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Urban planning for physical activity and nutrition: A review of evidence and interventions

Matthew Burke, Emily Hatfield and Joanne Pascoe

Urban Research Program

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The Urban Research Program seeks to improve understanding of, and develop innovative responses to Australia's urban challenges and opportunities by conducting and disseminating research, advocating new policy directions, and by providing training assistance. We aim to make the results of our research and advocacy work available as freely and widely as possible.

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The *Issues Papers* and *Research Papers* are edited by Jago Dodson, Research Fellow in the Urban Research Program. Email: j.dodson@griffith.edu.au.

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Introduction – Supportive built environments for healthy living

Background and purpose

The quality of the environment and the nature of development are major determinants of health. This review explores the relationship between health and urban form with a focus on physical activity and nutrition.

Physical activity and nutrition are significant risk factors of ill health in Australia and may have been impacted by urban environmental features such as urban form or transportation systems. Healthy lifestyles can improve mental wellbeing and influence physical health. Sedentary lifestyles have been identified as contributing to high obesity levels and increase the risk of cardiovascular disease, stroke and type II diabetes. The rise of overweight and obesity in Australia reflects international trends and places a significant burden on the health system, economy and the community.

Recent research has uncovered the importance of the built environment for physical activity and health, with particular attention focused on urban form and structure. As will be shown, there are both direct and indirect relationships between the built environment, physical activity, nutrition and health. A number of built environment interventions have commenced in Australia and overseas in order to influence health outcomes. These will be discussed later in this review.

This review of the literature seeks to answer the following questions:

1. What are meant by "active transport" and incidental physical "activity/movement" and how do they relate to the broader concept/aspects of "physical activity"?
2. What is meant by "nutrition"?
3. What are the links/relationships between active transport/incidental physical activity, nutrition and individual and community health?
4. What are the (physical and non-physical) environmental attributes of active transport, incidental physical activity and nutrition?
5. What can be learned from the experience of other jurisdictions? What measures have governments in other States, the Commonwealth Government and governments in other countries been taking to promote active transport, incidental physical activity and nutrition? How successful have they been and how has the success (or not) been measured? Specifically, how and how successful have governments (other than Queensland) wielded the legislative, policy and planning instruments and mechanisms at their disposal to promote active transport, incidental physical activity and nutrition?

Physical activity

What is physical activity?

Physical activity is any activity that involves significant movement of the body and limbs. It should not be confused with exercise, which is a type of physical activity, defined as a planned, structured and repetitive body movement done to improve or maintain physical fitness (Egger et al. 1999:9).

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 (Frank 2003:55).

Minimum recommended levels of physical activity

Physical activity is a fundamental means of improving the physical health, functional strength, general well-being and mental health of individuals. And there are additional health benefits to be gained from physical activity that are independent of other risk factors such as overweight/obesity and nutrition.

In Australia, the National Physical Activity Guidelines for Adults recommend a total of 30 minutes or more of moderate-intensity, physical activity on most or all days of the week, to gain a health benefit, though Australians are also encouraged to participate in some regular, vigorous activity for extra health and fitness. The 30 minutes total need not be continuous and persons may combine short sessions of different activities of around 10-15 minutes each to a total of 30 minutes or more (Department of Health and Aged Care 1999).

The National Guidelines encourage people to 'think of movement as an opportunity, not an inconvenience' (Department of Health and Aged Care 1999). Ideally such physical activity should be incorporated into everyday activity rather than solely through structured or organised sports.

What is incidental physical activity/movement?

In contrast to purposeful physical activity, incidental movement consists of those physical activities that are undertaken in order to accomplish another purpose (Frank 2003:56). Lifestyle activities are those that can fit easily into one's daily routine, for example, using the stairs, energetic housework, gardening and energetic occupational activities. There is significant interest in incidental physical activity because it is generally 'embedded' into people's daily lives. Two of the most common types, walking and bicycling, are easily incorporated into people's lives when the built environment is properly structured to encourage them (Frank 2003:39).

What is active transport?

Active transport is a term increasingly used to describe travel between destinations by walking, cycling and other non-motorised modes (Cooper et al. 2006:29; Evenson et al. 2006; Litman 2003). It is the transport component of the term active transport that sets it aside from other forms of personal physical activity. Sometimes referred to as active travel or 'utilitarian' travel (Frank, Andresen and Schmid 2004:88), it involves purposeful movement between different land uses to achieve transport objectives. Though multiple modes of non-motorised travel exist, walking and bicycling are the dominant modes. There is increased significance often attached to active travel as it offers one of the more direct means to provide for moderate and vigorous physical activity for modern societies, and the active transport agenda meshes neatly with other concerns about traffic congestion, environmental sustainability and oil vulnerability.

Nutrition

What is nutrition?

Nutrition is defined in a much broader way than simply the constituent materials in human food. Nutrition includes all the factors which are part of, and/or influence, the food system and population eating habits and behaviours (Yeatman 2003). When considering nutrition as part of associated research (Pretorius 2008:3) it was suggested that nutrition includes:

- Food production – primary production: agricultural land and gardens;
- Food processing, distribution and access – retail mix and accessibility; distance and transport to shops, food availability in shops and at events, drinking water fountains
- Food consumption – consumer behaviour and choices, food prices, quality and variety, food knowledge, skills; storage, preparation and cooking facilities

- Food marketing and promotion – signage (including directional and billboards); vending machines; sponsorships
- Nutrition-related services and facilities – parenting rooms and facilities; nutrition education programs, community kitchen facilities and community programs (such as Meals on Wheels or school/community gardens)

When viewed in this way, nutrition includes a number of systems that interact to provide food, and that in part determine whether healthy or unhealthy food options are available to and marketed to the public.

Supportive environments

There is growing interest in ways to improve human health by creating 'supportive environments' in which people can live healthier lives, including both regular physical activity and nutrition.

The *Sundsvall Statement of Supportive Environments for Health* declares that:

> "…supportive environments refers to both the physical and the social aspects of our surroundings. It encompasses where people live, their local community, their home, where they work and play. It also embraces the framework which determines access to resources for living, and opportunities for empowerment. Thus action to create supportive environments has many dimensions: physical, social, spiritual, economic and political." (WHO 1991)

An important part of the supportive environments agenda are interventions that seek to alter the built environment to encourage healthy lifestyles, especially in the areas of physical activity and nutrition. For instance, moderately intense physical activities can be built into the lives of many residents by changing the way communities are designed and built.

Environmental determinants of physical activity and nutrition

The environment, including the physical environment (built and natural) and its complex interaction with the social, economic, cultural, institutional and other dimensions of human existence affects the way humans work, play, eat, and go about their daily lives.

What is the built environment?

The built environment refers to human made aspects of the environment. This includes buildings, transport infrastructure, utilities, telecommunications, industry, housing and designed infrastructure which may appear to be natural environments, such as municipal parks. Transport infrastructure encompasses streets and highways for automobiles, public transport systems and infrastructure for active transport including footpaths and cycle paths (Pretorius 2008:2).

Urban form

Urban form refers to the built quality of the urban environment which in turn is related to the density and intensity of land-uses within urban areas (Mead, Dodson, Ellway 2006:23). Under consideration in this report are features of urban form which affect connectivity of the built environment, such as street layout and provision of footpaths. "Issues of Health, wellbeing and quality of life need to be considered during the urban planning process to resolve many of the problems faced in cities today." (Barton and Tsourou 2006:157)

Relationships of urban form to health

In Australia, "because the majority of people live in cities and towns, the environment within them also has a direct effect on people's quality of life, including health and access to services." (Beeton et al. 2006:7). The model provided by Whitehead & Dahlgren (1991), see Figure 1, describes five sets of factors influencing health. Outside of the central stratum of predetermined factors, the built environment affects every determinant of human health. For example, an individual lifestyle factor such as diet can be influenced by local access to fresh food.

Source: Whitehead and Dahlgren (1991)

Figure 1: Determinants of health

Given the variability and inter-connectedness of many environmental factors, it is often difficult to conduct research to identify causal relationships with health. Tucs and Dempster (2007: 7-8), who undertook a similar literature review of Canadian research on the built environment and health, noted they had a challenge with:

> '…the concept of "evidence." As several authors point out, perhaps no one can really speak to evidence of the connections between individual and/or public health and the built environment. Rather research provides a probable association(s) between some aspect(s) of the built environment or land use with behaviours (or in association with behaviours) and/or with probable impacts or influences, which, in turn, have probable association(s) with aspect(s) of health for individuals, groups and/or populations' …
>
> 'In summary, although there is not much research that claims evidence of causal connections between the built environment and health, there is research on the relationships between some aspect(s) of the environment (built or otherwise) and/or land use patterns and/or design and some behaviours and/or other factors that support and/or compromise health.'

A number of built environment factors that encourage sedentary behaviour have been associated with health conditions such as obesity, type 2 diabetes, cardiovascular disease (CVD). Patterns of urbanisation such as 'urban sprawl' are implicated in poor health outcomes. (Mead, Dodson and Ellway 2006: 23). As Lopez (2004: 1574) notes, the consequences of urban sprawl include 'increased reliance on automobile transportation and decreased ability to walk to destinations, decreased neighbourhood cohesion, and environmental degradation'. Further, there is growing evidence regarding links 'between contemporary public health epidemics, such as obesity and depression, and aspects of our urban environment', which have emerged in parallel with the increasing suburbanisation of Australian cities' (Capon 2003: 21).

In Australia, physical inactivity is now second only to tobacco as the leading cause of death and ill-health, which Giles-Corti (2006b: 1) contends relates in part to the design of 'obesogenic' environments that 'discourage physical activity and encourage over consumption of food'.

The figures in the following table show the top five burden of disease for Australian males and females in 2003. The DALY (disability-adjusted life year) measure describes the amount of 'years of life lost due to premature death coupled with years of 'healthy' life lost due to disability' (Begg et al. 2007: 2).

Table 1: Five leading burden of disease causes for Australian males and females in 2003

	Females	Males
1	Anxiety and depression (10.0%)	Ischaemic heart disease (11.1%)
2	Ischaemic heart disease (8.9%)	Type 2 diabetes (5.2%)
3	Stroke (5.1%)	Anxiety and depression (4.8%)
4	Type 2 diabetes (4.9%)	Lung cancer (4.0%)
5	Dementia (4.8%)	Stroke (3.9%)

(Source: Begg et al. 2007: 39)

The burden of disease report calculated the DALYs which were attributable to lifestyle behaviours, physiological state, social and environmental factors. Physical inactivity accounted for 6.6% of the disease burden, while urban air pollution accounted for 0.7%. The report attempts to quantify combined effects of each risk, recognising that "complex causal pathways" exist. Physical inactivity was a noted contributor to cancer (5.6%) and most significantly to cardiovascular disease (23.7%) and diabetes (23.7%). 'The rate of burden from physical inactivity per head of population increased with age' (Begg et al. 2007: 81). The five leading burden of disease risks for females and males include physical inactivity as outlined in Table 2.

Table 2: Five leading burden of disease risks for Australian males and females in 2003

	Females	Males
1	High blood pressure (7.3%)	Tobacco (9.6%)
2	High body mass (7.3%)	High blood pressure (7.8%)
3	Physical inactivity (6.8%)	High body mass (7.7%)
4	High blood cholesterol (5.8%)	High blood cholesterol (5.8%)
5	Tobacco (5.8%)	Physical inactivity (6.4%)

(Source: Begg et al. 2007: 39)

Built environments which improve the level of physical activity of its residents include opportunities for active transport such as walking and cycling. Walking remains the most popular form of exercise or active recreation in Australian adults (Australian Sports Commission 2004). Active transport contributes to the health and social wellbeing of residents by:

- reducing exposure to air pollution
- reducing exposure to traffic hazards (reduced car dependence and traffic calming)
- providing physical activity, improving health and well-being
- improving mental health through improved social capital (reduced social isolation and increased sense of community)

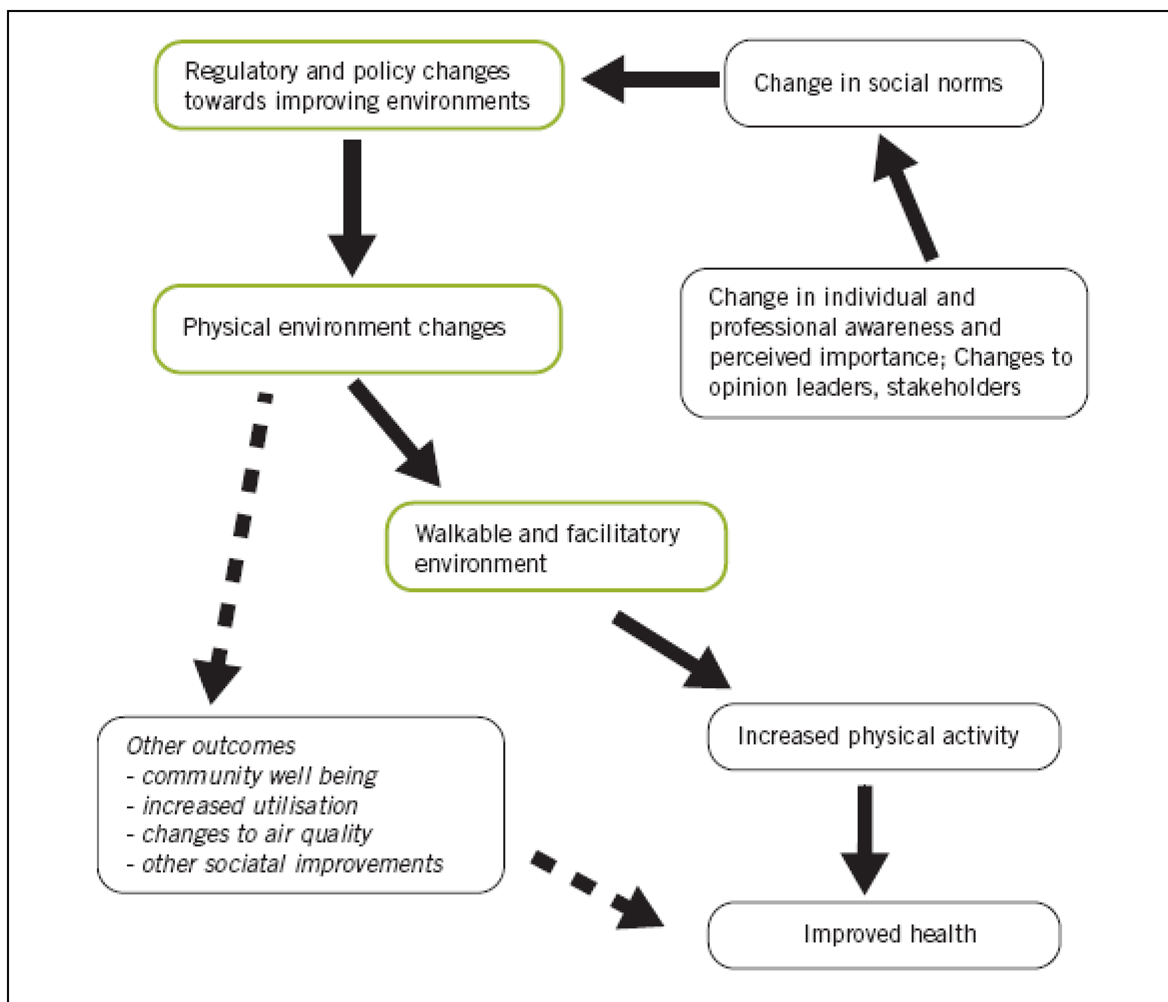
Urban design incorporating access to safe and attractive open space is associated with improvements in physical and mental health of residents by:

- encouraging walking
- reducing mental fatigue
- providing opportunities for social interaction

Modifying the built environment to improve health

As a result, the planning profession, health agencies and others are looking to modify the built environment to incorporate features that emerging evidence suggests will improve human health. As the Planning Institute of Australia suggested in it's submission to the Australia 2020 Summit, 'all professions and governments that influence the built environment should incorporate health outcomes into statutory and strategic planning processes and policies for example in areas such as urban design, building regulations, infrastructure, engineering and greenfield/new residential developments' (Planning Institute of Australia 2008:11).

To modify the built environment is no easy task and requires a comprehensive approach to changing policy and practice. There are many actors that influence urban processes, across various professions and institutions, each responsible for policies, plans or projects and playing a role in at least one aspect of the built environment. As such, attention is being given to multi-level environmental interventions that can create transform policy and practice at various levels in order to improve environments. In this way, rather than piece-meal site by site interventions, changes to policy and practice may achieve systemic change as shown in Figure 2.



(Source: Gebel et al. 2005:18)

Figure 2: Model of processes by which social and policy changes can influence the built environment and improve health

Target population groups

A number of target population groups have been identified as being at risk in terms of physical activity and nutrition. Population studies have repeatedly shown that women, people from non-English speaking backgrounds, the socio-economically disadvantaged and Aboriginal and Torres Strait Islanders are the least likely to be active. However, the evidentiary support for interventions targeted as specific population groups in regards to physical activity or nutrition is limited, and further research and evaluation is required (Bauman et al. 2002: 16, 19-20).

Children and the built environment

Australian cities have all seen significant decreases in the amounts of walking and cycling by children and adolescents, with sizable reductions in the proportion of children travelling to school by non-motorised modes. The reasons for these shifts have generally been identified as relating to changes in the built environment, as well as to parental controls, perceptions of traffic and 'stranger' danger, and changing lifestyles including increased consumption of electronic media. The decreases in walking and cycling activity are now generally acknowledged as being positively associated with a range of health impacts in the general community, including a rise in obesity and overweight, type II diabetes, heart disease and a range of other diseases (Burchell and Mukherji 2003; Committee on Physical Activity Health Transportation and Land Use 2005; Doyle et al. 2006; Frank and Engelke 2001; Frank et al. 2006b). Environmental factors may affect children in different ways to adults, primarily as children can be both more vulnerable and more highly exposed than adults to specific risks. Today, several scholars are positioning the blame for a decline in children's health on urban environmental factors, relating to the form and structure of cities (Burdette and Whitaker 2005; Dehghan, Akhtar-Danesh and Merchant 2005; Franks et al. 2005; Lumeng et al. 2006; McCambridge et al. 2006). This raises significant concerns for public policy - given that 80% of obese youth continue this trend into adulthood (Whitaker et al. 1997). Increasing attention is being given to interventions aimed at positively affecting children's long term health and developmental outcomes (Black, Collins and Snell 2001; Collins and Kearns 2005; DeRobertis 1999; McMillan 2005; Woolley 2006).

Seniors and the built environment

Australia's population is also aging, with the proportion who are over 65 years rising from 13% in 2006 to 26% in 2020 (Beeton et al. 2006:7). The design of the built environment has an important role to play in maintaining the health of an aging population because '…continuing to access the outdoor environment plays an important role in maintaining and enhancing the quality of life (QOL) of older people' (Kellaher, Peace and Holland 2004). One of the most important public health benefits of maintaining physical activity into older age is the prevention of injurious falls (Bauman et al. 2002:18).

Indigenous health and the built environment

A challenge for built environment planners are the unique health issues confronting some indigenous populations in Australia. 'The most disadvantaged group in Australia is remote Indigenous communities, in terms of almost every measure of wellbeing, including health, disability, housing, employment and education. Average life expectancy is around 17 years lower' (Beeton et al. 2006:7). Programs which target indigenous families are available as resources for education and health authorities to promote nutrition and physical activity. However many of the health issues associated with indigenous communities could be addressed by fundamental improvements in their built environment.

Key themes

There were a small number of key 'themes' in the research surveyed in this review. In no particular order, these were:

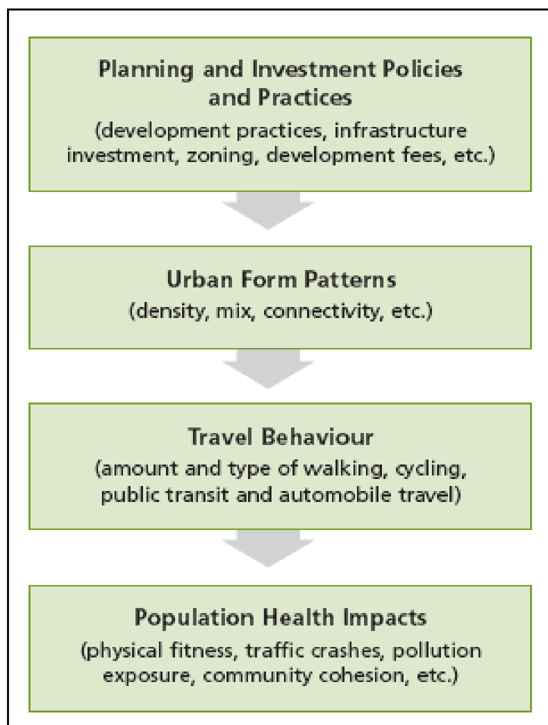
- research on physical activity, especially walking, and its association with specific built environment factors;
- research on urban systems and their impacts on nutrition;
- emerging research on social capital, the built environment and health, which is a growing area of concern;

Built environment factors and physical activity

There is now a well-developed literature available on relationships between urban design, urban structure, transport systems with people's travel behaviour and, in particular, walking activity. Though heavily biased to North American studies, a number of literature reviews have been conducted on this research (i.e. see Badland and Schofield 2005; Crane 2000; Ewing and Cervero 2002; Ryan and McNally 1995; Steiner 1994) that generally suggest that automobile-dominated, lower density, homogenous suburbs are associated with less walking and less incidental physical activity. The key comparative study on the transport and land use arrangements of cities and their travel behaviour, the Millennium Cities Project (Vivier 2001), suggests that cities with extensive public transport systems, higher residential density and higher employment density in the city centre have more walking and public transport use. And higher rates of public transport use have been identified as providing health benefits (American Public Transportation Association 2005; Edwards 2008).

Two Australian research efforts have provided similar findings – the RESIDE study (Giles-Corti et al. 2008), which reviewed the impacts of urban design changes in Perth neighbourhoods, and the PLACE study (Cerin et al. 2007), which included a suburb in Adelaide. Though still contested, there appears sufficient evidentiary support for interventions that seek to modify the built environment in order to increase participation in physical activity. However, the modifications that should be sought or prioritised are less well understood.

Frank et al. (2006a: 6) suggest that planning and investment policies and practices are greatly responsible for the form of our urban environment, which in turn influences travel behaviour, and then physical activity and a range of other health impacts, as shown in Figure 3.



(Source: Frank et al. 2006a: 6)

Figure 3: Links between urban form travel, physical activity and health

Ewing (2005) suggests there is relatively strong evidence that compact development patterns are associated with active travel modes such as walking and transit, but that evidence is weaker when linking compact development with overall physical activity, and related weight and health outcomes. Whilst measuring physical activity per se within urban populations is possible, how one may convert this into a metric into a quantifiable health impact is still unresolved. Similarly there remain a number of difficulties with the assessment and measurement of different urban design factors (Mead et al. 2006:40). Indeed, evidence for simple direct links between urban form and specific health outcomes remains weak and there are critics who suggest caution practitioners and governments from intervening, either on empirical or moral grounds (Eid et al. 2006; Laurian 2006). Though these criticisms have not gained traction, further research is needed to clarify the relationships and to determine how the built environment may influence behaviour, physical activity and healthy lifestyles.

In summarising the research we suggest that key aspects of the built environment seen as contributing to walking and cycling in human populations include:

- Those features of residential areas that may determine how far a householder must travel to access retail, public transport or other services, such as
  - residential and employment density,
  - clustering of development in centres and at transport nodes
  - street and path connectivity
  - land use mixing;
- the accessibility offered by the regional public transport system to provide opportunities to travel to education, employment, retail or other services;
- the comparative accessibility offered by the car, including congestion, ease of use and parking;
- the design of urban streets and public spaces in offering a quality walking and cycling environment

These factors are captured by Frank et al. (2006a) in Figure 4. Interventions to modify the built environment, such as New Urbanism (to be discussed later) generally seek to address these factors.

Factor	Definition
Density	People or jobs per acre or hectare.
Mix	Degree to which residential, commercial and institutional land uses are located close together. Can be mixed vertically within a single project or horizontally across several different developments.
Connectivity	Degree to which roads and paths are connected and allow direct travel between destinations.
Centredness	Degree to which commercial and other public activities are located in downtowns and other activity centres.
Pedestrian/ Cycling Environment	Quality of walking and cycling conditions such as sidewalk presence, continuity, separation from vehicular rights of way, safe crossings, building setbacks.
Parking supply and management	Number of parking spaces per building unit or hectare. Parking management includes pricing and regulations.
Street design and management	Scale and design of streets, and how various uses are managed. Traffic calming refers to street design features intended to reduce traffic speeds and volumes.
Transit accessibility	Degree to which destinations are accessible by quality public transit.

(Source: Frank et al. 2006a: 10)

Figure 4: Urban Design Factors influencing travel behaviour and physical activity

There are a number of particular opportunities that are being missed in this area. For instance, in Australia, much of the public open space is in the form of sports ovals. Giles-Corti (2006b:3) suggests these can be improved to encourage walking by maximizing visibility (for safety) and providing interesting landscaping features and shade. She refers to a study showing that residents who lived in a highly walkable residential area walked twice the amount of time and had half as many obese residents as those who lived in an area of poor walkability.

Urban systems and nutrition

The second relationship to be explored is that of urban systems and nutrition. The food environment can include availability and accessibility to food as well as food advertising and marketing. There is particular interest in how the built environment and urban systems may influence food security and nutrition. Food security may be defined as 'the ability of individuals, households and communities to acquire appropriate and nutritious food on a regular and reliable basis, and to do so using socially acceptable means (Carter and Taylor 2007:23).

Popkin et al. (2005) suggest the environment affects diet, physical activity, and obesity. Critically, if one is to look behind the changes in diet and physical activity there are very large shifts in food production, food processing, and food distribution systems as well in food shopping and eating options. These changes result in an increase in the availability of energy-dense foods to consumers. As will be shown, a number of studies have emerged to support this view and, while such environmental influences on eating behaviour may be weak, they can influence large segments of the population on a daily basis. For instance, foods served at schools and workplaces limit the food options for everyone in those settings. And every driver and passenger, however young, sees signs for fast food outlets along the roads they travel (Booth et al. 2001:S22).

In conducting this review we have uncovered significantly more studies linking the built environment to nutrition than we expected, however the evidentiary support is more limited than that obtained for physical activity. In particular, there are very few studies demonstrating an association or causal relationship between the built environment and eating behaviours. And other than for interventions such as community gardens, there has been little research testing built environment interventions for nutrition. More research and evaluation of such initiatives is a pressing need.

A useful model of the changes in food policy is provided by Lang et al. (2001:540-541) who contend that analysis of the food system has 'tended to be partial, narrowly confined to particular policy areas (agriculture or health, environment or industry, trade or development), or specific disciplines (agricultural economics, nutrition, environmental science, medicine, geography, etc.)'. They suggest that in order to address food policy it is necessary to produce an integrated, long-term strategy that links both the social and the environmental dimensions. Table 3 compares some of the features of what Lang et al. call the 'production-oriented' model with those of the new 'ecological health model'. They highlight a number of aspects relevant to the built environment, including a focus on the whole production, distribution and retail system, building environmental policy into food practices, shortening food supply chains, and supporting new forms of bioregionalism.

Table 3: Features of models of health policy

Key policy Feature, by area	***"Old" productionist model***	***"New" ecological health model***
Economic policy	Increase production and supply by application of science and capital. Consumers have right to choose	Reducing inequality by state action provides health safety net. Citizenship requires both skills and protection
Health policy	Health stems from prosperity, availability and some equity of distribution; rising prosperity makes health services affordable.	Population approach; ill health stems from entire supply chain; degenerative diseases suggest how food is grown and delivered is important.
Environment policy	Should not dislocate market forces; long supply chain; global reach for affluent consumers.	Has to be built into food practices; short supply chains where possible; bioregionalism for all?
Social policy	Family responsibility; plus welfare safety net.	Population approach; the state applies correctives to imbalances between individual and social forces.
Morality	Individuals should be responsible for food within market rules.	Societal responsibility should be based on citizenship.
Price policy	Cheapness of food may externalize costs	It is false accounting if costs are externalized to other budget headings; costs should be internalized where possible.
Policy Coordination	Primacy of economics; fragmented specialist decision making.	Social goals as significant as other policy goals; new mechanisms for integration.

Source: Lang et al. (2001: 541)

Production

Mechanised and corporatised farming have altered the way in which food is grown and supplied, with specialization leaving many areas less diverse in the range of food produced. However, where good quality agricultural land is protected in the regions surrounding major cities, local agriculture can continue to supply seasonal fresh produce in a timely manner. This is seen to be more resilient that systems reliant on transport from distant suppliers.

Land use planning and home purchaser preferences have altered the size and availability of home gardens in recent years in Australia (Hall 2007). Whereas previous generations of Australian city-dwellers obtained a significant proportion of their food needs from domestic production (Troy 1995) as economic and food systems have changed, the need for gardens has declined and opportunities for future generations to rely on this reliable source of food for their families is being eroded from the landscape.

Community gardens have been used to nurture and promote both domestic and communal production as 'a solution to the needs of people in increasingly dense cities' (Stocker and Barnett 1998:180). Community gardens will be discussed in greater length in discussing interventions within the built environment, below.

Processing

The food industry has transformed in recent decades with the elaborate transformation of food, new forms of packaging, advanced storage techniques and global distribution systems. These changing food systems provide both risks and opportunities for nutrition. Most concern appears to be about the proliferation of highly processed, energy-dense foodstuffs, high in sugar and fat, filling supermarkets and other food outlets (Webb and King 2007). In Australia the consumption of fresh fruit and vegetables has declined and the consumption of processed foods has increased. Many adults do not achieve the recommended two serves of fruit and five serves of vegetables per day (Carter and Taylor 2007).

Distribution

As transport costs, per unit, have tended to fall in recent decades, food now travels further and further to reach urban populations than ever before. The northern hemisphere supplies 'summer' fruit to Australian populations in our winter. The logistics chains of major supermarkets see food that may be grown locally shipped interstate for processing and packing before being shipped back to the region of its origin. When linked with the increasing specialization of farming particular crops in vulnerable locations of Australia, this production and distribution system is seen as potentially vulnerable to failure, as with the destruction of much of the nation's banana crop in Northern Queensland in early 2006.

Transport costs remain a problem though, especially where delivering small quantities of a range of fresh fruit and vegetables may be beyond the reach of some communities, such as in some rural and remote locations.

Healthy food accessibility

Good access from a person's home to healthy food options is often viewed as a necessary component of a supportive environment for good health. Convenience stores and fast food outlets may outnumber grocery stores where people can purchase nutritious food (Perdue, Stone and Gostin 2003:1391). Liu et al (2007) explored this issue to determine whether a child's place of residence and the proximity of that residence to various types of food retail influenced overweight and obesity. They found that increased distance between a subject's residence and the nearest large brand name supermarkets (which provide for a range of food options including fresh fruit and vegetables) was associated with increased risk of overweight, but only for subjects residing in lower population density regions. Importantly, fruit and vegetable intake is positively associated with proximity to supermarkets, even after controlling for other socioeconomic factors (Morland et al. 2002).

There are particular issues for residents who are disabled, elderly, without transport and who are nutritionally vulnerable. For such individuals the provision of home-delivered groceries and fruit and vegetables is an invaluable service (Webb and King 2007:13)

Fast food accessibility

Related to the issue of healthy food accessibility is the issue of increased access to unhealthy food options, particularly fast food. Cummins and McIntyre (2006) describe two food access pathways in relation to the food environment: food for home consumption from supermarkets and grocery shops and ready-made food for home and out-of-home consumption from restaurants and take-aways. The latter is mainly fast food in many urban areas, consumption of which has increased 500% since 1970 in the US (Hirschhorn 2005:213). Fast food has been directly implicated in the obesity epidemic given its high energy density and otherwise low nutritional content (Prentice and Jebb 2003).

Health researchers have focused on variations in the density of fast food outlets across urban areas to see whether the built environment appears to play a role. Reidpath et al. (2002) looked at the relationship between an area measure of socioeconomic status (SES) and the density of fast-food outlets, finding an association with people living in areas from the poorest SES category having 2.5 times the exposure to outlets as those people in the wealthiest category. Maddock (2004) used the state-level data for the US to investigate this issue. His results suggest that whilst ethnicity, age, gender, physical activity, and fruit and vegetable intake explained approximately 55% of the variance in obesity by state, the addition of density of fast food restaurants and residents per fast food restaurant increased the variance explained to 69%. Cummins et al. (2005:308) found that the greater the level of neighbourhood deprivation in Scotland and England, the more likely more likely the neighbourhoods were exposed to McDonald's restaurants, with the suggestion that this 'may provide support for environmental explanations for the higher prevalence of obesity in poor neighborhoods.' However, similar research conducted in Glasgow found nil association between neighbourhood level deprivation and access to take-away outlets (Macintyre et al. 2005).

Food advertising

The marketing of energy-dense confectionary, fast food and other unhealthy food choices is now a major feature of the urban landscape. The proliferation of billboards, illuminated signs, corporate livery on transport vehicles, retail signage, transit stop signage, on-board advertising on public transport, vending machines, to name just a few, ensure the built environment consistently provides urban populations with marketing messages, numerous times a day . And signage has grown not just in volume, but also in size. Signs previously designed at smaller human scales are now designed at what Prof Jan Gehl calls the '60 km/h design speed' (Gehl 1987) with the illuminated signs of fast food outlets on urban arterials rising to enormous proportions in the 1970s and 80s.

Domestic and commercial space

Land use planning, the actions of land developers and consumer demands are also important determinants of whether space is made available for food preparation and breastfeeding in both private and public spheres. Housing design determines whether the storage space, kitchen facilities and equipment needed to prepare food are adequate. Commercial design determines whether office workers and others have space for the preparation and consumption of meals. And the design of commercial and public facilities determines whether there is appropriate space for women to breastfeed their babies (Webb and King 2007:12).

Alcohol

Urban communities often bear the costs of alcohol misuse, whilst alcohol tax revenues tend to go to national governments (Room 1990:1395). Rabow and Watts (1983) showed that the presence of neighbourhood liquor stores increases alcohol consumption and its associated impacts on health. This finding in part led to the 'distribution of consumption of model' which may be summarized as 'a causal model whereby the availability of alcoholic beverages has a direct causal effect on the aggregate level of alcohol consumption in the population and, in turn, an indirect effect on the incidence and prevalence of alcohol-related damage (Rush, Gliksman and Brook 1986). The model has major implications given that as Webb and King (2007:13) note, in at least one area in Sydney there is a high density of liquor shops but no supermarket. Alcohol is also one of the dominant advertisers in all forms of media. Interventions to limit cigarette advertising have proliferated across most jurisdictions in recent decades, including bans on advertising of tobacco products in the built environment. Restrictions on the advertising of alcohol are less common.

Social capital, the built environment and health

The third relationship we wish to discuss at length is an issue only receiving attention in recent years, and relates to the concept of social capital and its relationship to health. Social capital refers to the set of connections within and between people's social networks. It is important as it enables individuals to function co-operatively in society for mutual benefit (Lochner, Kawachi and Kennedy 1999:260). Researchers are uncovering growing evidence of the importance of social capital in decreasing the risk of social isolation, a known determinant of health that increases the risk of premature mortality, cardiovascular disease and mental health problems (Berkman and Syme 1994; Yen and Kaplan 1999). An Australian expert group in reviewing the available research noted 'there is strong and consistent evidence of an independent causal association between depression, social isolation and lack of quality social support and the causes and prognosis of chronic heart disease' and that the 'increased risk contributed by these psychosocial factors is of similar order to the more conventional (heart disease) risk factors such as smoking, dyslipidaemia and hypertension' (Bunker et al. 2003). In addition, social capital is also linked to crime reduction, economic development and improved democracy (Putnam 2000).

High levels of automobile use have been associated with low levels of social capital (Leyden 2003) and there is growing interest in the positive impacts of cycling on the development of social capital. Some research has suggested there are higher levels of social capital in more walking- and cycling-friendly neighbourhoods (Leyden 2003; Wood et al. 2008). Although a new field of research, it appears that well-designed neighbourhoods not only encourage more walking and more cycling, but also allow for more interactions between neighbours, increasing the sense of community in residents, with positive mental and physical health benefits (Giles-Corti 2006a).

Further, 'wellbeing is not spread evenly through Australia's human settlements' and there are concentrations of welfare recipients residing in locations were housing is affordable, but where work is scarce (Beeton et al. 2006:15). A key finding of the recent *2020 Summit* in Canberra was that 'one of the principal determinants of community strength is the adequacy of social infrastructure in local communities' (Davis 2008:23). The Summit recommended 'the development of an urban design strategy for all towns and cities' to encourage social connectedness. It also supported strategies to develop local community capacity through skills development, mentoring and leadership to work more collaboratively with the public and private sectors (Davis 2008:23-24).

Interventions for supportive environments

State and National Governments are engaged in a number of interventions that seek to modify the built environment to create supportive environments for health. Indeed, there are seemingly countless examples of policies, plans, programs and initiatives that seek to modify the environment for active transport, incidental physical activity and nutrition. This review cannot do more than provide a broad overview and highlight key examples of successful initiatives.

We suggest the most important sets of interventions can broadly be classified as focused on:

- Transportation and active transport
- Land use planning
- Nutrition

Active transport

Given the evidence base supporting interventions on walking and cycling for recreation and exercise, and for active transport, and the built environment, it is not surprising this is a key area of activity.

There is no doubt the Europeans are world leaders in transport policy and planning to support non-motorised travel. Key examples include the EU's ADONIS project (European Commission. Directorate-General VII 1998), which explored the activities of governments in Amsterdam, Barcelona, Brussels and Copenhagen, developing guidance on how to provide encourage walking and cycling. This work showed the importance of setting up an integrated plan and a holistic framework for non-motorised transport, rather than ad hoc measures, which have limited effects. Cities across Europe have embraced these approaches, with Pucher's research (Pucher and Dijkstra 2003; Pucher et al. 2007) showing how countries such as Germany and the Netherlands have used a number of design approaches and systematic policy interventions to make active transport a key component of their urban transportation.

Internationally the basis of improving conditions for walking and cycling appears to revolve around policy, planning and provision of infrastructure. Whilst state and national policies for cycling are common, there are less available for pedestrians (in this review examples were found for states in the US such as Wisconsin and Florida, but they were more common at local government level).

National networks, such as the UK's National Cycle Network, have been the focus of attention. According to Sustrans (2007), the National Cycle Network now passes within one mile of half the UK's population and over 338 million trips were made on the Network in 2006 alone. For active transport, European examples demonstrate the maxim 'Build it and They Will Come' holds true.

Key active transport initiatives include:

- Policy coordination and integration, especially policy for walking and cycling embedded into key transport and planning agencies;
- Infrastructure programs
  - Routes and networks, Trails
  - End of trip facilities
  - Other ancillary facilities
- Integration with public transport
- Safety programs
  - Awareness and promotion,
  - Driver training
- Promotion and encouragement
  - Schools, workplace initiatives (i.e. walk to school day)
  - Behaviour change programs (i.e. TravelSmart)

For cycling, other specific initiatives include:

- *Bikeability Checklists*; facilitating audits of the built environment for bicycle use;
- *Copenhagen 'city bikes'*, a program offering free bicycle hire at pick up and drop-off points across the inner-city, now running in other European cities such as Paris, and currently being proposed by Brisbane City Council;
- *Bicycle stations*, which take end of trip facilities to another level, the first Australian example has opened at King George Square in Brisbane (*Cycle2City*, see www.cycle2city.com.au);

- Carriage policies for bicycles on public transport;
- Bike racks on public transport;
- *Bicycle Trains to School*, which provides a similar offer to walking school buses (below);
- *Cyclovia*, a promotion event that shuts down streets for non-motorised modes only, pioneered in Bogota, Colombia, and trialled recently in Preston, Melbourne.

For pedestrians, other specific initiatives include:

- *Walkability checklists*, facilitating audits of the built environment for pedestrians;
- *Way-finding strategies*, which are seen as offering a significant improvement to the pedestrian environment in town centres, and to which much attention is being given
- *Walking school buses*, used widely in schools programs to provide for chaperoned walking to school;
- *Walking challenges*, which are now available in a number of forms. i.e. *10,000 steps* – a whole community approach to encouraging walking. *10,000 steps Rockhampton* is the most widely known intervention in Queensland.

Other initiatives in the transport sector supportive of active transport include:

- Public transport improvements, including ticketing, network planning, information provision and promotion, as well as service improvements such as
  - No-timetable frequent routes in areas of highest demand
  - Demand responsive services in areas of low demand
  - Special events ticketing
  - Night-time or 24 hour service-provision
- *Travelsmart*, a program of travel planning and behaviour change initiatives used across most Australian metropolitan areas to encourage changes in travel behaviour within schools, workplaces and neighbourhoods, and which includes Individualised Marketing programs and the resource kits made available to schools, universities and workplaces;
- Reduced speed limits in urban areas;
- Travel demand management policy measures, such as,
  - London, Singapore and Stockholm's congestion charging schemes, which free up roadspace for cyclists and pedestrians;
  - Distance-based car registration and insurance;
  - Public transport priority measures;
  - Car parking policy (restrictions on capacity, parking levies, etc.)
  - Car share clubs
- Street design initiatives such as 'Shared Streets' programs;
- Crime Prevention Through Environment Design (CPTED) initiatives;
- Programs to assist local government and community transport initiatives.

At a Commonwealth level Australia has lagged behind in support for walking and cycling. The only major initiative in the area funded under the Howard Government was the *Travelsmart - National Travel Behaviour Change Project*, in collaboration with South Australia, Victoria, Queensland, Western Australia and the ACT, with no money otherwise made available for walking, cycling or public transport projects. State governments have been more pro-active, and in some areas Queensland is seen as a leader.

As with most states, Queensland has adopted some of the above approaches with the release of a State Cycle Strategy, an Action Plan for Pedestrians, the development of a Principle Cycle Network Plan for South East Queensland, and the creation of bicycle and pedestrian policy and project positions within the transport agencies and in local governments (i.e. Queensland

Transport 2003, 2004, 2005). Guidance for local authorities on walking and cycle provision is an on-going activity, with the publication of the *Cycle Notes* and *Easy Steps* series.

Though Queensland has invested moderately in public transport, and has vastly improved public transport planning and management in recent years, there has been little movement towards car restraint or travel demand management measures, despite the release of a Green Paper on the issue in 2005 (Queensland Transport 2005).

Land Use Planning

Given the evidence base regarding urban form, urban structure and travel behaviour, in particular, a number of interventions have been used by State and National Governments to transform land use planning and practice.

Significant attention has been given to changing the way in which new urban development is designed. A suite of design movements, including New Urbanism and neo-traditional development (Fulton 1996; Katz 1994) and transit-oriented development (TOD) (Dittmar, Belzer and Autler 2004) have emerged in recent decades as a response. New Urbanism looks to creating more connected, mixed use and higher density neighbourhoods, more akin to those created in the pre-automobile era. TOD seeks to create 'transit precincts' by clustering urban development around public transport nodes. What is common to these approaches is that both seek to reduce the distances people must walk from home to access the public transport network, as well as local shopping and services. Specific changes sought in land use planning generally include:

- Increase urban densities
- Clustering of development in centres
- Clustering of development at transport nodes
- Street connectivity
- Land use mixing
- Traffic calming
- Pedestrian oriented urban design

Aside from transport and physical activity issues, there is also an interest in the role of land use planning in supporting nutrition.

- Providing for private and public open space with access rights for food production activities
- Provision for spaces for breastfeeding in commercial and public facilities
- Provision of spaces and preservation of use rights for local production within cities and in peri-urban locations
- Protection of regional good quality agricultural lands (GQAL)

The means to achieve these changes is debated, but authorities have used many of the following:

- integrating and coordinating policy
- guidance to local authorities,
- planning policies,
- planning and design codes,
- rating schemes for new development
- demonstration projects, often in conjunction with state-owned land developers
- including land use planning within 'healthy' or 'sustainable' cities initiatives

Key initiatives include:

- Integrating and coordinating policy
- *Building, planning and design codes*, which seek to provide for modifications to new urban developments;
- Rating schemes, to stimulate best-practice approaches by land use developers;

Design codes

Model codes for inclusion in land use planning ordinances have been trialled as a means to facilitate modifications to new urban development. Where mandated under state planning policies, these codes can significantly influence future development across an entire jurisdiction.

- *Healthy by Design: a planners' guide to environments for active living resource* (National Heart Foundation of Australia. 2004) was developed by the Victorian division of the Heart Foundation to provide voluntary guidance for planners and developers.

- *Liveable Neighbourhoods* (Western Australian Planning Commission 2000, 2004) is a design code introduced in Western Australia to guide the design and approval of urban development. Liveable Neighbourhoods applies to structure planning and subdivision for greenfield sites and for the redevelopment of large brownfield and urban infill sites. Including specific guidance in the form of planning code and standards, these are considered to apply New Urbanist design principles to Australian urban development. The WA Government piloted these design guidelines at a number of developments before moving to legislate for their use. WA is seen as being at the forefront nationally on this issue.

Rating schemes

An alternative approach has been the introduction of rating schemes by state or national governments to encourage the development industry to strive for best-practice. The majority of these schemes have generally focused on environmental sustainability questions, deriving as they have historically from rating schemes for individual dwellings (Burke and Brown 2005). Only recently have health issues such as provision for walking and cycling begun to play a larger role in these schemes.

- In the US the *LEED for Neighborhood Developments Rating System* (US Green Building Council 2005) includes various measures designed to encourage active living, particularly in terms of walking and cycling.
- In Australia, *Enviro-Development* (Urban Development Institute of Australia 2005) is the equivalent rating scheme, now operational, which includes only a few summary measures applicable to active living.

Nutrition

Though less attention has been given to issues of nutrition within the built environment, our review has found a growing interest from governments and a number of often recent interventions that suggest this is an emerging area in health promotion practice. As noted earlier though, there has been less review and evaluation of built environment interventions for nutrition, and some caution should be exercised in that many of the interventions discussed in this section, particularly in land use planning, have yet to be meaningfully evaluated.

Interventions for food production

Much attention has been given to the issue of production, whether this be within the urban environment, or in peri-urban locations or in the regions surrounding cities. State and National government interventions reviewed include:

- Land use planning interventions
    - private open space provisions in dwelling approvals
    - provision of spaces for production
    - protection of local GQAL
    - fast food
    - food signage and outdoor advertising
- Community gardens
- Food co-operatives and community-supported agriculture
- Horticultural training
- Edible landscapes

Urban agriculture can be a major component in creating a green city environment. The provision of space for domestic, communal and commercial production within the city itself, and in peri-urban locations can also reduce food insecurity. The preservation of GQAL is now a standard feature of regional plans, including most Australian metropolitan strategies, such as the SEQ Regional Plan (Office of Urban Management (Qld Government) 2005).

There have been a small number of land use planning interventions seeking to halt the development of fast food outlets via urban planning. However, the use of planning instruments to control fast food outlets remains rare, despite the call from various health bodies for such interventions. Ashe et al. (2003:1407) suggests the following options:

- Requiring fast food outlets to locate a minimum distance from youth-oriented facilities such as schools and playgrounds
- Limiting the total number or per capita number of fast food outlets in a community
- Limiting the proximity of all fast food outlets to each other
- Charging fees to fast food outlets and using the proceeds to mitigate the impact of poor nutritional content (e.g., construct parks, fund after-school programs, or provide nutrition education)
- Prohibiting drive-through service

A related issue is restriction on advertising and outdoor signage, which is a major element in the business operations of multinational fast food chains. Land use planning can prohibit or modify the location, size and illumination of signage.

Community Gardens can act as change agents for sustainability by providing residents with fresh, often organic foods, by supporting social capital development, and also by supporting research and development for horticultural techniques and in communicating these to urban populations (Stocker and Barnett 1998). Australian cities have numerous examples of long-running successful community gardens in a variety of contexts (see http://www.communityfoods.org.au/) such as the Centre for Education and Research in Environmental Strategies (CERES) in Melbourne, and the Northey Street City Farm in Brisbane. There is significant interest emerging in community gardens in Australia thanks to promotion on key media, such as regular spots on the ABC's *Gardening Australia* television series and in *Organic Gardening* magazine.

Though not common in Australian cities, edible landscapes are a common feature of many developed nations, where street trees and other public plantings include productive species in

order to provide food to urban populations. For instance in many Sri Lankan cities jackfruit is regularly used as a street tree, creating 'urban orchards'.

Horticultural training is often supported by the State to ensure skills development and capacity in the sector. Formal training provision enables people to grow their own food or to work in the horticultural field, but at costs to participants. Informal training and involvement in community gardens can disseminate knowledge to many in the community who are either unwilling or unable to access or afford formal training.

The use of regional and local planning instruments to preserve opportunities for agricultural production proximate to cities has not been strong in Australia, in comparison to Europe where the division between urban and rural is often more markedly pronounced. Given the rise of regional planning instruments (statutory plans) in many Australian metropolitan regions, there may be more scope for the inclusion and coordination of policies to promote nutrition.

In Queensland, there may be a need to coordinate the activities of the State government for nutrition across the State, via a number of measures, such as via a State Planning Policy (SPP) to cover most land use planning issues for nutrition under Queensland's Integrated Planning and Development Assessment Framework (IDAS) (see Pretorius 2008:iv).

Other interventions

There are a range of other programs, policies and initiatives being used to influence nutrition that involve the built environment. These include:

- Policy coordination and integration
    - Setting up food agencies
    - Promoting food policy councils in local government
    - Including nutrition in 'healthy cities' projects
- Planning policy for food retail
- Food banks
- Home deliveries
    - groceries
    - fruit and vegetables
- Programs that influence the pricing, labelling and promotion of healthier food choices in food services, in food retail and in vending machines.
- Breastfeeding policies
- Behaviour change programs
    - schools programs
    - workplace programs
    - etc.
- Alcohol policy and programs

Policy coordination and integration happens in a number of ways, but specific interventions are being used to bolster the role of nutrition in the actions of both local and state governments. Pothukuchi and Kaufman (1999:218) suggest that what's really needed is a focal point at the local level for looking at the urban food system. One option to achieve this is establishing a Food Agency within government, to focus attention on nutrition issues and support local actions. i.e. The UK abolished the Ministry of Agriculture, Fisheries and Food, and replaced it with a Department of the Environment, Food and Rural Affairs, whilst the Blair government committed to setting up an Independent Commission into food and farming (Lang et al. 2001:554). A food agency could support multiple functions associated with outreach and

community education, regulation, capital programming, and food related services development and administration, and also research (Pothukuchi and Kaufman 1999:219).

Another option is the use of food policy councils and other local food policy coalitions, which provide an advisory service to government. Widespread in local governments in North America, these have been adapted for use in the Australian context. An example is the Penrith Food Policy Committee in NSW (Webb et al. 1998). Food policy councils exist to influence local food system policy development.

Planning policy for food retail is a key area of interest, as governments seek to plan for the provision of retailers who can offer easy access to healthy food options for all parts of the urban population. The options are many and Webb and King (2007:13) suggest that:

> The solutions to these problems vary … . Siting and zoning policies can be modified; councils can negotiate with retailers for intermediate-size markets (with supermarket prices) until the area can sustain a larger supermarket; and mixed land use planning can encourage the co-location of business parks (which could house supermarkets) and housing estates, to avoid concentrating business and industry in separate areas. Public–private partnerships to subsidise the initial establishment of supermarkets in underserved areas have worked well in North American projects, where the problems with supermarket access are similar to those in Australia.

Many low income households depend on emergency sources of food available from food banks and related charitable services, that are mostly invisible to middle and upper income residents (Pothukuchi and Kaufman 1999). Food banks have proliferated in Australia, North America and Europe due to the retreat of the state from welfare provision and problems of food insecurity and inequality. Clearing houses for the distribution of donated and surplus food, these institutions have become secondary extensions of weakened social safety nets. There is significant debate about the effectiveness of food banking as a strategy to ameliorate food poverty (see Riches 2002).

Policy and support for home deliveries is provided in a number of ways, including subsidy and support to 'Meals on Wheels' services through to support and promotion of home delivery services offered by major supermarket retailers.

Behaviour change programs are perhaps the most common intervention, particularly in Australia where each state employs variations of school, workplace and community level interventions. Examples include:

- The Queensland Government's *Eat Well be Active* campaign, with its Smart Choices schools program.
- *Healthy Eating by Design* , a program that seeks to increase access to healthy foods for children in low income communities and schools in the US, supported by the Robert Wood Johnson Foundation. Using community-based pilot projects, this program is testing approaches to providing affordable, healthy and appealing food options in urban areas.

Alcohol policies and control systems are already in use in almost all jurisdictions in developed countries, particularly through liquor licensing and control. Some regimes are notably 'tougher' than others, such as Sweden, whilst others are more liberal, like the UK, with differences in drinking behaviours across cultures. In Australian cities different approaches are in use, with reviews of liquor legislation recently conducted in both NSW and Queensland. A range interventions for alcohol control suggested by Holder (2001), many of which are in use in Queensland, include:

- restrictions on the production, distribution, and retail sale of alcohol
- limits on hours and days of sale
- limits on advertising
- drinking and driving enforcement by police
- policy and training for responsible alcoholic beverage service
- community prevention programs
    - responsible consumption campaigns
    - youth education activities
    - alcohol-free youth activities
- land use planning
    - local limits on the number of outlets in certain areas of the community (or the entire community)
    - distances between outlets
    - distances of outlets from schools, churches, and other specified locations
    - limits on floor or shelf space

Successful governments?

In reviewing the experience of cities abroad, we suggest that State and National Governments in Europe, North America and Australia, can broadly be segregated into three groups:

- those who have consistently supported active transport, incidental physical activity, and nutrition (whether deliberately or not), which are mainly in Northern Europe (i.e. see Pucher and Dijkstra 2000, 2003);
- those whose plans and policies since WWII have been problematic for active transport, physical activity and nutrition, but who have started making some changes in recent years, which includes most Australian states; and,
- some particularly laggard jurisdictions where little movement has been made on any front, which includes some US states.

In Australia, most states have now commenced initiatives targeting improvements for active transport, more directly for cycling, but also indirectly for walking. Bicycle strategies and key regional cycle planning initiatives for major metropolitan regions. Land use design changes are promoted, TravelSmart and other behaviour change programs are supported, and there are some initiatives that go beyond pedestrian safety issues emanating from the bureaucracies.

However the lack of attention given to walking, by far the most important of all transport modes for health purposes given the numbers of persons involved, is problematic. In Queensland the Action Plan for Pedestrians and projects such as *Easy Steps* places us slightly ahead of some other Australian states, though not nearly as advanced as comparator cities in Europe.

As for nutrition, it appears that most jurisdictions have only recently commenced on interventions to support nutrition, especially those that are outside the marketing and promotion of fresh fruit and vegetables.

We wish to highlight a few exemplar jurisdictions that are at the forefront on these issues:

Singapore

An island city-state, Singapore has been at the forefront in using its legislative, policy and planning mechanisms to reduce car use and to encourage walking and public transport use. With

heavy investment in mass rapid transit, bus priority and integration and coordination, the public transport on offer is recognized widely as world-class. Use of the car is discouraged with a combination of restrictions, taxes and vehicle purchase charges, road use charges and parking charges. The city's development has been highly ordered in clusters around mass rapid transit nodes, giving most of the population easy access to local shopping, services and public transport (Newman and Kenworthy 1999:192-194). Important greenspace has been retained to support both organized and informal physical activity. Catchments for water and land for limited local food production have both been retained within the city to provide security to the population.

Having some features of an authoritarian regime, the Singapore Government has been able to use the taxation system, fiscal instruments, its housing and transport investments and other organs of the state to achieve the transport and land use arrangements now evident on the island. However, the urban densities and car restraint measures used in Singapore are generally considered beyond what most Australians would accept (Newman and Kenworthy 1999:193). But Singapore does show that where governments are willing to use the measures available to them, significant change is possible.

British Columbia

The government of British Columbia, in conjunction with local governments, has overseen the development of Vancouver into a success story for active transport and incidental physical activity. Rejecting freeway-based urban development in the 1960s, the Canadian city opted instead for a vision of pedestrian and transit-oriented neighbourhood development. Key measures employed included restrictions on freeway construction, targeted medium- to high-density development throughout much of the region through land use planning initiatives, investment in the Skytrain rail system, and activities to provide for good-quality pedestrian and cycling environments throughout much of the Vancouver city area (Newman and Kenworthy 1999:217-219). A critical element in the success of the city appears to have been regional planning (only recently employed in SEQ) though not always with robust mechanisms to achieve the planning objectives. This regional planning provided for the preservation of 'green zones' outside the urban boundary, including agricultural lands (Newman and Kenworthy 1999:222).

Vancouver has also been the site of significant urban developments pioneering concepts that promote active transport, physical activity and nutrition, using 'ecological design'. Encouraged in part by state authorities, the Jericho Hill Village development used ecological design in order to maximize solar energy, local food production (60% of the community's food needs), walking, cycling and public transport, as well as reducing waste- and storm-water discharge (Paterson and Connery 1997).

The result is a much higher mode share for walking, cycling and public transport than is found in Brisbane (UITP 2001) and a city that is well-regarded for providing a supportive environment for a healthy population.

Cuba

Although a command economy, the experience of Cuba in the period following the collapse of its former patron, the Soviet Union, demonstrates what is possible with intensive government focus on supporting urban agriculture and nutrition.

Though it is beyond the scope of this review to provide a detailed summary of the Cuban experience (for further information see Altieri et al. 1999; Hugh 2001; Koont 2004). A synopsis is that following the collapse of the Socialist Bloc in 1989 the country was plunged into an oil supply, fertilizer supply and food crisis. Partly through government interventions from the Department of Urban Agriculture (created in 1994) and a National Urban Agriculture Group, support was given to a grassroots movement that opened up urban landscapes for production.

Urban agriculture rapidly became a significant source of fresh produce for the urban population. A large number of urban gardens in major cities helped stabilize the supply of fresh produce such that by 1996 Havana's urban farms provided the city with '8,500 tons of agricultural produce, …, 7.5 million eggs, and 3,650 tons of meat' (Altieri et al. 1999:131).

Key aspects of the Cuban experience are the establishment of government structures to support policy development and implementation, support of grassroots organizations, emphasis on recycling and use of local resources, skills development, and investment in research & development. The results are high yields of mainly organic produce with minimal reliance on petroleum and petroleum derivatives, synthetic chemical pesticides and fertilizers, in the face of significant food insecurity. The Cuban story is now being looked to by urban and agricultural researchers concerned about the possible impacts of Peak Oil (Altieri et al. 1999; Newman 2007).

Though the economic and institutional context differs greatly in Australia, the Cuban example also illustrates the possibilities should either the need or the desire arise to give significant policy and program support to local nutrition issues.

Conclusions and ways forward

The evidence reviewed confirms physical activity and nutrition as significant risk factors for human populations. The built environment is clearly implicated in influencing physical activity, and there is emerging evidence of associations with nutrition. The links are not always obvious or transparent, and there is considerable uncertainty as to causality. The influence of specific environmental factors is often in dispute, primarily due to the difficulties in operationalising research in real-world urban environments whilst controlling for other factors. However, the evidence accumulated quickly in the last twenty years suggests that with continued attention from health, built environment, transport and other research fields, further significant advances may be expected in the coming decades. This is a rapidly moving field.

Active transport and incidental physical activity are opportunities to embed physical activity into the daily lives of urban populations. The supportive environments agenda has incorporated these aspects readily, with attention to urban design, transport planning, behavior-change and other interventions seeking to alter the built environment to provide choices and encourage walking and cycling.

Nutrition is less advanced, and in the past was almost invisible within the supportive environments movement. We suggest this is partly due to the poor evidence base for the influence of the built environment on nutrition. The attention being given to specific interventions, such as community gardens, at the expense or exclusion of others, suggests a holistic agenda is yet to emerge. We hope that the list of interventions provided across food production, distribution, retailing and promotion may help those seeking to build nutrition into supportive environments policies and programs.

Other jurisdictions point to ways forward though there are no simple solutions, particular in Western democracies. In practical terms, there are few guidelines to local authorities or others with responsibility for the built environment to create supportive environments. Or at least, there are few at sufficient levels of detail to meaningfully engage across all areas of physical activity and nutrition.

There also remain key research gaps. The most pressing is enquiry into the effectiveness of interventions in the built environment targeting nutrition. More is clearly need to justify and improve the efficacy of such interventions. Yet a quandary exists for restrictive policies, such as

limiting densities of fast food outlets. Though these offer much in theory, they are yet to be fully tested, especially in the Australian context. Trials of such policies are needed to determine their worth. Yet the lack of evidence hinders their take-up.

That said, there are also many areas in physical activity where the research base is also deficient. The influence of many specific interventions is not known, partly due to the lack of meaningful evaluations. Health impacts of many projects are not assessed, either routinely or even on an ad hoc basis, especially transport and urban projects. For instance, what are the health impacts of Copenhagen-style bicycle hire schemes? Or cycle centres? Or Main Street redevelopments using shared streets principles? Are they worth prioritizing for health improvement? The lack of systematic evaluations underpinning initiatives such as Walk Bendigo (a major shared streets redevelopment) is a major opportunity lost. At present such evaluations are difficult, given there are few useful frameworks and datasets on hand to readily conduct small-scale health impact assessments. Such guidance would be a considerable step forward. The authors hope to play a role in furthering this research agenda.

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