate whether increases in walking are sufficiently frequent, intense, or sustained to produce measurable improvements in anthropometric, physiological, biochemical, or clinical outcomes, or alternatively whether increases in walking might be counterbalanced or outweighed by decreases in other forms of physical activity or an increase in injuries.

HBEP Policy Implications for Practice:

- Support walking groups.
- Target behaviour change programs at those who need to change, as well as those who want to change.

References:

Foster, C. and Hillsdon, M. (2004). 'Changing the environment to promote health enhancing physical activity'. *Journal of Sports Science* 22(8): 755-769.

Ogilvie, D., Mitchell, R., Mutrie, N., Petticrew, M. and Platt S. (2006). 'Evaluating health effects of transport interventions: Methodologic case study'. *American Journal of Preventive Medicine* 31(2): 118-126.

Petticrew, M., Cummins, S., Ferrell, C., Findlay, A., Higgins, C. and Hoy C. (2005). 'Natural experiments: An underused tool for public health?'. *Public Health* 119(9): 751-757.

Owen, N., Humpel, N., Leslie, E., Bauman, A. and Sallis, J. F. (2004). 'Understanding environmental influences on walking: Review and research agenda'. *American Journal of Preventive Medicine* 27(1): 67-76.

Key Words: Walking; physical activity; public health; environmental attribute.

Location: The authors are from Australia and the USA; the research reviewed is from around the world.

Aim: To review studies from the public health research literature specifically addressing the



environmental correlates of walking.

Method: Eighteen quantitative studies examining environmental attributes related to the walking behaviour of adults were identified from a previous literature review (Humpel et al. 2002) from database searches including PsycInfo, Cinahl, Medline. Studies were included if they used any type of walking as the main outcome variable and if the independent variables included environmental attributes, whether measured objectively or by self-report. Associations with environmental attributes were examined separately for exercise and recreational walking, walking to get to and from places, and total walking. Studies on relationships of objectively assessed and perceived environmental attributes with walking were included.

Conclusions: Aesthetic attributes, convenience of facilities for walking (sidewalks, trails); accessibility of destinations (stores, park, beach); and perceptions about traffic and busy roads were found to be associated with walking for particular purposes. Attributes associated with walking for exercise were different from those associated with walking to get to and from places.

Recommendations for Future Research: While few studies have examined specific environment-walking relationships, early evidence is promising. Key elements of the research agenda are developing reliable and valid measures of environmental attributes and walking behaviours, determining whether environment-behaviour relationships are causal, and developing theoretical models that account for environmental influences and their interactions with other determinants.

HBEP Policy Implications for Practice:

- Promote traffic safety programs.
- Provide facilities for walking such as well maintained footpaths and walking trails.
- Provide clusters of useful walkable destinations.

References:

Humpel, N., Owen, N. and Leslie, E. (2002). 'Environmental factors associated with adults' participation in physical activity: A review'. *American Journal of Preventive Medicine* 22(3): 188-199.

Pearce, J., Blakely, T., Witten, K. and Bartie, P. (2007). 'Neighborhood deprivation and access to fast-food retailing: A national study'. *American Journal of Preventive Medicine* 32(5): 375-382.

Key Words: Fast-food; socio-economic conditions; neighbourhood deprivation; geographic access.

Location: The authors are from various New Zealand universities; the study focus is on New Zealand.

Aim: The objective of this study was to determine whether geographic access to fast-food outlets varied by neighbourhood deprivation and school socioeconomic ranking, and whether any such associations differed to those for access to healthier food outlets.

Method: Data were collected on the location of fast-food outlets, supermarkets, and convenience stores across New Zealand. The data were geocoded and Geographic Information Systems (GIS) was used to calculate travel distances from each census mesh block (i.e., neighbourhood), and each school, to the closest fast-food outlet. The median travel distances are reported by a census-based index of socio-economic deprivation for each neighbourhood, and by a Ministry of Education measure of socio-economic circumstances for each school. The analyses were repeated for outlets selling healthy food to allow comparisons.

Conclusions:

- There is a strong association between neighbourhood deprivation and geographic access to fast-food outlets in New Zealand. This may contribute to the understanding of environmental causes of obesity.
- These results are consistent with international evidence highlighting that fast-food restaurants tend to be more prevalent in more-deprived neighbourhoods.
- Outlets potentially selling healthy food (e.g., supermarkets) are patterned by deprivation in a similar way. These findings highlight the importance of considering all aspects of the food environment (healthy and unhealthy) when developing environmental strategies to address the obesity epidemic.

Recommendations for Future Research:

Further research could usefully examine the relationship between neighbourhood access to fast-food outlets, fast-food consumption,

and obesity in schoolchildren and general population samples. Future studies should also simultaneously examine all aspects of the food environment (healthy and unhealthy) in order to disentangle the various contextual drivers of dietary intake.

HBEP Policy Implications for Practice:

- Incorporate zoning restrictions on fast-food outlets into primary planning instruments.
- Regulate the marketing, advertising and promotion of fast-food products.

Pearce, J., Hiscock, R., Blakely, T. and Witten, K. (2008). 'The contextual effects of neighbourhood access to supermarkets and convenience stores on individual fruit and vegetable consumption'. *Journal of Epidemiology and Community Health* 62(3): 198-201.

Key Words: Neighbourhood access; fruit and vegetable consumption, supermarkets; diet.

Location: The authors are from various New Zealand universities; the study focus is on New Zealand.

Aim: To examine the association between neighbourhood accessibility to supermarkets and convenience stores and individuals' consumption of fruit and vegetables in New Zealand.

Method: Using geographical information systems, travel times from the population-weighted centroid of each neighbourhood to the closest supermarket and convenience store were calculated for 38,350 neighbourhoods. These neighbourhood measures of accessibility were appended to the 2002-2003 New Zealand Health Survey of 12,529 adults.

Conclusions: There is little evidence that poor locational access to food retail provision is associated with lower fruit and vegetable consumption.

Recommendations for Future Research: Further research incorporating direct and precise measurements of fruit and vegetable access is required.

HBEP Policy Implications for Practice:

- There are no conclusive policy implications from this research.

Poortinga, W., Dunstan, F. D. and Fone, D. L. (2007). 'Perceptions of the neighbourhood environment and self rated health: A multilevel analysis of the Caerphilly Health and Social Needs Study'. *BMC Public Health* 7: 285.

Key Words: Neighbourhood environment; health; self rating; social cohesion; social capital.

Location: The authors are from the Cardiff University, Wales; the study focus is on the UK.

Aim: To examine the importance of different social and physical aspects of the neighbourhood environment for people's self rated health.

Method: The authors utilised population survey data from the Caerphilly Health and Social Needs Study collected in 2001. The responses of people under 75 years of age (n = 10,892; a response rate of 62.3 percent) were used. All individual responses were geo-referenced to the 325 census enumeration districts of Caerphilly County Borough (Council) in south-east Wales.

Conclusions:

- Unemployment significantly increased the odds of men reporting poor health, but did not do so for women.
- The result that neighbourhood deprivation is detrimental to people's health, even when taking into account individual socio-economic status, is consistent with other studies on the impact of the socio-economic environment on public health.
- Social cohesion was inversely related to the reporting of poor health, confirming that the social organisation of the local community plays an important role in public health.
- The gender-stratified analyses show that a lack of social cohesion significantly increases the odds of women reporting poor health, but not the odds of men reporting poor health.
- Men are more influenced by their work environment and tend to report more support at the workplace than women.

Recommendations for Future Research:

Exploring the suggestion that men and women benefit differently from the neighbourhood environment requires further research into how gender differences are affected by the impact of neighbourhood health.

HBEP Policy Implications for Practice:

- Promote physical activity interventions in both the workplace and the residential environment.
- Promote policies to enhance community capacity, including organised community events and programs, such as community gardens, mothers groups and walking groups.

Pretty, J., Peacock, J., Hine, R., Sellens, M., South, N. and Griffin, M. (2007). 'Green exercise in the UK countryside: Effects on health and psychological well-being, and implications for policy and planning'. *Journal of Environmental Planning and Management* 50(2): 211-231.



Key Words: Green exercise; natural environment; green space; health; psychological wellbeing; planning policy.

Location: The authors are from the University of Essex in the UK; the study focus is on the UK.

Aim: To measure the effects of ten green exercise case studies (including walking, cycling, horse riding, fishing, canal boating and conservation activities) in four regions of the UK. The authors hypothesised that 'green exercise' will improve health and psychological wellbeing.

Method: Ten green exercise case studies were selected from across the various types of green exercise initiatives (i.e., geographical, issue, habitat, activity and group based initiatives), and throughout the UK (two in Scotland, two in Wales, two in Northern Ireland and four in England). Participants were reached using a stratified cluster sampling technique and data was obtained through a composite questionnaire consisting of two sections. The first contained questions to determine the respondent's general physical and psychological health at the time of sampling and, the second, questions to determine their self-esteem and mood. Section Two of the questionnaire was completed before and after participation in the green exercise initiative, in order to identify any resulting changes to psychological health.

Conclusions:

- Self-esteem improved as a result of participation in green exercise. The study found that there was a statistically

significant improvement in self-esteem scores pre- and post-activity.

- Participation in green exercise was shown to elicit positive benefits on mood states. Exercise reduced anger-hostility, confusion-bewilderment, depression-dejection and tension-anxiety. However, there was an increase in fatigue-inertia.
- Overall, participation in green exercise was shown to decrease Total Mood Disturbance (TMD), which provides an indication of a person's emotional state.
- Due to the fact that TMD scores did not vary significantly between the ten case studies, the authors argued, 'the key conclusion is that all these 10 green exercise activities, regardless of their type or level of intensity, yield mental health benefits, despite varying duration and intensity' (Pretty et al. 2007, p. 222).
- In relation to physical health, all the activities represented in the ten case studies provided positive contributions. The most intensive energy expenditure resulted from mountain biking, closely followed by horse riding. Interestingly, self-esteem was shown to increase slightly as energy expenditure increased.

Recommendations for Future Research:

This study could be expanded to include a habitually inactive group. Further research is also needed to identify the barriers to participation in green exercise and the economic benefits associated with this type of exercise.

HBEP Policy Implications for Practice:

- Support participation in green exercise by improving access to green open space and promoting the physical and psychological benefits of green exercise.
- To increase opportunities for green exercise, establish partnerships with recreational providers, the sports and leisure industry, agricultural managers, schools, social and mental health professionals, environmental managers, planners and the health sector.

Prezza, M. and Pacilli, M. G. (2007). 'Current fear of crime, sense of community, and loneliness in Italian adolescents: The role of autonomous mobility and play during childhood'. *Journal of Community Psychology* 35(2): 151-170.

Key Words: Fear; crime; community; loneliness; youth.

Location: The authors are from the University of Rome, Italy; the study focus is on Italy.

Aim: To examine the role of autonomous mobility and play in public and semi-public places in childhood to predict adolescents' sense of community, fear of crime, and, through the mediation of these two last psychosocial factors, feelings of loneliness.

Method:

- The participants included 789 Italian students (mean age 16).
- The instruments used were the Italian Sense of Community Scale, the Neighborhood Relations Scale, and the UCLA Loneliness Scale.
- A questionnaire was administered to investigate the adolescents' current fear of crime and their autonomous mobility when they were children by asking them to recall their play habits and independent mobility at eight to ten years of age.

Conclusions:

- More frequent play in public places and greater autonomy in mobility and in play in childhood predict less fear of crime, whereas becoming autonomous at an older age predicts greater fear of crime.
- More autonomy and play in public areas during childhood influences more intense neighbourhood relations, a stronger sense of community, and less fear of crime and, in turn, these latter variables consequently reduce feelings of loneliness during adolescence.
- If a form of territoriality, appropriation, and personalization of space is established in childhood through mobility and autonomous play in public and semi-public places, a good 'antidote' is created for fear of crime in adolescence.
- Public places are the theatre for significant childhood events and can provide a base for constructing an affective link with the territory. In adolescence, this link may evolve into what is defined as a sense of community.

- The relationship between neighbourhood characteristics and children's autonomy and development outcomes is strongly linked and consequently play in public spaces should be encouraged without the use of strict supervision.

Recommendations for Future Research:

No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- Include children in the development and management of places for play.

Pucher, J., Dill, J. and Handy, S. (2010). 'Infrastructure, programs, and policies to increase bicycling: An international review'. *Preventive Medicine* 50(Supplement 1): S106-S125.

Key Words: Bicycling; active travel; active transport; health; intervention; policy; infrastructure; sustainable transportation.

Location: The authors are from the USA; the studies reviewed are from Europe, the USA, Australia, Canada and Columbia.

Aim: To assess research on the effects of various interventions to encourage cycling, including infrastructure, public transport integration, education and marketing as well as comprehensive packages.

Method: The article reviews 139 peer and non-peer reviewed research papers as well as analysis of secondary data from 14 case study cities. To identify research to review, the authors developed a list of direct interventions that were hypothesised to encourage cycling and looked for studies measuring the effects of these interventions. Database searches were used, along with contact with practitioners, website searches. To be included in the study, reviews had to be written in English, published after 1990 and contain some kind of quantitative component.

Conclusions: Interventions to encourage cycling will be most effective when they are part of a comprehensive effort. This can be achieved through careful planning and policy integration across transport, housing and land use sectors and with public consultation – particularly from cyclists. 'Health' is posited as a major draw card to garner the public and political support necessary to implement a truly comprehensive package of policies.

Recommendations for Future Research:

Implementing authorities need to undertake

before and after studies to evaluate interventions. Standardised instruments to measure cycling uptake (such as household survey instruments and protocols for cycling counts) need to be developed.

HBEP Policy Implications for Practice:

- Pursue a range of interventions to encourage cycling, including infrastructural provision, educational programs and workplace support.
- Include the public in the development of cycling infrastructure that may be controversial.

Radbone, I. and Hamnett, S. (2003). *Land use, walking and cycling: A review of recent research, Australian policies and suggestions for further work.* Proceedings of the 26th Australasian Transport Research Forum, New Zealand Institute of Highway Technology, New Plymouth, New Zealand.



Key Words: Built environment; Land use, walking, cycling; active transport; transport infrastructure; urban form; public health; physical activity; sustainable travel.

Location: The author is based in Australia; the review has a very Australian 'policy relevant' focus, however, it reviews research from around the world.

Aim: To examine empirical studies on ways in which urban form affects public health, specifically through the ways in which the built environment encourages or discourages physical activity and the use of more sustainable modes of travel.

Method: The authors undertook a general, not systematic review of the selected literature.

Conclusions:

- *The Impact of Density in Encouraging Sustainable Travel*

Areas of agreement: Higher densities lead to shorter distances between origins and destinations; aggregate walking and cycling levels increase with density; modal share of trips by walking and cycling rises with increased density.

Issues: Density is less significant than socio-economic factors in influencing travel behaviour; density may often be a proxy for other urban form variables.

- *The Impact of Mixed Use in Encouraging Sustainable Travel*

Areas of agreement: Mix of use, like higher density, can lead to shorter distances between origins and destinations; shorter local shopping and entertainment trips may replace longer trips to regional centres; aggregate walking and cycling levels increase with increasing mix of uses; modal share of trips by walking and cycling rises with mixed use.

Issues: Limited number of studies of the impact of mixed use in employment centres, as distinct from neighbourhoods; mixed use developments may provide local facilities, but people still need to choose to use them; living close to work has become less relevant because of the changing nature of employment and the diminishing importance of work-related trips as a proportion of all trips.

- *The Impact of Micro-design Issues in Encouraging Sustainable Travel*

Areas of agreement: Grid street patterns create higher levels of connectivity and decrease distances between origins and destinations; empirical studies have found higher modal shares for walking and cycling in areas designed around grids; a wide range of detailed design features – shelter, safe storage facilities, detailed attention to street and footpath surfaces increase people's propensity to use more sustainable modes of travel; micro-design is important in creating environments supportive of physical activity.

Issues: Several studies of the impact of grid layouts on mode share are inconclusive; few rigorous studies of the effects of street design on travel behaviour; regional accessibility issues may be more influential on travel decisions than local street network characteristics.

- *Other Conclusions*

Location of grid-based suburbs is likely to be significant – grid-based suburbs at the urban fringe may have less evidence of sustainable modes of travel than suburbs with similar features in inner urban areas. Pedestrian and bike amenities tend to be co-located with other urban form elements, such as higher densities and grid street patterns. Once again, it is difficult to separate out causes and effects.

The intuitive notion that higher density may encourage less car use is being replaced by the notion that density,

mixed use and micro-design elements in some combination are most likely to influence people's willingness to use more sustainable modes of travel. Increasing levels of density alone will not serve to promote more walking without increased mixing of uses which brings services and other destinations closer to where people live and work. Areas that are dense and mixed often exist without the required linkages between uses. While increased proximity can be achieved through higher levels of density and mix, the ability to efficiently move between activities requires an interconnected street network that is supported at the micro scale through site design.

Recommendations for Future Research:

- There is a lack of understanding of how to isolate the effects of urban form on transport and physical activity from other factors.
- Available data on travel behaviour and urban form is biased towards motorised transport and is not generally sufficient to test the impact of micro-design elements on travel behaviour.
- Too often walking and cycling are combined in any statistical analysis.
- Overseas research, particularly in the United States, has set an agenda, however the technology available with Geographical Information Systems (GIS) needs to be used to test this agenda in local conditions.
- Information on the effects of interventions by governments and developers needs to be collected and analysed appropriately.

HBEP Policy Implications for Practice:

- Combine carefully planned higher densities with mixed uses.
- Promote grid like streets.

Renalds, A., Smith, T. H. and Hale, P. J. (2010). 'A systematic review of built environment and health'. *Family and Community Health* 33(1): 68-78.

Key Words: Built environment; health; land use; social capital; walkability.

Location: The authors are from the USA; the research reviewed is from around the world.

Aim: 'To review and summarise the literature on the built environment as it pertains to health' (Renalds et al. 2010, p. 69).

Method: The 'integrative systematic review' focuses on published research articles indexed in the CINAHL and MEDLINE databases. The search criteria included research articles written in English, peer-reviewed and published between January 2003 and January 2009. The search term was 'built environment' located in the article's title. Only 64 articles were initially identified, 41 of these were considered editorial or review articles and only 23 articles were included in the review. The audience for the review is obviously very general.

Conclusions: The selected articles were reviewed with some basic conclusions drawn under the headings of:

- Built environment and physical activity (e.g., there are statistically significant associations between (1) increased walkability and residential density (Clark and George 2005, Nagel et al. 2008) (2) increased walkability and smaller size of neighbourhood blocks (Wood et al. 2008) and (3) increased walkability and close proximity to retail stores for elderly residents (Berke et al. 2007)).
- Built environment and social capital (e.g. built environment characteristics such as land use mix and walkability may increase social cohesion related to increased familiarity with neighbours (Leyden 2003)).
- Built environment and obesity (e.g. residents living in neighbourhoods that promoted physical activity, through being more pedestrian-friendly or through greater access to physical activity facilities, had a lower Body Mass Index (BMI) (Rundle et al. 2007, Heinrich et al. 2008, Li et al. 2008)).
- Built environment and mental health (e.g., the presence of a higher degree of social capital among neighbours (i.e. a greater degree of community investment, connection, and feelings of safety) fosters a greater sense of well-being and thus perceptions of better mental health (Araya et al. 2006)).

Recommendations for Future Research: Many of the studies used a cross-sectional research design, making it difficult to infer causation. There is a need for longitudinally designed studies to further assess impact. In addition, most studies were conducted in an urban setting – it is not known what findings would result in a rural setting. Longitudinal studies and studies conducted in a rural setting are needed.

HBEP Policy Implications for Practice:

- Consider cautious increases in density of employment and residential uses. The future amenity of residents in the design of increased densities is of paramount importance to this recommendation.

References:

- Araya, R., Dunstan, F., Playle, R., Thomas, H., Palmer, S. and Lewis, G. (2006). 'Perceptions of social capital and the built environment and mental health'. *Social Science and Medicine* 62(12): 3072-3083.
- Berke, E. M., Koepsell, T. D., Moudon, A. V., Hoskins, R. E. and Larson, E. B. (2007). 'Association of the built environment with physical activity and obesity in older persons'. *American Journal of Public Health* 97(3): 486-492.
- Clarke, P. and George, L. K. (2005). 'Understanding and addressing the challenges of disability: The role of the built environment in the disablement process'. *American Journal of Public Health* 95(11): 1933-1939.
- Heinrich, K. M., Lee, R. E., Regan, G. R., Reese-Smith, J.Y., Howard, H.H., Haddock, C.K., Poston, W.S. and Ahluwalia, J.S. (2008). 'How does the built environment relate to body mass index and obesity prevalence among public housing residents?'. *American Journal of Health Promotion* 22(3): 187-194.
- Leyden, K. M. (2003). 'Social capital and the built environment: The importance of walkable neighborhoods'. *American Journal of Public Health* 93(9): 1546-1551.
- Li, F., Harmer, P. A., Cardinal, B. J., Bosworth, M., Acock, A., Johnson-Shelton, D. and Moore, J. M. (2008). 'Built environment, adiposity, and physical activity in adults aged 50-75'. *American Journal of Preventive Medicine* 35(1): 38-46.
- Nagel, C.L., Carlson, N. E., Bosworth, M. and Michael, Y. L. (2008) 'The relation between neighborhood built environment and walking activity among older adults'. *American Journal of Epidemiology* 168(4): 461-468.
- Rundle, A., Roux, A. V. D., Freeman, L. M., Miller, D., Neckerman, K. M. and Weiss, C. C. (2007). 'The urban built environment and obesity in New York City: A multilevel analysis'. *American Journal of Health Promotion*. 21(4): 326-334.

Wood, L., Shannon, T., Bulsara, M., Pikora, T., McCormack, G. and Giles-Corti, B. (2008). 'The anatomy of the safe and social suburb: an exploratory study of the built environment, social capital and residents' perceptions of safety'. *Health Place* 14(1): 15-31.

Saelens, B. E. and Handy, S. L. (2008). 'Built environment correlates of walking: a review'. *Medicine and Science in Sports and Exercise* 40(7 Suppl): S550 - S566.

Key Words: Walking; built environment; physical activity; urban design.

Location: The authors are from USA; the studies reviewed are mostly from the USA and Australia.

Aim: To review evidence published in existing studies on the built environment correlates with walking.

Method: The authors sourced nine 'reviews of reviews', three articles discussing research in general and a Transport Research Board (TRB) publication. To this, the authors added 29 original studies sourced from database searches (criteria for inclusion were: must have one measure of the built environment, must have one measure of walking or walking and cycling as a distinct form of physical activity and must be in English).

Conclusions: The article presents a detailed review of key research on the built environment and walking up to and including 2006.

- There are consistent associations found between walking for transportation purposes and density, land use mix, and proximity of non-residential destinations.
- Recent evidence less consistently found a relation between transportation walking and pedestrian infrastructure, such as sidewalk presence and condition, although pedestrian infrastructure was more consistently related to recreation walking.
- There has been methodological progress such as the greater use of more objective measures of physical or built environment when examining correlates of walking. One advancement has been to increase focus on the micro level through objective measurement of the built environment around an individual's residence rather than at larger scales (such as census tract) (see for example Lee et al. 2006a and 2006b). Other advancements include the greater diversity in environmental factors studied from the street level to the neighbourhood level and even regional



level, more specificity in measurement for environmental factors and walking, the inclusion of more age-diverse samples and examination of demographic variables as moderators (e.g. gender).

- The evidence regarding children is primarily restricted to factors related to walking to school, for which proximity, density, and the quality of the pedestrian infrastructure and traffic safety appear to play roles.
- The issue on which researchers have made the least progress in examining relations between environment and walking is causality. Despite this, the identification of environmental correlates of walking through cross-sectional studies offers guidance to increase opportunities for walking.
- There is a need to evaluate and analyse demographic and other potential confounding variables at both the individual and larger environment level.
- Cross-sectional studies of the built environment and walking have been most loudly criticised on the issue of self-selection, observed associations between the built environment and walking are potentially explained by the prior self-selection of residents into a built environment that is consistent with their predispositions toward walking. The limited evidence on self-selection suggests that it does occur but that the built environment influences walking even after accounting for self selection (see for example Handy et al. 2006).
- It is possible that an increase in transportation walking resulting from a change to the built environment substitutes for other forms of physical activity without increasing overall physical activity, but empirical evidence regarding this potential substitution is generally lacking.
- Limitations to the review include that some of the original reviews were not necessarily comprehensive and that there are too many variables and measures in each review to make a meta analysis of the evidence possible.
- 'Evidence points to latent demand for walking suggesting an opportunity to increase walking through improved environments; needed improvements include increased land use intensity and mix along with investments in walking infrastructure; and planners should focus efforts on enablers and constraints on walking (Lee et al. 2004). The review

of prior reviews and recent empirical evidence regarding built environment factors and walking support such recommendations' (Saelens and Handy 2008, p. S564).

Recommendations for Future Research: More prospective, longitudinal studies are needed if causality is to be proved however the evidence on correlates appears sufficient to support policy changes.

HBEP Policy Implications for Practice:

- Promote mixed land uses that provide clusters of useful walkable destinations.
- Promote grid like streets.
- Consider cautious increases in density of employment and residential uses. The future amenity of residents in the design of increased densities is of paramount importance to this recommendation.

References:

- Handy, S., Cao, X. and Mokhtarian, P. L. (2006) 'Self-selection in the relationship between the built environment and walking'. *Journal of the American Planning Association* 72(1): 55-74.
- Lee, C. and Moudon, A.V. (2004). 'Physical activity and environment research in the health field: Implications for urban and transportation planning practice and research.' *Journal of Planning Literature* 19(2): 147-181.
- Lee, C. and Moudon, A.V. (2006a). 'The 3Ds + R: Quantifying land use and urban form correlates of walking'. *Transportation Research Part D* 11(3): 204-215.
- Lee, C. and Moudon, A.V. (2006b). 'Correlates of walking for transportation or recreation purposes'. *Journal of Physical Activity and Health* 3(1 Suppl): S77-98.

Sallis, J. F. and Glanz, K. (2009). 'Physical activity and food environments: Solutions to the obesity epidemic'. *Milbank Quarterly* 87(1): 123-154.

Key Words: Built environment; policy; nutrition; health behaviour; ecological models.

Location: The authors are from the USA; the study focus is on the USA.

Aim: This article is a status report on research on physical activity and food environments, and it suggests how these findings can be used to improve diet and physical activity and to control or reduce obesity.



Method: This article summarises and synthesises recent reviews and provides examples of representative studies. It also describes ongoing innovative interventions and policy change efforts that were identified through conference presentations, media coverage, and websites.

Conclusions:

- Environment, policy, and multilevel strategies for improving diet, physical activity, and obesity control are recommended based on a rapidly growing body of research and the collective wisdom of leading expert organisations.
- A public health imperative to identify and implement solutions to the obesity epidemic warrants the use of the most promising strategies while continuing to build the evidence base.
- Policies with beneficial effects for both obesity and climate change need to be evaluated, and opportunities for collaboration with the environmental protection movement should be considered.
- Teaching school age students about their food and physical activity environments could produce a generation of advocates for healthy community environments.
- Strategies that engage the community, involve multiple stakeholders, and strengthen advocacy need to be developed, evaluated, and refined to implement the evidence-based policy changes expected to lead to non-obesogenic food and physical activity environments.

Recommendations for Future Research:

Research is required on how students can be educated to embrace healthy eating and physical activity and the way such education can create a generation of healthy environmental advocates. Community focused research which follows through assessment of the impacts of educating students is also required. This should be through observation of local areas with comparisons of results between neighbourhoods of contrasting socio-demographic characteristics.

HBEP Policy Implications for Practice:

- **Employ land use regulation to support the provision of local supermarkets and prevent clusters of fast-food outlets.**

Sallis, J. F., Bowles, H. R., Bauman, A., Ainsworth, B. E., Bull, F. C., Craig, C. L., Sjostrom, M., De Bourdeaudhuij, I., Lefevre, J., Matsudo, V., Matsudo, S., Macfarlane, D. J., Gomez, L. F., Inoue, S., Murase, N., Volbekiene, V., McLean, G., Carr, H., Heggebo, L. K., Tomten, H. and Bergman, P. (2009). 'Neighborhood environments and physical activity among adults in 11 countries'. *American Journal of Preventive Medicine* 36(6): 484-490.

Key Words: Neighbourhood; built environment; physical activity; adults; international.

Location: The lead author is from the USA with others from around the world; the study focus is worldwide.

Aim: To assess and compare the impacts of neighbourhood environments on physical activity throughout 11 countries.

Method: Data for an International Physical Activity Prevalence Study was collected alongside Environmental surveys from 11 countries: Belgium, Brazil, Canada, Colombia, China (Hong Kong), Japan, Lithuania, Norway, New Zealand, Sweden, and the US. The sample was required to be representative of national populations or a significant region(s) within a country (defined as a population of <1,000,000), with an age range of 18-65 years. Households were typically selected at random, and individuals within households were selected either randomly or by most recent birthday. The data collected measured perceptions of the neighbourhood environment and physical activity measures.

Conclusions:

- A variety of neighbourhood attributes relevant to physical activity for both the transportation and recreation domains were associated with meeting health-enhancing guidelines.
- Changes to the built environment may be effective in increasing physical activity, but multiple environmental changes are likely needed to have a substantial effect.
- The majority of participants in all countries except Brazil reported having free or low-cost recreation facilities and sidewalks on most streets in their neighbourhoods. European countries had the highest access to bicycling facilities.
- The US had the most limited access to transit stops and was the only country in which less than 60 percent of participants were within walking distance of shops which helps to explain the small

percentage of trips made by walking and bicycling in the US.

- The multiple significant individual variables suggest that a variety of environmental interventions may affect physical activity, with different environmental variables having particular relevance for physical activity such as for transportation versus recreation.
- Highly supportive environments were associated with a 100 percent higher likelihood of sufficient physical activity and with a 70 percent higher likelihood of meeting guidelines after adjusting for education.

Recommendations for Future Research: No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- Pursue a social ecological approach in order to encourage physical activity by including modifications to the built environment with other policy innovations such as educational programs.

Schaefer-McDaniel, N., O'Brien Caughy, M., O'Campo, P. and Gearey, W. (2010). 'Examining methodological details of neighbourhood observations and the relationship to health: A literature review'. *Social Science and Medicine* 70(2): 277-292.

Key Words: Review; systematic social observations (SSO); methods; neighbourhood observation.

Location: The authors are from Canada; the literature reviewed is from the USA; Canada; London, UK; and Perth, Australia.

Aim: In recent years, neighbourhood observations have become a popular alternative method for characterising neighbourhood environments. Rooted in sociology of crime research, observations are conducted by trained observers who use a checklist to observe and rate neighbourhoods on a number of conditions such as physical (e.g. traffic volume, housing conditions) and social (e.g. presence of people, gang activity) attributes. While this methodology has been gaining momentum in recent years, notably absent from the literature is a review to examine this methodology in detail. The

purpose of the present study was to examine research that has used neighbourhood observations as a method.

Method: Fifty-one English language studies from 1990 onwards were identified from an original list of over 1000 abstracts. Specific criteria were that the study must contain a neighbourhood observation as part of its method. These 51 studies were then analysed paying particular attention to the areas of (1) methodological rigor (i.e. how observations are carried out in the field and how data are analysed), (2) geographical boundaries (i.e. how neighbourhoods and areas of observation are spatially defined), and (3) the relationship between neighbourhood observations and residents' health (i.e. how studies examine and analyse the link between observed neighbourhood attributes and health).

Conclusions: The use of neighbourhood observations as a method in assessing the built environment in a health context has been given very little attention. There is widespread variability in the way observations are conducted and analysed making comparative studies impossible.

Recommendations for Future Research: The nature of observational research does not lend itself to standardisation. The study does not recommend standardisation of observational measures of neighbourhood factors however it does encourage researchers to assess existing literature and be explicit about any adaptation of existing methods so that comparisons might be made. The study also recommends further research into observational research as a method, such as training for raters and tool development. Finally, the study recommends more dialogue on the definition of 'neighbourhood' and the best methods to pursue to ensure the neighbourhood unit selected for the study is relevant rather than convenient.

HBEP Policy Implications for Practice:

- Support interdisciplinary collaboration to explore less traditional methods of data collection.

Semenza, J. C. and Krishnasamy, P. V. (2007). 'Design of a health-promoting neighborhood intervention'. *Health Promotion Practice* 8(3): 243-256.

Key Words: Neighbourhood intervention; built environment; social capital; social networks, community empowerment and participation.

Location: The authors are from the USA; the study focus is on the USA.

Aim: To assess how community intervention through integration of public spaces into a grid-plan city can improve social capital, and to promote community participation and neighbourhood stewardship in the interest of public health.

Method: The method involved the assessment and analysis of a community intervention to improve the public domain through the utilisation of both social and built form commodities. This involved a structured intervention entitled 'Intersection Repair' devised in Portland, Oregon, by a non-profit organisation, to implement urban gathering places in the public right of way. Specific steps included situation analysis, community outreach, asset mapping, design workshops, construction permitting, building workshops, and process evaluation.

Conclusions:

- Design and implementation of health-promoting community interventions can advance public health and community wellbeing; however, realisation of such programs is often challenging. Even more challenging is the implementation of ecologic interventions to revitalise built urban environments.
- The community created human-scale urban landscapes with interactive art installations to encourage social interactions. Such aesthetic improvements, which included painted street murals, information kiosks, hanging gardens, water fountains, benches, and so on, were intended to strengthen social networks and social capital by providing places for residents to engage in conversation.
- Community engagement in neighbourhood design benefits the public at multiple levels, by promoting a healthier lifestyle, over and above urban landscape improvements.
- Community initiated health-promoting interventions build social relationships, empower neighbourhood residents, and enable them to collectively solve local problems in collaboration with various

stakeholders within and outside the community.

- For these projects to be successfully implemented, and institutionalised, they should be tailored to address the needs and norms of the individual neighbourhoods.
- Analysis of the characteristics and needs of individual neighbourhoods is fundamental for the design and successfully implement a health-promoting neighbourhood intervention that is specifically tailored for a neighbourhood.
- When applied in different settings these interventions can increase physical activity and social interactions and may help to reverse chronic diseases including obesity, diabetes, and depression.

Recommendations for Future Research: No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- Involve the community in the design of projects such as public art installations.
- Tailor community interventions to local contexts and needs.

Shoup, L. and Ewing, R. (2010). *The Economic Benefits of Open Space, Recreation Facilities and Walkable Community Design*. Robert Wood Johnston Foundation, Princeton, USA.

Key Words: Economic; open space; recreation facilities; walkable community design; physical activity; open space.

Location: The authors are from the USA; the literature reviewed is mostly from the USA.

Aim: To review peer-reviewed and independent reports on the economic value of outdoor recreation facilities, open spaces and walkable community design with a focus on 'private' benefits that accrue to nearby homeowners and to other users of open space.

Method: The authors review 50 relevant studies and give details of a further 36 relevant studies.

Conclusions:

- Open spaces such as parks and recreation areas can have a positive effect on nearby residential property values and can lead to proportionately higher property tax revenues for local



governments (provided municipalities are not subject to caps on tax levies).

- Open space in urban areas will increase the level of economic benefits to surrounding property owners more than open space in rural areas.
- The economic impact parks and recreational areas have on home prices depends on how far the home is from the open space, the size of the open space and the characteristics of the surrounding neighbourhood.
- Compact, walkable developments can provide economic benefits to real estate developers through higher home sale prices, enhanced marketability and faster sales or leases than conventional development.
- Open space, recreation areas and compact developments may provide fiscal benefits to municipal governments.

Recommendations for Future Research:

- More detailed evidence on the actual type of park, landscape elements and locations preferred will better inform local government and policy makers.
- Ecological services, greenhouse gas reduction and mental health benefits should also be factored in as indirect benefits of parks.

HBEP Policy Implications for Practice:

- Use proven market demand for open spaces, recreational facilities and traditional neighbourhood design to justify policy change.

Story, M., Giles-Corti, B., Yaroach, A. L., Cummins, S., Frank, L. D., Huang, T. T. and Lewis, L. B. (2009). 'Work group IV: Future directions for measures of the food and physical activity environments'. *American Journal of Preventive Medicine* 36(4 Suppl): S182-S188.

Key Words: Food environment; physical activity environment; research; policy; diet; obesity.

Location: The authors are from the UK, USA, Australia and Canada; the research reviewed is from around the world.

Aim: The 2007 'Measures of the Food and Built Environments' workshop, sponsored by the National Institute for Health and the Robert Wood Johnson Foundation, included four work groups that deliberated on various aspects of the food and physical activity environments. This paper comes out of Work Group IV: a group convened to identify current evidence gaps and barriers in food and physical activity environments and policy research measures to date, and develop recommendations to guide future directions related to measurement and methodologic research efforts and policy measures.

Method: The workshop began with an individual visioning activity with participants thinking about the question: 'Where do we need to be by 2015 with regard to measuring the food and physical activity environments and related policies?' Ideas were then solicited in a group format and recorded on large poster paper by the facilitator. After the ideas were consolidated, participants voted to determine the priority areas for future directions. Group participants then discussed the barriers and challenges for each priority area and developed recommendations.

Conclusions: To further advance progress in environmental and policy research, six measurement and methodologic issues need to be addressed as summarised below.

Recommendations for Future Research:

- *Priority 1: 'Identify Relevant Factors in the Food and Physical Activity Environments to Measure, Including Those Most Amenable to Change' (i.e. WHAT are the relevant factors?).*

Recommendations:

- Social-ecologic and multilevel approaches (e.g. social, physical, economic, and policy contexts) are well suited for understanding food and physical activity environments and developing interventions and policies. These approaches should be used in

future research.

- New theories and conceptual models should be developed, and/or existing theories or models expanded or refined to help identify and assess relevant factors and their amenability to change.
- Transdisciplinary research approaches should be strengthened and expanded (a number of mechanisms to do this are listed in the paper).
- **Priority 2: 'Improve the Understanding of Mechanisms for Relationships Between the Environment, Physical Activity, Diet, and Obesity' (i.e. HOW can the relevant factors be manipulated?).**

Recommendations:

- Work groups should be developed to conceptualise and develop theoretical frameworks that capture environments in greater depth and that hypothesize potential pathways and mediating effects on food and physical activity environments.
- Mechanistic studies are needed that involve mixed methodology (e.g. qualitative and quantitative approaches), interventions related to changes in the environment, secondary analysis of existing observational and intervention data; and development and application of new methodologies for the analysis and design of multilevel studies.
- Research frameworks should be developed to form effective community partnerships (e.g., academic-community) in order to help render mechanistic studies more feasible, valid, and meaningful.
- **Priority 3: 'Develop Simplified Measures That Are Sensitive to Change, Valid for Different Population Groups and Settings, and Responsive to Changing Trends' (i.e. HOW can changes be measured?).**

Recommendations:

- A common core of measures should be developed and disseminated. Funding for this type of research should be made available through grants or exploratory research grant mechanisms that provide enough support and resources for high quality research.
- An electronic repository of field-tested, reliable, and validated measurement tools should be developed with full supporting documentation that can be freely accessed online.

- Federal, state, and local sources of policy, environmental, and geographic data on the food and physical activity environments should be collected after a consistent protocol is developed, adopted, and made freely available.
- **Priority 4: 'Evaluate Natural Experiments to Improve the Understanding of Food and Physical Activity Environments and the Impact on Behaviours and Weight' (How can opportunities for natural experiments be better utilised?).**

Recommendations:

- Funding bodies should develop rapid review mechanisms to facilitate timely funding of evaluations of natural experiments.
- Public and private sector agencies should identify, in collaboration with researchers, appropriate natural experiments for evaluation and best-practice models of evaluation.
- Procedures and processes should be developed to train a cadre of researchers in the evaluation of the impact of environmental interventions and policies on obesity-related behaviours. For example, this could occur through continuing education or professional development efforts as well as formal coursework in graduate school programs.
- **Priority 5: 'Establish Surveillance Systems to Predict and Track Change over Time'.**
'Currently, few consistently adopted standards exist for data collection or for measuring food and physical activity environments. Similarly, few protocols have been established to monitor how environments change over time' (Story et al. 2009, p. S186).

Recommendations:

- Strong advocates for a surveillance system to predict and track change should be cultivated at different levels – grassroots and higher – who can champion and encourage such a system.
- Any surveillance system should start with what we already know (proof of concept, from around the world) and should be flexible enough so new information can be added.
- Localities should be identified and supported to serve as pilot sites for developing a surveillance system.
- Performance monitoring systems



should become tools to monitor compliance between proposed growth and development activities and health outcomes.

- Cross-pollination of expertise in health and planning departments should be encouraged.

- *Priority 6: 'Develop Standards for Adopting Effective Health-Promoting Changes to the Food and Physical Activity Environments'.*

Recommendations:

- A better understanding is needed of environmental and policy change thresholds to be achieved in order to bring about behavioural change.
- Quality standards should be developed for the collection of geographic and environmental data and measures and survey tools.
- Funders should support a series of projects that undertake pooled analyses of existing studies with common measures or meta-analyses of published data.
- A review and evaluation of existing standards should be conducted to assess their impact on health outcomes, including any unintended consequences.
- Existing standards producing negative health or health behaviour outcomes should be modified and a periodic review commissioned.

HBEP Policy Implications for Practice:

- Support interdisciplinary collaboration to develop accepted standards of evidence and ways to analyse existing evidence to justify policy change.

Sugiyama, T., Leslie, E., Giles-Corti, B. and Owen, N. (2008). 'Associations of neighbourhood greenness with physical and mental health: do walking, social coherence and local social interaction explain the relationships?'. *Journal of Epidemiology and Community Health* 62(5): e9.

Key Words: Green environment; physical and mental health; walking; recreation; social.

Location: The authors are from Australia; the study was conducted in the city of Adelaide, South Australia.

Aim:

- To test whether perceived neighbourhood greenness is associated with perceived physical and mental health; and
- To test whether walking (both utilitarian and recreational) and social factors (social coherence and local social interaction) might explain the association between perceived neighbourhood greenness and physical and mental health.

Method: The study employed a spatially based sampling method and involved households selected from 32 neighbourhoods in the city of Adelaide, South Australia. In each of the 32 neighbourhoods, 250 addresses were randomly selected and mailed a letter requesting the participation of one individual from the household. Before an individual could undertake the study survey, they had to meet an eligibility criteria, which included the following attributes: 'living in a private dwelling, aged between 20 and 65 years, able to walk without assistance and be able to take part in surveys in English' (Sugiyama et al. 2008, p. 2). Survey question covered issues associated health status, perception of neighbourhood greenness and neighbourhood social characteristics. A total of 2,194 questionnaires were returned.

Conclusions: Perceived neighbourhood greenness enhances perceived physical and mental health, but to different degrees. It was found that there is a stronger association between mental health and neighbourhood greenness than with physical health. In greener environments, it was identified that people are more likely to participate in walking for recreational purposes. Consequently, walking explained the association between neighbourhood greenness and physical health.

Recommendations for Future Research:

Longitudinal studies are needed to further examine the casual relationship between natural environments and health. In particular, such studies would focus on the effects of environmental interventions, such as the expansion of open/green space.

HBEP Policy Implications for Practice:

- Promote the provision of natural open spaces.

Sustainable Development Commission (UK) (2008). *Health, place and nature: How outdoor environments influence health and well-being: A knowledge base.* Unpublished review.

Key Words: Health; outdoor environment; natural spaces; air pollution; traffic; noise; flood; climate; accessibility; safety; land use; street design.

Location: The review has a UK focus but looks at articles from around the world.

Aim: This is a non-systematic general review to examine the contribution of aspects of the outdoor environment (both natural and built) to health in the context of promoting sustainable development.

Method: A 'snowball' method of literature review was conducted, which included looking at reference lists of key articles and consulting with key stakeholders. Peer-reviewed literature was given preference as were studies conducted since 2000. UK studies were sought, however, studies were included from around the world. The review is categorised as concentrating on one of the following specific aspects of the environment: natural spaces, air pollution, road traffic, noise, floods, climate, accessibility, safety and incivilities, mixed land-use and street design. The review breaks these aspects into 'direct effects' (flooding, noise, air pollution) and 'indirect effects' (street design, mixed use).

Conclusions: The article includes a set of very generic findings, with no systematic or new conclusions to that already present in the scholarly literature.

Recommendations for Future Research:

- The extent to which contact with nature can contribute to human health and well-being is considered by some to need further investigation (see Maller et al. 2005).
- The relationship between access to shops and services and mental health is unclear (see Clark et al. 2007).
- There is a lack of systematic research demonstrating evidence that the natural environment increases levels of social contact (see Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning, Nature and the Environment 2004).
- An interesting statistic: 'Between 1995 and 2000, Britain lost approximately one-fifth of its local services, including corner shops, post offices and banks' (New Economics Foundation 2002 cited

in Sustainable Development Commission 2008, p.14).

HBEP Policy Implications for Practice:

- There are no conclusive policy implications from this research.

References:

Clark, C., Myron, R., Stansfeld, S. A. and Candy, B. (2007) 'A systematic review of the evidence on the effect of the built and physical environment on mental health'. *Journal of Public Mental Health* 6(2), 14-27.

Health Council of the Netherlands and Dutch Advisory Council for Research on Spatial Planning, Nature and the Environment. (2004). *Nature and health: The influence of nature on social, psychological and physical well-being.* Health Council of the Netherlands and RMNO, The Hague, Denmark.

Maller, C., Townsend, M., Pryor, A., Brown, P. and St Leger, L. (2005). 'Healthy nature healthy people: 'Contact with nature' as an upstream health promotion intervention for populations'. *Health Promotion International*, 21(1), 45-54.

Thompson, S. M., Corkery, L. and Judd, B. (2007). 'The Role of Community Gardens in Sustaining Healthy Communities'. *Proceedings of the 3rd State of Australian Cities Conference, University of South Australia, Adelaide, Australia.*

Key Words: Community gardens; healthy communities; built environment; public health; public housing.

Location: The authors are from the University of New South Wales in Sydney, Australia; the study focus is on Sydney, Australia.

Aim: To study a community garden scheme operating in a public housing estate in Sydney's inner west and discuss the role of community gardens in building healthy and sustainable communities.

Method: A qualitative methodology was used for the study. This involved a literature review, data collection on the gardens, in-depth interviews with key stakeholders and five focus groups involving a total of 28 gardeners representing 50 percent of all gardeners. The focus groups explored five key themes: activity and therapeutic benefit, ownership and belonging, social function, managing the garden, cultural diversity and safety. The meetings were recorded and transcribed, and



the resulting transcripts analysed for recurring themes.

Conclusions:

- **Contribution to health and wellbeing:** The gardens were found to provide a setting for physical health benefits, through physical activity and access to fresh food and medicinal herbs, as well as psychological benefits, through relaxation, meditation, the maintenance of a daily routine, and spiritual connection.
- **Contribution to community and social life:** The gardens enabled social interaction and developed social capital within the community studied. The gardens were identified as a place to develop friendships, care for others and break down barriers. Some gardeners also believed that the presence of the gardens improved neighbourhood safety and security.
- **Contribution to cross-cultural relations:** The gardens also provided a link to many of the participants' traditional cultural practices. Specialised produce could be grown for cooking ethnic dishes and a sharing of produce often translated into a sharing of culture and knowledge.

Recommendations for Future Research:

More studies are needed to examine the social health benefits of community gardens, along with their role in areas subject to urban intensification.

HBEP Policy Implications for Practice:

- Support the development of community gardens, especially in areas with high residential densities and limited access to open space.
- Introduce regulations to protect unused land for community purposes such as gardening.

Tzoulas, K., Korpela, K., Venn, S., Yli-Pelkonen, V., Kaźmierczak, A., Niemela, J. and James, P. (2007). 'Promoting ecosystem and human health in urban areas using Green infrastructure: A literature review'. *Landscape and Urban Planning* 81(3): 167-178.

Key Words: Public health; human well-being; green Infrastructure; urban ecosystem; ecosystem health.

Location: The authors are from the UK and Finland; the research reviewed is from across the world but has a European focus.

Aim: To formulate a conceptual framework of associations between urban green space, and ecosystem and human health. To critically review the possible contributions of urban and peri-urban green space systems, on both ecosystem and human health.

Method: Relevant journals and texts were identified by the authors and searched using key words. A number of themes were then extrapolated from a critical evaluation of the articles identified. The review focused on studies that tested an association rather than causation.

Conclusions:

- An accumulating set of studies provide weak evidence on the positive relationship between wellbeing, health and green space.
- Evidence of the association between levels of physical activity and proximity of green areas in the neighbourhood have been provided in studies which have controlled for age, sex and education level.
- Ecosystem services provided by natural areas can provide healthy environments and physical and psychological health benefits to the people residing within them. Healthy environments can contribute to improved socio-economic benefits for those communities as well.

Recommendations for Future Research:

Considerable empirical research to explore the roles of environmental factors in public health is needed in order to resolve the following theoretical and methodological issues before policy interventions can be formulated:

- the identification, description and measurement of the environmental processes that affect health;
- the development and testing of hypotheses to explain how environmental factors influence health;

- the identification of causal relationships between environmental factors and health;
- testing of residual confounding variables;
- undertaking longitudinal studies and ensuring that geographical units (scale) are relevant to the health outcome under investigation; and
- the development of an ability to distinguish between the compositional, contextual and collective explanations for environmental effects on health.

There is a need to evaluate the potential economic implications of natural open spaces, linked to health effects and health service budgets.

Further research is required to establish different possible health responses to natural, semi-natural or artificial habitats.



HBEP Policy Implications for Practice:

- Promote the provision of natural open spaces.
- Support interdisciplinary collaboration to develop accepted standards of evidence and ways to analyse existing evidence to justify policy change.

van der Horst, K., Oenema, A., Ferreira, I., Wendel-Vos, W., Giskes, K., van Lenthe, F. and Brug, J. (2007). 'A systematic review of environmental correlates of obesity-related dietary behaviors in youth'. *Health Education Research* 22(2): 203-226.

Key Words: Obesity; dietary behaviour; youth; environmental factors.

Location: The authors are from the Netherlands; the studies reviewed are from around the world.

Aim: To address which environmental correlates have been studied in relation to child and adolescent energy, fat (total and energy percent), fruit, vegetable, snack, fast-food and soft drink intake. To identify environmental factors consistently associated with these obesity-related dietary behaviours.

Method: The authors sourced studies from a variety of databases written during a 24 year period (1980-2004). Their search criteria used 20 key terms including: energy intake, caloric intake, fat consumption, soft drink consumption. To be included in the research, studies needed to include the energy and fat intake, food or soft drink consumption of

healthy three to 18 year olds as dependent variables and an outcome measure that was assessed for at least one complete day. Only countries with established market economies, published in English in international peer reviewed journals were included. Intervention studies and studies that included only overweight/obese children were excluded. Studies were summarised with each environmental factor coded for association with dietary outcomes whether positive or negative.

Conclusions:

- There is consistent evidence for the relationship between parental intake and children's fat, fruit and vegetable intake, for parent and sibling intakes with adolescent's energy and fat intake and for parent educational level with adolescent's fruit and vegetable intake.
- Authors identified gaps in the available evidence of relationships between environmental factors and child and adolescent dietary intakes. Very few studies examined associations between micro-environmental factors in school and neighbourhood settings, and macro-environmental factors in city/ municipality settings.
- Finding that parental behaviour is associated with child and adolescent intakes implies that interventions should take the behaviour of parents into account.

Recommendations for Future Research:

Studies are required which focus on environmental levels and factors such as physical, socio-cultural, economic and political factors in the school, neighbourhood and city environment. These studies will create a broader understanding of the influence of environmental factors associated with obesity inducing behaviours in children and adolescents. Furthermore, factors such as availability and accessibility at home, school and neighbourhood should be studied in relation to energy, fat, soft drink, snacks and fast-food intake.

HBEP Policy Implications for Practice:

- Employ land use regulation to promote equitable access to healthy, fresh food.

Weaver, N., Williams, J. L., Weightman, A. L., Kitcher, H. N., Temple, J. M. F., Jones, P. and Palmer, S. (2002). 'Taking STOX: Developing a cross disciplinary methodology for systematic reviews of research on the built environment and the health of the public'. *Journal of Epidemiology and Community Health* 56(1): 48-55.

Key Words: Built environment; public health; systematic review; cross disciplinary research.

Location: The authors are from a multi-disciplinary team based at the University of Cardiff in Wales; the research reviewed is from around the world.

Aim: To develop a cross disciplinary literature search methodology for conducting systematic reviews of all types of research investigating aspects of the built environment and the health of the public.

Method: The authors trialled several database and key word search methods to explore the impact of searching in only medical, social science or built environment databases and came up with STOX – a way to classify research (Systematic Reviews, Trials, Observational Studies, Expressions of Opinion).

Conclusions: There is value in a broad-based approach to research on health and the built environment, including databases from a variety of disciplines in a comprehensive systematic review covering all types of research. Sole reliance on medical databases is likely to exclude a significant number of relevant research studies. 'Current relevant systematic reviews on public health and the built environment do not usually search built environment databases, and only half search beyond medical ones' (Weaver et al. 2002, p. 54).

Recommendations for Future Research:

While the majority of intervention studies may currently be retrieved by the medical and social science databases, a large number of observational studies are available in the built environment and grey literature. A broad-based approach, which considers a large range of evidence types, could be of value in a complex area like public health. Our methodology is designed to search for and classify all types of evidence via a cross disciplinary approach.

HBEP Policy Implications for Practice:

- Support interdisciplinary collaboration to develop accepted standards of evidence and ways to analyse existing evidence to justify policy change.

Wendel-Vos, W., Droomers, M., Kremers, S., Brug, J. and van Lenthe, F. (2007). 'Potential environmental determinants of physical activity in adults: A systematic review'. *Obesity Reviews* 8(5): 425-440.

Key Words: ANGELO framework; environment; physical activity; review.

Location: The authors are from the Netherlands; the article reviews research mainly from USA and Australia, but has a European interpretation of findings.

Aim: To gain insight into potential determinants of various types and intensities of physical activity among adult men and women.

Method: Studies were retrieved from Medline, PsycInfo, Embase and Social Scisearch. The ANGELO framework was used to classify environmental factors. In total, 47 publications were identified.

Conclusions: Supportive evidence was found for only very few presumed environmental determinants. Social support and having a companion for physical activity were found to be convincingly associated with different types of physical activity [(neighbourhood) walking, bicycling, vigorous physical activity/sports, active commuting, leisure-time physical activity in general, sedentary lifestyle, moderately intense physical activity and a combination of moderately intense and vigorous activity]. Availability of physical activity equipment was convincingly associated with vigorous physical activity/sports and connectivity of trails with active commuting. Other possible, but less consistent correlates of physical activity were availability, accessibility and convenience of recreational facilities. No evidence was found for differences between men and women.

Recommendations for Future Research: Most studies used cross-sectional designs and non-validated measures of environments and/or behaviour. Therefore, no strong conclusions can be drawn and more research of better quality is clearly needed. As a result of non-standard variables and measurement techniques, comparability between the included studies may be relatively low. Standardisation will enable a more systematic

review of evidence – ‘it is important to conduct future research with clear, possibly standardized definitions of environmental attributes and physical activity within the strongest study design possible’ (Wendel-Vos et al. 2007, p. 438).

HBEP Policy Implications for Practice:

- Promote policies that encourage locally based social networks such as organised community events, community gardens and mothers groups.
- Support interdisciplinary collaboration to develop accepted standards of evidence and ways to analyse existing evidence to justify policy change.

Winkler, E., Turrell, G. and Patterson, C. (2006). ‘Does living in a disadvantaged area mean fewer opportunities to purchase fresh fruit and vegetables in the area? Findings from the Brisbane food study’. *Health and Place* 12(3): 306-319.



Key Words: Health inequalities; area socio-economic disadvantage; access; retail outlets; fruits; vegetables; food, nutrition and diet; grocery shopping.

Location: The authors are from Brisbane, Australia; the study focus is on Brisbane, Australia.

Aim: To determine whether there are systematic differences in shopping infrastructure which are likely to influence the fruit and vegetable purchasing patterns of socio-economic groups in an Australian urban setting, and compare findings with international studies. Access to retail outlets is considered in terms of distance, the number of local shops, and their opening hours.

Method: The study was conducted in 2000 in the Brisbane City Statistical Subdivision (SSD). The study used census collection districts (CCDs), which contain an average of 200 households, are socio-economically homogeneous and cover varying spatial areas. A stratified random sample of 50 CCDs was selected from the 1,517 CCDs in the Brisbane SSD.

Shopping catchments were created to overcome the limitations of only addressing shops within administrative boundaries, and included shops ‘nearby’ to administrative boundaries. This covered a two and a half kilometre radius of the centroid of the sampled

CCDs to represent the area where residents of sampled CCDs were likely to shop. The authors used a previously developed eight category shop classification system based on shop size, primary activity and merchandise. The data was obtained through an audit of the shopping catchments conducted between July and October 2000.

Conclusions:

- The authors discovered null findings in terms of the number of shops and their opening hours in terms of the influence on access to shops and the purchasing of fruit and vegetables.
- Distances to shops should be measured as a relative distance as only measuring a straight line from the centre of the CCD to the nearest shop does not equate to the average distance a person must travel to reach fresh food.
- While it is unlikely that living in a socio-economically disadvantaged urban area (in Australia) means less opportunities to purchase fruits and vegetables; the individual socio-economic differences in diet are still influenced by environmental characteristics.
- Contrary to expectations, medium socio-economic areas had the most local supermarkets and greengrocers, yet the distance between supermarkets and green grocers was greater than that for disadvantaged CCDs.
- Access to a relatively equal shopping infrastructure assists in minimising socio-economic inequalities in diet.

Recommendations for Future Research: No recommendations were articulated in the reference.

HBEP Policy Implications for Practice:

- Employ land use regulation to promote equitable access to healthy, fresh food.

