



Healthy urban environments for children and young people: A systematic review of intervention studies

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ABSTRACT

This systematic review collates, and presents as a narrative synthesis, evidence from interventions which included changes to the urban environment and reported at least one health behaviour or outcome for children and young people. Following a comprehensive search of six databases, 33 primary studies relating to 27 urban environment interventions were included. The majority of interventions related to active travel. Others included park and playground renovations, road traffic safety, and multi-component community-based initiatives. Public health evidence for effectiveness of such interventions is often weak because study designs tend to be opportunistic, non-randomised, use subjective outcome measures, and do not incorporate follow-up of study participants. However, there is some evidence of potential health benefits to children and young people from urban environment interventions relating to road safety and active travel, with evidence of promise for a multi-component obesity prevention initiative. Future research requires more robust study designs incorporating objective outcome measures.

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1. Introduction

Both globally and nationally, there has been increasing recognition of a need for action in building 'healthy communities' (Centers for Disease Control and Prevention, 2011; Edwards and Tsouros, 2006; National Institute for Health and Care Excellence, 2008; The Royal Town Planning Institute, 2009). Policy makers, urban planners and practitioners have a significant role in implementing and influencing policies to shape the urban environment in ways which enable people to live healthier lives. Historically, urban planning has focused on improving system efficiency or reducing environmental impacts (Handy et al., 2002). However, in more recent years there has been a focus on linking characteristics of the built environment with health behaviours and outcomes of the population.

There are increasing concerns that current 'lifestyles' in high income countries, particularly poor quality diet and sedentary behaviour, lead to chronic illnesses and health disparities which are socially and geographically patterned. Children can be particularly vulnerable as they have few opportunities to choose or change their environment. Systematic review evidence derived from cross-sectional or longitudinal studies have identified components of the built environment associated with physical

inactivity (Sallis and Glanz, 2006), active travel (Pont et al., 2009), dietary intake (Sallis and Glanz, 2006), obesity (Dunton et al., 2009; Galvez et al., 2010), and mental health (Clark et al., 2007; Sinha and Rosenberg, 2013) in children and young people. Lack of sidewalks, distance to school or public open spaces, and density and availability of food sources are correlated with poorer physical health behaviours and outcomes (Dunton et al., 2009; Galvez et al., 2010; Pont et al., 2009; Sallis and Glanz, 2006). Worse mental health outcomes are associated with exposure to violence or crime in the neighbourhood (Clark et al., 2007; Sinha and Rosenberg, 2013). Although adaption of the built environment to overcome these factors may have the potential to improve health, robust intervention studies are required to provide evidence of a causal relationship and effectiveness.

A Cochrane review of built environment interventions for increasing physical activity in children and adults is yet to be published (Tully et al., 2013). However, in the protocol the authors argue that much of the previous evidence has been from cross-sectional studies which demonstrate inconsistent associations between features of the built environment and physical activity, do not demonstrate a causal relationship and do not control for confounders such as more active people choosing to live in neighbourhoods that support physical activity.

In a recent systematic review of the impact of interventions to promote physical activity in green space (Hunter et al., 2015) the authors argue, given the significant investment by local authorities in maintaining and improving urban green spaces, there is a need to identify if investments are effective in increasing the use of such

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spaces and whether there are public health benefits. Some evidence supported the use of built environment only interventions, but more promising evidence was found for physical activity programmes combined with changes to the built environment. However, the authors urged caution in interpreting the results because of the paucity of intervention-based research in this area. Furthermore, they highlighted the dearth of evidence in relation to children and adolescents.

The aim of the current systematic review is to examine evidence from intervention studies which involved changes to the urban environment and reported outcomes in relation to health related behaviours, and the physical or mental health outcomes, of children and young people.

2. Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed throughout the design, conduct, and reporting of this systematic review (Moher et al., 2009).

2.1. Search strategy

A comprehensive search strategy to identify primary studies reporting interventions to the urban environment and the health outcomes of children and young people was developed by an experienced systematic reviewer (H.B.-F.) for the Medline database. This was refined following discussion with the second reviewer (S.A.). A combination of the following Medical Subject Heading (MeSH) terms indexed within the database, and relevant text words from previous systematic reviews, comprised the initial search strategy: 'Obesity'; 'Weight gain'; 'Weight loss'; 'Diet'; 'Dietary fats'; 'Exercise'; 'Physical activity'; 'Mental disorders'; 'Adjustment disorders'; 'Anxiety disorders'; 'Mood disorders'; 'Neurotic disorders'; 'Child'; 'Adolescent'; 'Child, preschool'; 'Infant'; 'Urban health'; 'City planning'; 'Urban renewal'; 'Environment design'; 'Public facilities'; 'Intervention studies'; 'Evaluation studies', and; 'Program evaluation' (Supplementary file 1). The indexing terms were modified to be applicable to other databases.

2.2. Data sources

The following biomedical, geographical, and transportation databases were searched from inception to 29 October 2014: Embase; Geobase; Medline; PsycINFO; Transportation Research Information Services, and; ISI Web of Science & ISI Proceedings. Searches were not restricted by date of publication. All abstracts were saved using reference manager Endnote X3.

2.3. Study selection

Intervention studies (randomised controlled trial, controlled trial, controlled before and after, before and after, interrupted time series) were eligible if they: included a change to the built environment; reported outcomes in relation to children and young people's physical or mental health and well-being, or health behaviours such as dietary intake or physical activity, or counts of active transport or park use; were undertaken in urban areas; were published in English, and; were undertaken in high-income countries using the World Bank classification (available from <http://data.worldbank.org/about/country-classifications>). Studies were excluded if they: focused on changes to the school or home environment rather than the wider public realm; were undertaken in rural areas or low- or middle-income countries, or; were not published in English. Conference abstracts, dissertations, letters,

and books were not eligible for inclusion but were checked for relevant publications. Separate publications presenting results from the same intervention were reported together.

After duplicates were removed, all records were reviewed by one reviewer (H.B.-F.) to consider their relevance for inclusion. A random 10% sample of the records was independently assessed by a second reviewer (S.A.), with 'very good' inter-rater agreement ($\kappa=0.90$) (Altman, 1991). Full text articles were retrieved and independently assessed for inclusion by two reviewers (H.B.-F. and S.A.). Disagreements were resolved by discussion. Reference lists and bibliographies from relevant primary studies, reviews, and intervention protocols were hand searched for additional primary studies not retrieved by the electronic search (H.B.-F.).

2.4. Data extraction

One reviewer (H.B.-F.) extracted and entered the following information for each study onto an excel spreadsheet: study characteristics (authors' names, publication year, location, study period, objective(s), participants, and intervention setting), and; characteristics of study design (intervention, change to urban environment, sampling strategy, data collection methods, analysis, and main findings). These were double-checked by another reviewer (S.A.) to ensure accuracy.

2.5. Quality assessment

Quality assessment allows the methodical appraisal and evaluation of primary studies and is an established feature of systematic reviews of randomised controlled trials. Due to the anticipated nature of built environment interventions, which may preclude incorporation of randomisation and blinding within the study design, we did not exclude studies on the basis of quality. Quality assessment was carried out primarily to highlight the risk of bias and the resulting uncertainty of the results reported. Eligible primary studies were appraised by one reviewer (H.B.-F.) using a validated tool for non-randomised controlled trials (Sterne et al., 2014).

3. Results

A narrative synthesis approach (Popay et al., 2006) to reporting the results was taken because of the heterogeneity of outcomes, population groups and interventions. Further, there was a lack of suitable data to calculate standardised effect sizes (Higgins and Green, 2011). Primary studies were grouped according to the main focus of the intervention and reported narratively. Included primary studies are summarised in Table 1; the study designs and main findings are shown in Table 2, and; the assessment of bias is in Table 3. Table 4 offers a simplified overview of the key results for different types of intervention with their respective overall risk of bias.

3.1. Study selection

Of 9686 records initially identified through the database searches, 7645 records were reviewed and 113 full text studies assessed for eligibility (Fig. 1). Of those full text studies excluded: 25 did not report a health behaviour or health outcome measure; 15 presented no data in relation to children or young people; 19 did not incorporate changes to the built environment; five were not intervention studies, and; two were not published in English. Fourteen systematic reviews were excluded following hand searches of reference and citation lists. A total of 33 relevant primary studies in relation to 27 separate interventions were included in

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