Cambridge Centre for Housing & Planning Research

Places for People

# Healthy Communities:
## Place-based built environment interventions to reduce health inequalities by increasing physical activity

Dr Katy Karampour
Dr Gemma Burgess

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UNIVERSITY OF CAMBRIDGE

Dr Katy Karampour and Dr Gemma Burgess
Cambridge Centre for Housing and Planning Research
Department of Land Economy
University of Cambridge
19 Silver Street
Cambridge
CB3 9EP

kk678@cam.ac.uk
glb36@cam.ac.uk

www.cchpr.landecon.cam.ac.uk

Cambridge Centre for Housing & Planning Research

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# 1. Executive summary

Health inequalities arise because of the conditions in which people are born, grow, live, work and age (PHE, 2021a). Place, or local area, has an important role to play in reducing health inequalities across the life course, as health inequalities are caused by the complex mix of environmental and social factors in a local area (PHE, 2021a, p.3). A place-based intervention is any policy, programme or action that aims to reduce health inequalities and is delivered at a local level (PHE, 2021a, McGowan et al., 2021). An ever-increasing body of research indicates that built environment interventions that are delivered at a local level (e.g., introducing cycle/walking routes and increasing green space) can improve health outcomes (PHE, 2017).

Increasing physical activity levels through built environment interventions to reduce obesity, which is one of the main risk factors for diseases that are the main contributors to lower life expectancy in deprived areas (PHE, 2021b), has gained increasing interest worldwide among public health experts and policy makers. In recent years, a broad range of built environment interventions have been implemented to increase physical activity levels, for example, by improving the public realm, promoting active modes of transport, installing outdoor exercise equipment, reconstructing playgrounds and increasing the amount of open green space (Cohen et al., 2012).

To better understand the role of the place-based built environment interventions that are intended to increase physical activity, the following report investigates the effectiveness of three types of built environment interventions and the methods that are used to evaluate them. The three selected types of built environment interventions are walking/cycling routes, outdoor gyms and playgrounds. These interventions have been chosen as they are widely used and are considered to have positive impacts on levels of physical activity.

Our desk-based literature review notes that a growing number of built environment interventions aim to promote walking and cycling as active modes of transport by implementation of a walking and/or bicycling trail (Stappers et al., 2018). The evidence suggests that walking and cycling interventions are mostly effective in increasing levels of physical activity. The scale of the intervention, the context in which the intervention has happened, proximity to the intervention, and the accompanying non-physical initiatives (e.g., media campaigns, and training) may further increase the effectiveness of the schemes. However, it may take time and additional marketing and outreach activities to increase the use and effectiveness of the improved and/or newly introduced routes. Engaging communities in identifying barriers to walking and cycling on local routes and asking them to

suggest solutions may increase the success of the intervention for increased active transportation.

The provision of outdoor gyms is increasingly seen as an important strategy to realise public health agendas that promote habitual physical activity (Lee et al., 2018). The advantages of outdoor gyms include their suitability for most adult age groups with different fitness levels, being free of charge and their capacity to influence large numbers of people to be physically active due to their accessibility within local public spaces (Jansson et al., 2019). A range of health and social benefits are associated with outdoor gym interventions. Improvements to health include increased physical activity, losing weight, and feeling fitter. In terms of social aspects, the outdoor gyms are perceived as spaces where local people can find social connectedness while participating in structured physical activity at no cost.

Playground interventions are effective in promoting physical activity and reducing sedentary time in children and adolescents. Boys and younger children seem to gain more benefits from playground interventions. Hence, interests and preferences of different age groups and genders should be considered when designing a playground. The effectiveness of playground interventions in promoting physical activity may decrease in the long term as the novelty of the playground equipment may reduce over time. Hence, renovating and upgrading the equipment may enhance the novelty of a playground for children.

The findings of this report suggest that the built environment has great potential not only to improve health outcomes but also to have wider social impacts (PHE, 2017), including building social connections and promoting social interaction. Hence, allocating substantial resources to invest in the built environment in the places most in need should be a priority (The Commission on Creating Healthy Cities, 2022). Organisations such as housing associations with long term stewardship responsibilities, like Places for People, are in a pivotal position to continually create, improve, and maintain the physical environments that support communities to be healthy. However, providing the physical infrastructure may not be sufficient on its own, and promoting the use of facilities through local programmes and media communication can support communities to make the most of the investment made in their local built environment.

# 2. Introduction

## 2.1. Background

Opportunities for physical and mental health are influenced by the circumstances in which people are born, grow, live, work, and age. These circumstances are understood as the social determinants of health (NHS et al., 2019). Creating a healthier population requires greater action on these issues, including 'addressing the role of both the physical built environment and the social factors which shape neighbourhoods and places' that we live in (ibid, p. 4).

Place, or local area, has an important role to play in reducing health inequalities as health inequalities caused by the complex mix of environmental and social factors at play in the local area (PHE, 2021a, p.3). In order to address these inequalities, broad actions and an alignment of approaches across the public, private, and voluntary, community and social enterprise (VCSE) sectors are required, as part of a 'whole systems approach' to the health of local populations (NHS et al., 2019, p.6).

Obesity is one of the main risk factors for diseases that are the main contributors to lower life expectancy in deprived areas (PHE, 2021b), and public health experts and policy makers are increasingly interested in built environment interventions as strategies for population-wide improvements in physical activity as a means to reduce and prevent obesity and associated non-communicable diseases (Kaplan et al., 2000; Chaix, 2009; Sallis and Glanz, 2009; Stappers et al., 2018). In recent years, a broad range of built environment interventions have been implemented to improve physical activity levels, for example by improving the public realm, promoting active modes of transport, installing outdoor exercise equipment, reconstructing playgrounds and increasing the amount of open green space (Cohen et al., 2012).

Adopting a whole systems approach means working across traditional sector boundaries to address immediate needs as well as the root causes of preventable health conditions and poor wellbeing (NHS et al., 2019, p.6). This includes addressing the role of housing developers, housing associations and built environment professionals in the way the places are planned and shaped (ibid). This is recognised in the NHS Five Year Forward View, the NHS Long Term Plan and the National Planning Policy Framework, but for it to become a reality, significant focus from all players in shaping the place we live in is required (NHS et al., 2019).

## 2.2. Research aims and objectives

To inform the development of Places for People's place-based interventions to reduce health inequalities and to develop evaluation metrics for measuring the outcomes of interventions, this research focuses on the role of the place-based built environment interventions that are intended to increase physical activity and thus reduce health inequalities.

The following questions are explored through this research:

- What is the role of the built environment in increasing physical activity?
- What is the available evidence on the effectiveness of built environment place-based interventions in increasing physical activity?
- What are the metrics (methods) used to evaluate the effectiveness of these interventions?

To narrow down the focus of the research, three types of built environment interventions were selected, namely walking/cycling routes, outdoor gyms, and playgrounds, to better understand their role in addressing health inequalities. We provide an overview of the available evidence on the effectiveness of these initiatives and the methods that are used to evaluate them.

## 2.3. Research methods

The main methods used for this research were a desk-based literature review of academic systematic reviews of place-based built environment interventions and their role in improving health, and of academic publications evaluating place-based built environment interventions. In addition to reviewing academic publications on the topic, policy documents were reviewed in order to better understand the policy landscape on the role of place-based interventions in addressing health inequalities. Relevant reports and publications produced by the National Health Service (NHS) and Public Health England (PHE) were also reviewed to understand the government's approach and direction for future. Statistics and background information published by the Office for National Statistics (ONS) and PHE provided relevant context.

## 2.4. About this report

This report presents the findings of our analysis of the literature in the following sections:

*Section 3: What is health inequality and how can place-based strategies address it?*

This section sets out the definitions of health inequalities, life expectancy and healthy life expectancy. It also overviews the current trends in health inequalities in England. Place-based initiatives are also defined and briefly discussed.

*Section 4: Policy landscape*

This section summarises high level national government policies that address health inequalities through place-based approaches and built environment sector policies on the topic.

*Section 5: Effectiveness of place-based initiatives in promoting physical activity*

This section overviews the available evidence about the effectiveness of place-based built environment interventions in increasing physical activity. It provides evidence in effectiveness of three types of built environment interventions (cycling/walking routes, outdoor gyms and playgrounds).

*Section 6: Metrics*

This section overviews the methods used to evaluate the effectiveness of place-based built environment interventions in increasing physical activity.

*Section 7: Conclusions and reflections*

This section reflects on the findings of the research and summarises them.

# 3. Health inequalities and place-based interventions

## 3.1. Health inequalities

### 3.1.1. Definitions

*Health inequalities*

According to Public Health England (PHE, 2021a), the term 'health inequalities' is understood to mean differences in health status between different population groups that are unfair and avoidable. Health inequalities arise because of the conditions in which people are born, grow, live, work and age (PHE, 2021a). These conditions influence people's opportunities for good health and how they think, feel and act, and shape their mental health, physical health and wellbeing (PHE, 2021a).

Health inequalities have been documented by Public Health England between population groups across four overlapping dimensions of socio-economic position, protected characteristics, disadvantaged groups, and geography (PHE, 2018), as illustrated in Figure 1.

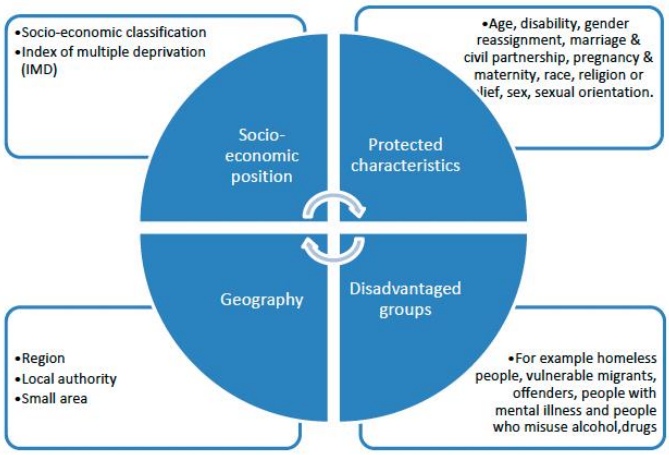


Figure 1: Four dimensions used by Public Health England for assessing inequalities (PHE, 2018)

*Life expectancy*

Life expectancy is a measure of the average number of years people will live beyond their current age (ONS, 2021). Life expectancy at birth is the average number of years that would be lived by babies born in a given time period, if mortality levels at each age remain constant (PHE, 2017).

Life expectancy at age 65 is, similarly, the average number of remaining years of life that a man or woman aged 65 will have if mortality levels at each age over 65 remain constant (PHE, 2017).

*Healthy life expectancy*

Healthy life expectancy is the number of years lived in self-assessed good health. Healthy life expectancy at birth is an estimate of the average number of years babies born this year would live in a state of 'good general health' if mortality levels at each age, and the level of good health at each age, remain constant in the future (PHE, 2017).

Healthy life expectancy at age 65 is the average number of remaining years a man or woman aged 65 will live in 'good general health' if mortality levels and the level of good health at each age beyond 65 remain constant in the future (PHE, 2017).

The healthy life expectancy measure adds a 'quality of life' dimension to estimates of life expectancy by dividing it into time spent in different states of health including very good, good, fair, bad, or very bad (PHE, 2017). If, in the PHE survey, a respondent answers 'very good' or 'good', they are classified as having 'good' health. Those who answer 'fair', 'bad', or 'very bad' are classified as having 'not good' health and equate to those in 'poor' health (PHE, 2017).

*Years spent in poor health*

The average number of years lived in poor health is the average life expectancy minus the average number of years lived in good health (healthy life expectancy). An increase in the average number of years lived in poor health is often referred to as 'expansion of morbidity', whereas a reduction in the average number of years lived in poor health is referred to as 'compression of morbidity' (PHE, 2017).

### 3.1.2. Current trends in health inequalities

*Health inequality in adults*

In the more deprived areas of England, the improvement in life expectancy has been lower than in less deprived areas (PHE, 2021b). In 2014 to 2016, the level of inequality in life expectancy between the most and least deprived areas of England was 9.3 years for males and 7.3 years for females (PHE, 2018). The gap in life expectancy between the most and least deprived areas in England increased after the COVID-19 pandemic (PHE, 2021b): in 2020, the gap in male life expectancy had grown to 10.3 years, which represented an increase of 1 year over the previous year. For females, the equivalent gap in life expectancy in 2020 was 8.3

years, 0.6 years more than in 2019 (PHE, 2021b). This demonstrates that the pandemic has exacerbated existing inequalities in life expectancy (ibid).

Prior to COVID-19, which was the cause of death that contributed most to the gap in life expectancy in 2020 (PHE, 2021b), the incidence of heart disease, lung cancer and chronic lower respiratory diseases in deprived areas were the main contributors in the gap in life expectancy for both sexes (PHE, 2018; PHE, 2021b). Smoking and obesity are the main risk factors for these diseases (PHE, 2018). Although smoking prevalence in England has declined, people in more deprived areas are still more likely to smoke than people in the least deprived areas (PHE, 2018), and the prevalence of obesity is also higher in the most deprived than in the least deprived areas (PHE, 2021b). In 2019, obesity prevalence was highest in the North East (34.0%) and lowest in London (23.4%) (ibid).

The gap in healthy life expectancy (years lived in good health) between the most and least deprived areas of England was around 19 years for both males and females in the period 2014 to 2016 (PHE, 2018). People living in the most deprived areas spend nearly a third of their lives in poor health, compared with around a sixth for those in the least deprived areas (PHE, 2018).

*Health inequality in children*

Health inequality begins early in life. In the period 2014 to 2016, children in the most deprived areas were twice as likely to be born with low birthweight and more than three times as likely to experience tooth decay than children in the least deprived areas (PHE, 2018). In general, the proportion of children aged 10 to 11 years who are overweight or obese has been increasing in England as a whole (PHE, 2018). Alongside this, inequalities in child excess weight between the most and least deprived areas, and between ethnic groups, have also been widening (PHE, 2018).

### 3.1.3. Childhood and adulthood obesity

A lack of exercise and poor diet lead to a greater incidence of obesity[1] which in turn has consequences for individuals. The prevalence of obesity in the UK population is one of the highest in Europe (The Guardian, 2017). The Health Survey for England (NHS Digital, 2019) estimates that 28.0% of adults aged 16+ in England are obese and a further 36.2% are overweight (Baker, 2022). In the most deprived areas in England, the prevalence of excess weight (overweight or obese) is 9 percentage points higher than in the least deprived areas (Baker, 2022).

[1] Obesity is usually defined as having a body mass index (BMI) of 30 or above and BMI between 25 and 30 is classified as 'overweight'.

The National Child Measurement Programme 2020/21 found that 14.4% of reception age children in England (age 4-5) were obese, with a further 13.3% overweight (Baker, 2022). These proportions were higher among year 6 children (age 10-11), with 25.5% being obese and 15.4% overweight (Baker, 2022). In both age groups, children living in deprived areas are substantially more likely to be obese: among reception year children (age 4-5) in 2020/21, 9.1% of those in the least deprived areas are obese compared with 19.7% of those in the most deprived areas, and in year 6 (age 10-11), 15.5% of children in the least deprived areas are obese, compared with 32.1% in the most deprived areas (Baker, 2022).

The full impact of the COVID-19 pandemic on obesity levels for children is not yet known (PHE, 2021b), however, the closure of schools, sporting and leisure facilities, park facilities and recreational areas, together with an increase in screen time over the pandemic period have led to a reduction in physical activity in children and young people (Atmakur-Javdekar, 2021). Sport England estimates that the impact has been greater on boys than girls, and on those from Asian, Black and Mixed and other ethnic groups (Sport England, 2021).

Prevention and treatment of childhood obesity presents a significant public health challenge as it can result in the early onset of cardio-metabolic, respiratory, and musculoskeletal conditions, as well as adverse psycho-social outcomes and an increased risk of living with obesity and associated mortality and morbidity later in life (PHE, 2021b).

### 3.1.4. Health outcomes of physical activity

According to the UK government's physical activity guidelines, participating in at least 150 minutes of moderate intensity physical activity per week, or at least 75 minutes of vigorous intensity physical activity per week, can have various health benefits including the reduction of the risk of developing Type 2 diabetes by up to 40%, cardiovascular disease by up to 35%, and joint and back pain by up to 25% (Department of Health and Social Care, 2019a). For children and young people (5-18 years), physical activity guidelines recommend an average of 60 minutes per day across week to maintain a healthy weight (Department of Health and Social Care, 2019a).

Despite this, in England, only 67% of adults and 47% of children and young people were considered active in 2018/19 as per government guidelines (NHS Digital, 2020). A low level of physical activity can result in increasing public health issues, as well as greater economic and social burden from associated diseases related to low levels of physical activity (Allender et al., 2007; Lee et al., 2012; Adams and Cavill, 2015). In fact, according to Statistics on Obesity, Physical Activity and Diet, England (NHS Digital, 2020), in 2018/19, there were

11,117 hospital admissions directly attributable to obesity, an increase of 4% on 2017/18, when there were 10,660 admissions.

## 3.2. Place-based approaches

### 3.2.1. Definitions

A place-based approach is a joined-up approach that treats a local area - i.e., a 'place' - rather than individual problems or issues, to reduce inequalities in health and wellbeing (PHE, 2021a). A place-based approach recognises the importance of addressing the wider determinants of health (the conditions into which people are born, live and work) across the life course (PHE, 2021a).

### 3.2.2. Place-based interventions

There is a critical role for local areas to play in reducing health inequalities across the life course, by taking a joined-up place-based approach and utilising the leadership, expertise and levers that are available to them to affect this environment (PHE, 2021a).

PHE's (2021a) guidance document, 'Place-based approaches for reducing health inequalities', describes the Population Intervention Triangle (PIT) as a model for planning place-based action to reduce health inequalities. Figure 2 shows the main components of the PIT which are civic-level, community-centred and service-based interventions. The document also introduces a series of tools designed to support local areas in applying the principles set out in each part of the model[2].

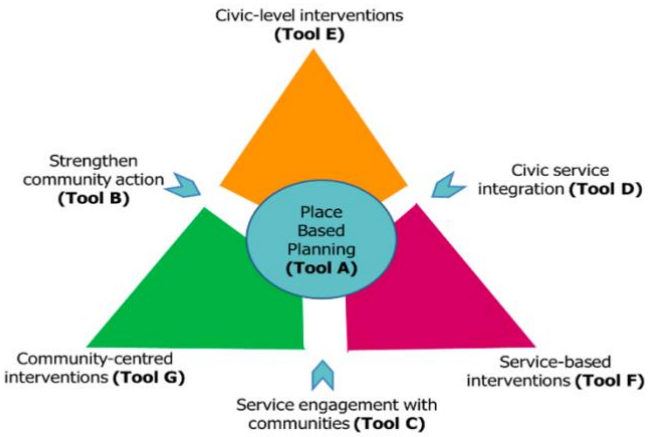


Figure 2 - Population Intervention Triangle (source: PHE, 2021a)

[2] For more information on the tools refer to: https://www.gov.uk/government/publications/health-inequalities-place-based-approaches-to-reduce-inequalities

A place-based intervention is defined as any intervention, policy, programme or action that aims to improve health and reduce health inequalities and is delivered at a local level (PHE, 2021a, McGowan et al., 2021). These interventions can be categorised into three overlapping categories of physical, social, and economic environment approaches (McGowan et al., 2021). Examples of these approaches, according to McGowan et al. (2021), are:

- Improving the physical built environment (e.g., active travel, pedestrianisation, school crossing patrols, green space, cycle/walking routes, playgrounds, outdoor gyms, fly tipping/ littering, housing);
- Improving the social environment (e.g., children's services, alcohol and food licensing powers, provision of health promotion services, cultural venues and activities); and
- Improving the economic environment (e.g., local investment and growth strategies including local employment/training/education, subsidised public transport, welfare such as council tax discounts, and economic development initiatives).

McGowan et al.'s systematic review (2021) reports that out of 51 primary studies of place-based interventions, 50 studies reported on interventions that changed the physical built environment, one on changes to the economic environment, and no reviews were identified that assessed the impact of social interventions.

The Commission on Creating Healthy Cities (2022) has produced an evidence bank, the Healthy Cities Toolkit[3], to highlight problems and solutions that connect health and the built environment. The Commission's report sees great potential for future built environment policies and practices to contribute more to meeting city's health needs.

### 3.2.3. Built environment place-based interventions to promote physical activity

The term 'built environment' refers to aspects of our surroundings that are built by humans. It includes not only buildings, but the human-made spaces between buildings, such as parks, and the infrastructure that supports human activity. As the choices people make are partially shaped by the environments in which they live, promoting physical activity through interventions in the built environment has gained increasing interest worldwide among public health experts and policy makers, in order to reduce and prevent obesity and associated non-communicable diseases (Sallis and Glanz, 2009; Stappers et al., 2018).

In recent years, a broad range of built environment interventions have been implemented to improve physical activity levels, for example, by improving public spaces, promoting active

[3] https://www.healthycitiescommission.org/toolkit/

modes of transport, installing outdoor exercise equipment, reconstructing playgrounds, and increasing the amount of open green space available (Cohen et al., 2012). Section 5 of this report overviews the available evidence in effectiveness of some of these built environment interventions in promoting physical activity.

# 4. Policy landscape

This section summarises some of the published and forthcoming high level policies that address health inequalities and pay attention to place-based approaches.

Improvements to health outcomes is one of the twelve core missions in the Levelling Up white paper, with a commitment to raising healthy life expectancy by five years by 2035, and an interim target to narrow the gap between the highest and lowest local areas by 2030. The policy programme focuses on improving public health in a variety of ways, including social prescribing, supporting people to change their diet, and tackling diagnostic backlogs (HM Government, 2022).

The government has launched two independent reviews that will feed into a white paper on health disparities which is expected to be published later in 2022. It is anticipated that the new white paper will set out a strategy for tackling the core drivers of inequalities in health outcomes, with a strong focus on prevention and disparities by ethnicity, socioeconomic background and geography (HM Government, 2022). It will share learnings from experiences during the pandemic response about how best to mobilise communities to address shared health challenges, as well as set out proposals for place-based solutions and new approaches that will ensure that business plays a part in improving health (HM Government, 2022).

In addition to this, the NHS Long Term Plan published in 2019 sets out key commitments to accelerate action to prevent ill health and tackle health inequalities in England (NHS, 2019). The plan stresses the importance of the NHS and the built environment sector continuing to work together to improve health and wellbeing (NHS, 2019). Some of the commitments in the NHS Long Term Plan that relate to inequalities include:

- 5-year funding allocations to local areas, using a more accurate assessment of health inequalities and unmet need;
- Setting out specific, measurable goals for narrowing inequalities, including those relating to poverty; and
- The development of detailed and measurable plans for every local area in England to contribute to narrowing the health inequalities gap over the next 5 to 10 years.

Built environment policy also considers health to be one of the main areas of note. The National Planning Policy Framework (NPPF), published by Ministry of Housing, Communities and Local Government (now the Department for Levelling Up, Housing and Communities) in 2021, sets out the Government's planning policies for England. Promoting healthy and safe communities is one of the main planning policies in the NPPF, and the policy notes that

planning policies and decisions should aim to achieve healthy, inclusive, and safe places which enable and support healthy lifestyles. Particular attention is paid to planning decisions that address identified local health and wellbeing needs – for example, through the provision of safe and accessible green infrastructure, sports facilities, local shops, access to healthier food, allotments, and layouts that encourage walking and cycling (MHCLG, 2021).

The NPPF also emphasises the need for planning policies and decisions to plan positively for the provision and use of shared spaces, community facilities and other local services to enhance the sustainability of communities and residential environments, take into account and support the delivery of local strategies to improve health, social and cultural well-being for all sections of the community, and guard against the unnecessary loss of valued facilities and services, particularly where this would reduce the community's ability to meet its day-to-day needs (MHCLG, 2021). The policy also notes that access to a network of high quality open spaces and opportunities for sport and physical activity are important for the health and wellbeing of communities (MHCLG, 2021).

Furthermore, Public Health England (PHE) has developed a suite of tools and resources known as 'Place Based Approaches to Reducing Health Inequalities' (PBA). The core offer of PBA is an online suite of resources available for all local systems (including local authorities, GPs, and other local services) to access, to enable cross-system leadership and action to address health inequalities. The PBA resources includes guidance documents and tools to support local areas in the implementation of practical solutions for reducing health inequalities[4].

The aims of the main PBA report are:

- To reinforce a common understanding of the complex causes and costs of health inequalities; and
- To provide a practical framework and tools for places to reduce health inequalities

The report recognises that places and communities have the most critical role to play in closing the gap in healthy life expectancy, and highlights the roles played by employment, decent housing and the prevention of social isolation in reducing health inequalities (PHE, 2021a). PHE tested the practical use of the resources at place level through facilitated workshops and support in four pilot areas during 2019 and 2020 and, in addition to the publication of resources, published the findings and evaluation of the pilot areas studied (PHE, 2021c).

[4] All the PBA resources are available at: https://www.gov.uk/government/publications/health-inequalities-place-based-approaches-to-reduce-inequalities

# 5. Effectiveness of place-based initiatives in promoting physical activity

## 5.1. Evidence in effectiveness of built environment interventions

As noted earlier, promoting physical activity through interventions in the built environment has gained increasing interest worldwide to promote population-wide improvements in physical activity in order to reduce and prevent obesity and associated non-communicable diseases (Stappers et al., 2018).

Despite the increase in guidance advocating action on the role of the built environment to improve health outcomes, the evidence base underpinning its effectiveness is still a matter of debate among the scientific and practitioner communities (PHE, 2017). Systematic reviews on the effectiveness of built environment interventions on physical activity presented a mixed but mostly positive result on the effectiveness of these interventions. A systematic review of 28 studies by Smith et al. (2017), shows that, with the exception of two studies which show no significant impact (West et al., 2015; Clark et al., 2014), and one with a negative impact (Dill et al., 2014), all other 25 studies reported a significant positive impact of the built environment interventions on physical activity.

Another systematic review (Cohen et al., 2012) which reported on the evaluations of interventions targeting the increase in physical activity shows that one study of park renovation (Tester and Baker, 2009), an evaluation of a skate park renovation (Cohen et al., 2009) and the increased use of a school playground after painting areas were all associated with more vigorous physical activity among children (Stratton and Mullan, 2005). However, other reviewed studies found that neither renovating a senior citizens' centre with indoor exercise equipment nor renovating or building new gymnasiums attracted more users (Cohen et al., 2008; Cohen et al., 2009). Similarly, they report, an evaluation of a new walking trail did not demonstrate increases in physical activity among local residents (Evenson et al., 2005).

In some cases, insufficient marketing and outreach were considered partly responsible for the failure to increase facility use and physical activity. Marketing and new facilities are both likely to be important factors in attracting people to the intervention areas and influencing onsite physical activity (Cohen et al., 2012). Physical proximity to the intervention may also affect the effectiveness of some interventions (Stappers et al., 2018).

The unique and individual nature of the built environment makes it difficult to develop evidence-based approaches that can be universally applied, and successful practices in one community setting may not be transferrable to another (PHE, 2017, p.5). In the following section, to further understand the outcome of the built environment interventions in improving physical activity, we investigate:

- The evidence in relation to physical activity outcomes related to cycling and walking route interventions;
- The evidence in relation to physical activity outcomes related to improving/adding outdoor gyms; and
- The evidence in relation to physical activity outcomes related to upgrading playgrounds.

These three types of interventions have been chosen as they are widely used and are considered to have positive impacts on the level of physical activity.

## 5.2. Effectiveness of walking and cycling interventions

### 5.2.1. Overview of effectiveness of walking and cycling interventions in promoting active transport

Walking and cycling are important sources of everyday activity and are associated with a wide range of health benefits (Goodman et al., 2014). A growing number of built environment interventions aim to promote walking and cycling as active modes of transport by implementation of a walking and/or bicycling trail and thus reducing passive and sedentary modes of transport (Stappers et al., 2018). There are multiple systematic reviews and scientific articles that evaluate the effects of built environment interventions targeting increased physical activity by improving active transport (e.g., Goodman et al., 2014; Hunter et al. 2015; Mayne et al. 2015; Smith et al., 2017; Stappers et al., 2018; MacMillan et al., 2018; McGowen et al. 2021, Ahmed-Dobson and Richards, 2022). These reviews report mostly positive results on physical activity outcomes.

For example, a review by Stappers et al. (2018) reported on seven studies (from the US, Australia, Brazil, and England) that assessed the effects of new on- and off-road walking and cycling routes on physical activity. They found mixed results, with four studies reporting no significant changes or negative effects on overall physical activity after the implementation of new cycling and walking routes, and three studies reporting an increase in cycling after the construction of new separated bicycle paths (Stappers et al., 2018). Three studies in this review also assessed whether outcomes differed depending on proximity to the intervention: two found that living closer to the intervention was associated with more cycling and

walking, and one found a greater increase in cycling for those living between 1.0–2.99 km from the intervention area compared with individuals living less than 1.0 km or further than 2.99 km away (Stappers et al., 2018).

A review by Goodman et al., (2014), drawing on five studies (from Denmark, England, the Netherlands, and the US), reported increases in cycling after the implementation of fairly substantial infrastructure improvements, such as building cycle parking, extending networks of on- and off-road cycle routes, or modifying junctions to create advance stop lanes for cyclists. However, they note that interpretation of the outcomes is complicated as modifications were sometimes accompanied by other cycling initiatives (e.g., media campaigns, cycle training or community-based events) which make it difficult to attribute outcomes to infrastructure improvements alone (Goodman et al., 2014).

Goodman et al. (2014) reported that few studies have examined whether any effects were observed equally across different population groups, and very few have examined equity impacts with respect to any characteristic other than gender. According to their review (Goodman et al., 2014), one Australian study found a trend toward a greater increase in activity among women than men (Brown et al., 2006), and one English study found comparable changes across all socioeconomic groups (Sloman et al., 2009). Furthermore, one English and one US study found some suggestion of larger increases among socioeconomically disadvantaged groups (Goodman et al., 2013; Brownson et al., 2004).

It is perceived that European countries are more compact, leading to shorter trip distances, which in turn may lead to the higher prevalence of active modes of transport (Pucher and Buehler, 2008). However, most of the reviewed studies in the systematic reviews are based in the US and Australia, where the prevalence of active transportation is low (for example, in one paper by Stappers et al. (2018), 11 out of 15 reviewed interventions took place in the US and Australia, and only three interventions were in Europe). This may influence the perceived outcomes of walking or cycling interventions.

A review by Goodman et al., (2013) of case studies in England evaluated the programme of town- and city-wide initiatives (18 initiatives) aimed at increasing cycling (Cycling Demonstration Towns funded 2005-2011 and Cycling Cities and Towns funded 2008-2011). Their research showed that, after the implementation of these initiatives, the prevalence of cycling to work increased in both absolute and relative terms among commuters living in the intervention towns. Walking to work also increased somewhat, while driving to work declined and public transport use remained unchanged (Goodman et al., 2013). These effects were also observed in the most deprived areas (ibid).

In summary, the outcomes reported by these systematic reviews suggest that walking and cycling interventions increase walking and/or cycling, but the scale of the intervention, the context in which the intervention has happened, proximity to the intervention, and the accompanying non-physical initiatives (e.g., media campaigns, and training) should all be taken into consideration when evaluating the schemes.

The following three sections present the evaluation of the effectiveness of three UK-based interventions aimed at promoting walking and/or cycling as active modes of transport, by the implementation of a walking and bicycling trail.

### 5.2.2. Case study 1: Connect 2, UK-wide

Connect 2 was a major new project, supported by a grant from the Big Lottery Fund and led by the sustainable transport charity Sustrans[5]. It aimed to promote walking and cycling by improving local walking and cycling routes at 79 sites around the UK. Each Connect 2 site consisted of one flagship engineering project to overcome a physical barrier (e.g., a bridge over a dual carriageway) coupled with improvements to signed on- and off-road feeder routes, leading into that flagship project. Projects were tailored to individual sites, but all embodied a desire to create new routes for everyday local journeys by foot or by bike to destinations such as schools, shops, parks, and the countryside (PHE, 2017).

Goodman et al. (2014) evaluated the effects of Connect 2 initiatives in three UK municipalities: Cardiff, Kenilworth, and Southampton, looking specifically at the impact of providing new traffic-free routes for walking and cycling on overall levels of walking, cycling, and physical activity in each area. For their study, 1796 adult residents in the three municipalities completed postal questionnaires at a baseline point (2010) and as a follow-up (2011) one year after the construction of the new infrastructure. 1465 adults completed a follow-up questionnaire two years after the construction of the infrastructure (2012).

The Connect 2 initiatives studied by Goodman et al., (2014) were in Cardiff, where a traffic-free bridge was built over Cardiff Bay; Kenilworth, where a traffic-free bridge was built over a busy trunk road; and Southampton, where an informal riverside footpath was turned into a boardwalk. The results of the study 'provide evidence that improved, high-quality, traffic-free routes for walking and cycling may help to increase overall physical activity levels in the local population and thereby contribute to the primary prevention of a range of non-communicable diseases' (Goodman et al., 2014, p.44).

[5] https://www.sustrans.org.uk/our-blog/research/all-themes/all/fit-for-life-report-on-connect-2-programme/

According to the research, living nearer the infrastructure did not result in changes in activity levels at 1-year follow-up but did result in increases in activity at 2 years relative to those living farther away, with an increase of 15.3 minutes per week walking and cycling per kilometre closer to the intervention and 12.5 minutes of total increase in physical activity per week (Goodman et al., 2014).

In total, 32% of participants in Goodman et al. (2014)'s study reported using the new Connect 2 routes after one year and 38% reported using it after two years. Patterns of use were very similar at both time points, with walking for recreation being by far the most commonly reported use. Cycling for recreation and walking for transport were the other two common Connect 2 uses. The least commonly use reported in this study was cycling for transport.

They did not find evidence that the effect of Connect 2 proximity on walking and cycling after two years was moderated by site, sex, age, education, employment, income, having a child, or having access to a bicycle. However, they did find strong evidence that the effect was larger among participant households without a car (Goodman et al., 2014).

In summary, the evaluation of Connect 2 initiatives in Cardiff, Kenilworth, and Southampton suggested that living nearer the new routes did not predict changes in activity levels at one-year follow-up, but did predict increases in activity at two years, relative to those living farther away (15.3 additional minutes/week walking and cycling per km nearer; 12.5 additional minutes/week of total physical activity). The study suggested that the new routes may have displaced walking or cycling trips from elsewhere in the short term but generated new trips in the longer term, particularly among those unable to access more distant destinations by car. The findings support the potential for walking and cycling infrastructure to promote physical activity.

### 5.2.3. Case study 2: Fitter for Walking, UK-wide

Fitter for Walking is a Big Lottery funded project managed and delivered by the charity Living Streets[6]. The project ran from 2008 to 2012 with the aim of improving walking routes in specific neighbourhoods and promoting walking in 12 deprived communities across five regions of England: London (Barking and Dagenham, Redbridge), North East England (Gateshead, Sunderland, Newcastle), North West England (Blackburn with Darwen, Bolton), the West Midlands (Dudley, Sandwell, Wolverhampton) and Yorkshire (Doncaster,

6 https://www.livingstreets.org.uk/?gclid=CjwKCAjw5NqVBhAjEiwAeCa97USkxFVfX47QhFI5e2_1zS5oYQMRlcgWfg6enFzAy0aTNFGuy3dydxoC7XgQAvD_BwE

Rotherham) (PHE, 2017). Encouraging communities and local residents to work together to promote walking was a further aim for the project (Adams and Cavill, 2015).

The local authorities were recruited from areas with low levels of reported physical activity, based on survey results from Active People Survey 1 (2005–2006) (carried out by Sport England, 2005–2006), and high levels of deprivation. Five full-time project coordinators, one based in each region, were recruited to act as a link between the local authority partner and local communities to improve local route environments based on identified barriers to walking (Adams and Cavill, 2015; PHE, 2017).

The Fitter for Walking projects focused on making changes to access (foot path quality and provision), safety (safe crossings, dropped kerbs, lighting) and aesthetics (cleaning up streets, removing litter and graffiti, cutting back hedges and planting bulbs) on a local route which led to key destinations and had the potential for increasing walking trips (Adams and Cavill, 2015).

Adams and Cavill (2015) evaluated changes in the pedestrian use of the local routes following the Fitter for Walking project to assess route users' awareness of the improvements. Route user counts and intercept surveys were conducted in five Fitter for Walking case study areas (Barking and Dagenham in London, Newcastle in the North East, Blackburn in the North West, Wolverhampton in the West Midlands, and Rotherham in Yorkshire) at baseline and at 12 months and 14–20 months after the project activities had commenced.

The study concluded that, after 12 months, there was a decrease in pedestrian route use overall (-19.4%) and across all case studies, except for the Newcastle case study where 14% increase was observed. However, after 14–20 months, an increase in pedestrian route use overall (14.9%) and in all case studies (range 5.4–58.9%) was observed, compared to baseline (Adams and Cavill, 2015). However, the study did not explain why the number of pedestrian route use was decrease first before increasing after 14–20 months.

According to the study's findings, the age and gender of the route users varied across case studies. In the Barking and Dagenham and Blackburn case studies, a larger proportion of route users were minors (under 16 years old), whereas in the Newcastle and Wolverhampton case studies, adult males were the most frequent users. Across all case studies and survey time points, a low proportion of route users were older adults (Adams and Cavill, 2015).

Adams and Cavill (2015) also reflected on engaging communities, the approach adopted in the Fitter for Walking project. They observed that engaging communities in identifying

barriers to walking on local routes and asking them to suggest solutions was successful for instigating small-scale environmental improvements for increased walking for transport. However, they noted that it can take some time and effort to gain community buy-in, and concluded that increasing the number of people walking on newly improved routes may take time and may require additional promotional initiatives (Adams and Cavill, 2015).

#### 5.2.4. Case study 3: Cambridgeshire Guided Busway with parallel walking/cycling path, Cambs, UK

The Cambridgeshire Guided Busway is a bus network using 22 km of guideway (segregated bus track), accompanied by a traffic-free path for pedestrians and cyclists, which was opened in 2011 (PHE, 2017). The aim of this project was to improve transport infrastructure to support active commuting (walking and cycling on the journey to and from work), to promote physical activity and to improve population health (Ogilvie et al., 2016).

Ogilvie et al. (2016) assessed this project to understand whether or not investment in new high-quality transport infrastructure was associated with an increase in active commuting, wider health impacts of changes in travel behaviour, determinants of the use and uptake of active commuting, and how changes in travel behaviour were distributed in the population and related to the wider social context.

For the evaluation, a cohort of 1143 adults living within 30 km of Cambridge and working in the city was recruited in 2009, and a separate sample of 1710 users intercepted on the Cambridgeshire Guided Busway in 2012 was also examined (Ogilvie et al., 2016).

The study showed that commuting practices are complex and shaped by various changeable social and environmental factors, and it concluded that walking and cycling were often incorporated into longer commuting journeys made predominantly by car or public transport. They also noted that living closer to the intervention was associated with a greater likelihood of a larger increase in the proportion of commuting trips involving any active travel, a large decrease in the proportion of trips made entirely by car, and an increase in weekly cycle commuting time. They found a mixed pattern of effects at the individual level, with the intervention providing a more supportive environment for active commuting for some and not for others. There was some evidence that the effect was most pronounced among those who reported no active commuting at baseline, and observational evidence suggested a relationship between active commuting, greater overall physical activity, and improved wellbeing and weight status (Ogilvie et al., 2016; PHE, 2017).

Interviews carried out for this study showed that, although people were unlikely to use the new infrastructure unless it closely matched the journeys they needed to make, a range of other factors informed travel behaviour, and these were dependent on the value attributed to different aspects of the journey experience. These generally involved considerations of comfort, ambience, or pleasantness, and of feeling safe, which could trump considerations of reliability and speed. Although experiences of the busway were complex, they culminated in meaningful travel behaviour change for some users, through shifts in the balance between influential factors and planning, trialling, and adopting new practices over time (Ogilvie et al., 2016).

In terms of linking active commuting with health benefits, Ogilvie et al. (2016) found no direct evidence of an effect of the intervention on overall time spent on physical activity, but they noted that the study lacked statistical power to detect such an effect. However, they found no compensatory decrease in recreational physical activity, and in the observational cohort, analysis changes in active commuting were associated with commensurate changes in total self-reported physical activity. Cycle commuting was also associated with lower sickness absence at work and improved well-being and weight status 1 year later, albeit with modest effects at the individual level (Ogilvie et al., 2016).

The overviewed case studies (Connect 2, Fitter for Walking, and Cambridgeshire Guided Busway) suggest that improved and newly introduced routes for walking and cycling may help to increase overall physical activity levels in the local population. However, it may take time and may require additional marketing and outreach activities to increase the use and effectiveness of these routes. Living nearer the intervention may increase the effectiveness of interventions in increasing physical activity. Engaging communities in identifying barriers to walking and cycling on local routes and asking them to suggest solutions may increase the success of the intervention for increased active transportation.

## 5.3. Evidence in effectiveness of outdoor gym interventions

### 5.3.1. Overview of effectiveness of outdoor gym interventions in promoting physical activity

Outdoor gyms are facilities that typically consist of simple and durable exercise equipment that requires no electricity and is usually installed in public open spaces to promote structured physical activity (Jansson et al., 2019). The provision of outdoor gyms is increasingly seen as an important strategy to realise public health agendas that promote habitual physical activity (Lee et al., 2018). The advantages of outdoor gyms include their suitability for most adult age groups with different fitness levels, being free of charge and their capacity to influence large numbers of people to be physically active due to their accessibility within local public spaces (Jansson et al., 2019).

While outdoor gyms are being rapidly installed around the world, little is known about their impact on physical activity, fitness and other health-related outcomes (Jansson et al., 2019). To our knowledge, only two systematic reviews have examined the outcomes of outdoor gyms to date (Lee et al., 2018 and Jansson et al., 2019). The review by Lee et al. (2018) is descriptive, providing qualitative information about the characteristics of outdoor gyms and user experiences and perceptions, while Jansson et al. (2019) examine the effects of outdoor gyms on community-based physical activity (i.e., changes in park-based physical activity, pre and post outdoor gym installations), individuals (i.e., as measured by fitness tests) and other health-related outcomes, such as diabetes-related health outcomes, balance and the risk of falls.

According to both these reviews, unlike sport facilities, which have international standards for size and structure, the scale of outdoor gyms investigated in these studies varied by site. The type of exercise equipment also varied across facilities, with some offering mechanical equipment (e.g., chest press, ski machine) and others static equipment (e.g., push up bar and step-up station). Terminology used for the outdoor gyms varied (e.g., stretching station, fitness zone), as did the location of outdoor gyms and availability of instructional support (Lee et al., 2018; Jansson et al., 2019).

Lee et al. (2018) integrated evidence from quantitative, qualitative, and mix-methods studies in their systematic review. They looked at nine studies (three quantitative studies, four mixed-methods studies and two qualitative studies) across Australia, Canada, Brazil, Taiwan, China, USA and Chile. Improving physical health, according to Lee et al. (2018), was central to the experiences of outdoor gym users and residents in the neighbourhoods in which the facilities were located. They also noted that outdoor gyms are also perceived as spaces where community-dwellers can find social connectedness while participating in structured physical activity at no cost.

Participants identified that using the equipment at outdoor gyms helped to treat their health issues, which included frozen shoulder, post-surgery rehabilitation, spinal problems, and general pain. The participants in one study mentioned that they used outdoor gyms for weight reduction and as a form of leisure activity. Users of outdoor gyms also perceived that they were improving their physical strength and general fitness, thus preventing disease and maintaining their health. Quantitative evidence showed 39% of the survey respondents of one study indicated that losing weight was the most common reason for using the facility. Furthermore, survey respondents from another study rated the statement 'I feel fitter because I use this equipment' an average of 3.45 on a seven-point Likert-scale (Lee et al., 2018).

Increased social connectedness is another theme identified in many of studies reviewed by Lee et al. (2018). Participants expressed the view that users of outdoor gyms became friends, and they liked the idea that they could exercise, chat with friends and gain encouragement from others. The subtheme of family was found in one study, in which a participant said she liked the idea that the outdoor gym allowed her to bring her children with her when she was exercising (Lee et al., 2018).

Outdoor gyms are a free facility for public use and the theme of affordability was found in two of the studies reviewed by Lee et al. (2018). They reported that a participant in one study said that she and her family could not afford a paid gym and the outdoor gym was her only opportunity for resistance training. This theme was supported by survey data, in which survey respondents rated the statement 'I only do this type of exercise because the equipment is freely available' an average of 3.77 on a seven-point Likert-scale (Lee et al., 2018).

Based on Lee et al. (2018)'s synthesis, outdoor gyms mainly serve adult and older adult groups, and they are mostly under-supervised and minimally supported by a user guide.

A second systematic review by Jansson et al. (2019) included 18 studies conducted in nine different countries (Australia, Brazil, Canada, Chile, Columbia, Korea, Taiwan, United States of America, and Uruguay). They found that there is some evidence that outdoor gyms improve physical activity, fitness, and other health-related outcomes, although few experimental studies have been conducted to date.

According to their review, four of the studies used System for Observing Play and Recreation in Communities (SOPARC)[7] to evaluate the impact of outdoor gyms on physical activity. Half (2 out of 4) of the studies reported a significant increase in moderate-to-vigorous physical activity (MVPA) in areas where outdoor gyms had been installed, while findings from the other two studies failed to identify statistically significant increases in MVPA (Jansson et al., 2019).

Jansson et al. (2019) also reported that the studies targeting fitness and other health-related outcomes that were reviewed by them, found significant results in some but not all outcomes. For example, they report, Sales et al. (2017) found no significant improvements in standing balance and functional mobility in the elderly population, nor in a number of other outcomes (e.g., hand grip strength, gait speed, fear of falling or quality of life) at the study's primary endpoint. An 18-week evaluation, however, found significant improvements in some

[7] SOPARC is an observational method for assessing park and recreation areas. The method will be explained in section 6.

of the outcomes (i.e., single leg stance, knee strength, two-minute walk test and sit-to-stand test).

In summary, outdoor gyms can be an effective intervention in increasing physical activity. Although improving health is central to the experiences of outdoor gym users, increasing social connectedness is another outcome of using outdoor gyms. The studies reviewed in the systematic reviews included populations that were narrow in age, making it difficult to transfer results to other populations. Most outdoor gym users were living in close proximity to the outdoor gym, and in terms of age and gender, there was no consensus in the literature regarding which age or gender groups are most likely to use outdoor gym equipment (Jansson et al., 2019).

The following two sections present the evaluation of the effectiveness of two outdoor gym interventions, one USA-based and one UK-based.

### 5.3.2. Case study 4: Outdoor gyms in Los Angeles, USA

With support from a variety of funders, the Trust for Public Land installed outdoor exercise equipment (Fitness Zones) in public parks in Southern California. The average total cost of each Fitness Zone was $45,000, which covered the cost of 8 pieces of equipment, installation, and staff time for coordinating the installations. The equipment needs no electricity and is appropriate for individuals 13 years and older, and for all fitness levels (Cohen et al., 2012).

Cohen et al. (2012) evaluated the impact of these outdoor Fitness Zones in 12 parks on physical activity. They used the System for Observing Play and Recreation in Communities (SOPARC), an observational method used to assess use and estimate energy expenditure prior to and twice after Fitness Zone installation, as well as at 10 similar parks that did not get Fitness Zone equipment. According to their observation findings, Fitness Zone users increased 11% in intervention parks. This increase was more for parks with a larger population density. They also noted that the overall mean park use was significantly higher on weekend days compared to weekdays during two follow-up periods. Across the 12 parks, Fitness Zone users comprised 5.4% and 5.6% of total park visitors at the first and second follow-ups, respectively.

They also observed that people in Fitness Zones engaged in substantially more moderate to vigorous physical activity (MVPA) than those in other park activity areas because they were using the exercise equipment. They also report that they observed fewer people using Fitness Zone parks than comparison parks at baseline. However, over time, the number of

Fitness Zone users increased more in the intervention parks than the number in comparison parks.

As well as direct observation, Cohen et al. (2012) conducted intercept interviews with park users at all parks at baseline (742 interviews) and at two follow-up points (942 at the first follow-up, and 952 at the second). Their findings showed that the Fitness Zone respondents reported visiting the park more frequently than those in other comparison parks, and they reported engaging in more exercise sessions per week. Losing weight was the most common reason reported for using the fitness equipment. Compared to other area users, Fitness Zone users reported getting to the park more often by walking (56.3 vs. 34.9%) and visiting the park for the first time within the past six months (20.5% vs. 7.1%).

Cohen et al. (2012) also calculated the cost effectiveness of the Fitness Zones by determining the increment in METs[8] generated per USD cost of the equipment. They conclude that installing Fitness Zones appears to be cost-effective (10.5 cents/MET increase) and most successful in parks in densely populated areas with limited local facilities. They noted that longer-term follow-up measures are needed to determine whether the early increases in physical activity associated with the Fitness Zone installations are sustained or not.

#### 5.3.3. Case study 5: outdoor gyms in Sefton, Merseyside, UK

As part of efforts to improve health in Sefton in North West England, NHS Sefton secured funding to install outdoor gym equipment in 37 sites across the borough over a four year period. The location of each outdoor gym was carefully considered to encourage maximum use and accessibility throughout the borough. It was intended that the provision of free to use, accessible equipment would encourage local residents to increase their physical activity and improve their health (Bates et al., 2018).

To understand the impact of the provision of outdoor gym equipment on the health and physical activity levels of local people, Bates et al. (2018) evaluated 10 outdoor gym locations in Sefton. For this study, a questionnaire was administered across 10 outdoor gym locations, and through an online survey. Survey findings were supplemented with interviews and focus groups carried out with participants identified during surveying and through contacts within Sefton Council and local physical activity groups.

In total, 162 participants provided data through the online and onsite surveys, nine participants were interviewed, and one focus group was undertaken with four participants. According to Bates et al. (2018) participants generally had positive attitudes towards the

[8] MET stands for the metabolic equivalent of task. One MET is the amount of energy used while sitting quietly.

outdoor gyms. Three quarters or more of participants agreed or strongly agreed that the gyms are easily accessible and that using an outdoor gym is both beneficial for their health and enjoyable. Just under half of participants used an outdoor gym at least once in a typical week, and just over one quarter reported that they used the equipment on two or more occasions a week.

According to survey findings, Bates et al. (2018) report that the average length of time using the equipment in one session was 19 minutes amongst all participants, and 22 minutes amongst those who used the equipment at least once in a typical week. Amongst all survey participants who had used the equipment on at least one occasion, over half agreed or strongly agreed that the outdoor gyms had an overall positive impact on their health and that since using the equipment they felt fitter or healthier, more confident when exercising and took part in more physical activity. Benefits for health were greater amongst those who used the equipment at least once a week.

Based on interview findings, Bates et al. (2018) note that a range of health and social benefits were associated with the outdoor gyms. The social aspect of using the equipment was important, with participants reporting attending with friends and family. Exercising with others was associated with being more confident and feeling supported when using the equipment. Improvements to health included increased physical activity, feeling fitter and seeing improvements to physique. It was identified by the participants that more information on how to effectively use the equipment would enable greater and more effective use of outdoor gyms.

Bates et al. (2018)'s findings suggest that providing outdoor gym equipment is a promising approach to increasing physical activity that may reduce some of the complex barriers to taking part in exercise.

The overviewed outdoor gym interventions suggest that providing outdoor gym equipment is a promising approach to increasing physical activity. Findings of these interventions confirm that users of outdoor gyms benefit from a range of health and social improvements. Improvements to health included increased physical activity, losing weight, and feeling fitter. In terms of the social aspects, the UK case study confirms that participants reported attending with friends and family which may be associated with being more confident and feeling supported when using the equipment.

## 5.4. Evidence in effectiveness of playground interventions

### 5.4.1. Overview of effectiveness of playground interventions in promoting physical activity

The promotion of physical activity in children and adolescents can have great benefits that are continued throughout childhood, as it is a time when children are highly receptive to healthy behaviours (Suga et al., 2021). The UK physical activity guideline for children and young people (5 to 18 years) recommends at least 60 minutes of daily moderate or vigorous physical – mainly aerobic – activity (Department of Health & Social Care, 2019a). However, in the UK and the US, fewer than 25% of the child and adolescent population meet the recommended duration of moderate-to-vigorous physical activity (Pfledderer et al., 2022), and one promising venue for increasing physical activity in children and adolescents is the playground setting (Pfledderer et al., 2022).

A playground is usually an outdoor area and is defined as an area that has been specifically designated for play or recreation. Usually, playgrounds contain play equipment including slides, swing sets and jungle gyms, and may contain defined areas for other types of recreation such as hopscotch (Pfledderer et al., 2022).

To our knowledge, the systematic reviews that have examined the physical activity outcomes of playground interventions to date are on either school-based playground renovations (e.g., Escalante et al., 2014; Suga et al., 2021; Pfledderer et al., 2022) or green space renovations where a playground upgrade was part of wider renovations (e.g., Hunter et al. 2015; MacMillan et al. 2018). However, some of the findings of these reviews can be helpful to inform us about the effectiveness of playground renovations in promoting the physical activity of children and adolescents. This section summarises these findings before presenting the case studies.

Suga et al. (2021)'s systematic review of school-based playground interventions indicates that boys and younger children seem to gain more benefits from playground interventions. According to their review of 10 studies, female gender was negatively associated with physical activity in the playground, especially in terms of the vigorous and moderate-to-vigorous intensity categories. They infer that design of these interventions may have been unattractive to girls since their preferences were not considered during the design. Suga et al. (2021) think that older children may acquire other interests in place of physical activity as they grow up and therefore, different promotion strategies for physical activity should be considered for different age groups.

Escalante et al. (2014)'s systematic review explores the influence of playground design on physical activity: playground markings (e.g., marking on the floor with bright florescent

colours), game equipment (e.g., skipping ropes), playground markings plus physical structures (e.g., swing sets, football goal posts and basketball hoops), and playground markings plus game equipment. The authors found that the strategies analysed do have the potential to increase physical activity levels, although those interventions which included playground markings and equipment did not increase activity, whereas interventions that took the form of physical structures in playgrounds did increase physical activity.

Pfledderer et al. (2022)'s systematic review notes that, while most of the studies included in their review reported the positive effect of playground interventions on physical activity, the effect may decrease in the long term as the novelty of the playground equipment may decrease over time. Changing seasons can also influence physical activity levels of children in playgrounds: in general, deteriorating weather conditions (e.g., extreme temperatures, rain, or snow) are linked to higher levels of sedentary behaviour and lower levels of physical activity in children (Remmers et al., 2017).

In summary, systematic reviews suggest that playground interventions are effective in promoting physical activity in children. However, the design of the playground can play an important role in the effectiveness of the playground in promoting physical activity. Interests and preferences of different age groups and genders should be considered when designing a playground. Weather circumstances can affect the level of playground use. Promoting any activity regardless of intensity becomes beneficial when there is a need to decrease children's sedentary behaviours (Suga et al., 2021). Few studies have investigated the health benefits of light intensity interventions although they may be as important as moderate and vigorous activities (Suga et al., 2021).

The following two sections present the evaluation of the effectiveness of two playground interventions, one in New Zealand and the other one in Belgium.

### 5.4.2. Case study 6: Playground upgrade in Dunedin, New Zealand

This case study is based on two playground upgrades by the local authority in Dunedin, New Zealand. At one playground, ten new components, including play equipment, seating, additional safety surfacing and waste facilities were installed. At the other, two new play equipment pieces were installed, and a small modification was made to a piece of equipment (Quigg et al., 2012).

Quigg et al. (2012) assessed whether the upgrade of these two playgrounds was associated with changes in local children's physical activity levels. The study used a natural experiment design involving 5-10 year old children. At baseline, 184 children participated in the study, of

which 156 completed the 1-year follow-up assessment. A similar matched community which did not undergo park regeneration was also studied to compare the results.

To monitor physical activity, each participant was asked to wear an accelerometer (an activity monitor device) on a waist belt for 8 days at baseline and then at the follow-up data collection. In addition, a self-administered questionnaire was mailed to participants' homes at the beginning of each physical activity assessment phase to gather additional data about the individual child, the household, the family structure, and the responding adult. Height and weight of participants were measured, and the data converted to BMI, age and sex standardized z-scores. Socioeconomic deprivation information and spatial variables were also obtained from the participants' residential address (Quigg et al., 2012).

The study found a statistically significant increase in mean physical activity levels for participating children with lower BMIs, but not for those children with higher BMIs. The study also found evidence of statistically significant associations between physical activity level and participant's age, usual mode of travel to school, sex, and ethnicity (Quigg et al., 2012). However, the study did not elaborate on these associations. Quigg et al. (2012) note that, in addition to increasing physical activity, playgrounds also have benefits for social development and fundamental movement skills.

### 5.4.3. Case study 7: Play Streets, Ghent, Belgium

Since 1998, Play Streets have been organised in different Belgian cities during summer school holidays with the aim of offering children a safe space for active outdoor play in their neighbourhood. The rules and timing of the Play Street may differ across different cities, but they are all streets that are reserved for children's safe play for a specific period of time. Motorised traffic is generally prohibited, and although local traffic is allowed, this is only at a footpace so that children playing in the Play Street are not hindered or endangered by traffic.

To understand the effect of Play Streets on children's moderate-to-vigorous physical activity (MVPA) and sedentary time, D'Haese et al. (2015) studied 12 Play Street projects in Ghent that lasted at least 7 consecutive days. For each Play Street, a control neighbourhood with comparable walkability characteristics and annual household income, also in Ghent, was selected. 167 children aged 6–12 years and their parents were studied for this research.

The participating children were asked to wear an accelerometer for 8 days and their parents were asked to complete a questionnaire concerning demographic variables before the

measurement week and to complete another questionnaire concerning Play Streets after the measurement week. In half of the intervention streets, children were first measured during normal conditions and afterwards during the intervention condition, whereas in the other half of the intervention streets, children were first measured during the intervention condition and afterwards during normal conditions. In control streets, measurements were performed at the same time as in their comparable Play Street (D'Haese et al., 2015).

The study found positive effects in reducing sedentary time and increasing the MVPA of children living in Play Streets. Sedentary time from children living in the Play Street decreased from 146 minutes during normal conditions (the days that Play Streets were not in operation) to 138 minutes during the Play Street intervention, whereas the sedentary time of children in the control groups increased from 156 minutes to 165 minutes. The MVPA for children living in Play Streets increased from 27 minutes during normal conditions to 36 minutes during the Play Street intervention, whereas MVPA for children in the control groups decreased from 27 to 24 minutes (D'Haese et al., 2015).

The study concluded that creating a safe play space, close to home, in the form of a Play Street intervention, is effective in increasing urban children's MVPA and decreasing their sedentary time.

Two playground interventions were reviewed to understand the effectiveness of playground interventions in increasing physical activity of children. Evaluation of these two case studies suggest that there is a positive effect in reducing sedentary time and increasing moderate-to-vigorous physical activity of children after the introduction of playground interventions in a neighbourhood. However, this positive effect may benefit children with lower BMIs more than those with higher BMIs.

# 6. Metrics

The methods adopted to evaluate the health impacts of built environment interventions are critical for understanding the effectiveness of the interventions. The aim of this section is to summarise some of the methods used to evaluate the effectiveness of built environment interventions in increasing physical activity.

## 6.1. Methods of measuring physical activity

Description of the methods discussed below and examples of them are included in Brownson et al. (2009) and Sylvia et al. (2014). Here, a summary of the most common methods of measuring physical activity is reviewed.

### 6.1.1. Self-report questionnaires

Self-report questionnaires are one of the most common methods of measuring physical activity. They rely on the information that participants provide. Questionnaires vary by what they measure (e.g., mode, duration, or frequency of physical activity), how data are reported (e.g., activity scores, time, calories), quality of the data (e.g., measures of intensity, differentiating between habitual and merely recent activities, inclusion of leisure and non-leisure activity), and how data are obtained (e.g., paper and pencil assessment, computerised questionnaire, interview) (Sylvia et al., 2014).

Advantages of self-reported questionnaires include their cost effectiveness, ease of administration, accuracy in measuring intense activity and determining discrete categories of activity level (e.g., low, moderate, high) (Sylvia et al., 2014). However, their potential disadvantages are that self-report questionnaires are less robust in measuring light or moderate activity, assessing energy expenditure and may be limited by the dependency on written language (i.e., questions) and external factors (i.e., complexity of the questionnaire and age) (ibid).

### 6.1.2. Self-report activity diaries

Self-report diaries require participants to record physical activity in real time which provides the most detailed data and can overcome some limitations of questionnaires, including being less susceptible to recall errors (Sylvia et al., 2014). However, the diary is burdensome, particularly for individuals with cognitive dysfunction. In addition, activities that are not completed in real time could be subject to memory bias (ibid).

### 6.1.3. Direct observation

In direct observation method, an independent observer monitors and records physical activity. This method of assessment is mostly used when activity is restricted to a specific space (e.g., a playground) (Sylvia et al., 2014). It is also a popular method to assess physical activity of young children as they may have difficulty recalling their physical activity (ibid). This method is useful in gathering contextual information (e.g., location and time) and details of the physical activity (e.g., type, personalised variations to activities) (ibid). Disadvantages of this method include its high cost of time and energy, and a potential difficulty in obtaining ethical approval (ibid).

An observational method that was used in a few studies that were reviewed in this report, is the System for Observing Play and Recreation in Communities (SOPARC). This method entails dividing a park/area into distinct target areas and then systematically rotating through the areas and counting every individual, noting his/her gender, age group, race/ethnicity, and activity level (McKenzie et al., 2006). Cohen et al. (2012) used this method to assess the use of the entire park before and after the installation of the Fitness Zones in Los Angeles, USA (discussed in section 5.3.2).

### 6.1.4. Accelerometers and other devices

In recent decades, accelerometers have gained popularity given their accuracy, ability to capture large amounts of data, and ease of administration, particularly in large studies (Sylvia et al., 2014). Accelerometers measure acceleration (counts) in real time and detect movement (ibid). These counts are then translated into a metric of interest, which can be biological (e.g., energy expenditure) or physical activity patterns (e.g., stationary). Investigators can use accelerometer data to compute physical activity volume, rate, and time spent in different intensities of exercise (ibid).

However, accelerometers are expensive and require technical expertise, specialised hardware and software, and individual programming. Additionally, accelerometers also do not provide any contextual information, and some accelerometers are unable to differentiate body position (i.e., sitting, lying, standing) or walking intensity (Sylvia et al., 2014).

To evaluate the effectiveness of playground interventions in increasing physical activity of children, both Quigg et al. (2012) in case study 6 (playground upgrade in Dunedin, New Zealand) and D'Haese et al. (2015) in case study 7 (Play Streets, Ghent, Belgium) used accelerometers to monitor physical activity of playground users.

In addition to accelerometers, there are other devices that can be used to measure physical activity including pedometers, heart-rate monitors, and armbands. Pedometers measure number of steps taken, and they appear to yield the most accurate data for running and moderate walking (Sylvia et al., 2014). Heart-rate monitors provide physiological real-time data on the frequency, duration, and intensity of physical activity in an unobtrusive (e.g., they can be worn as watches or on the chest) and low-effort way (ibid). Armband technology uses motion and heat-related sensors (i.e., heat flux, and skin temperature) to measure energy expenditure and monitor metabolic physical activity (ibid).

## 6.2. Study designs

### 6.2.1. Longitudinal study vs. cross-sectional study

A longitudinal study is a research method in which researchers repeatedly examine the same individuals to detect any changes that might occur over a period of time (Caruana et al., 2015). This study design is particularly useful to examine causal associations between different interventions received and subsequent outcomes. However, the cost and time associated with this method can be considerable (ibid).

In contrast, a cross-sectional study examines different samples (or a 'cross-section') of the population at one point in time, while a longitudinal study repeatedly observes the same participants over a period of time. A cross-sectional study can be used to provide a snapshot of a group or society at a specific moment (Caruana et al., 2015).

A cross-sectional study is generally less valid for examining cause-and-effect relationships (Caruana et al., 2015). But it requires less time to be set up, and may be considered for preliminary evaluations of association prior to embarking on a longitudinal-type study (ibid).

### 6.2.2. Randomised control trial vs. natural experiment

A randomised controlled trial (RCT) is a form of scientific experiment used to control factors not under direct experimental control. For a RCT study, a number of similar people are randomly assigned to 2 (or more) groups to test a specific intervention. One group (the experimental group) has the intervention being tested, the other (the comparison or control group) has an alternative intervention or no intervention at all. The groups are followed up to see how effective the experimental intervention was. Outcomes are measured at specific times and any difference in response between the groups is assessed. This method is also used to reduce bias. (National Institute for Health and Care Excellence, n.d.)

Natural experiment (or quasi-experiment), unlike RCT, does not rely on random assignment. Instead, participants are assigned to groups based on non-random criteria. Generally, natural experiment design is used when the studied interventions are not designed for research purposes and the researchers does not have control on them (Goodman et al., 2013). Choosing suitable comparison groups is a key methodological challenge for natural experimental studies (Goodman et al., 2013, p.230).

### 6.2.3. Controlled before-and-after study

This is a type of study in which observations are made before and after the implementation of an intervention, both in a group that receives the intervention and in a control group that does not. This study design cannot rule out that something other than the studied intervention may have caused a change (UK Health Security Agency, 2020).

# 7. Conclusions and reflections

Health inequalities are differences in health status between different population groups that are unfair and avoidable. They arise because of the conditions in which people are born, grow, live, work and age (PHE, 2021a). These conditions influence people's opportunities for good health and shape their mental and physical health (PHE, 2021a). Place, or local area, has an important role to play in reducing health inequalities as health inequalities caused by the complex mix of environmental and social factors at play in the local area (PHE, 2021a, p.3).

Obesity is one of the main risk factors for diseases that are the main contributors to lower life expectancy in deprived areas (PHE, 2021b). Prevention and treatment of obesity presents a significant public health challenge. Public health experts and policy makers are increasingly interested in built environment interventions as strategies for population-wide improvements in physical activity as a means to reduce and prevent obesity and associated non-communicable diseases.

Despite the increase in guidance advocating action on the role of the built environment to improve health outcomes, the evidence base underpinning its effectiveness is still a matter of debate among the scientific and practitioner communities (PHE, 2017). Systematic reviews on the effectiveness of built environment interventions on physical activity presented a mixed but mostly positive result on the effectiveness of these interventions.

To better understand the role of the place-based built environment interventions that are intended to increase physical activity, this report, by looking at three types of built environment interventions, conducted a desk-based literature review on the effectiveness of these interventions and the methods that are used to evaluate them. The three types of built environment interventions that were selected are walking/cycling routes, outdoor gyms and playgrounds. These three types of interventions have been chosen as they are widely used and are considered to have positive impacts on the level of physical activity.

Walking and cycling are important sources of everyday physical activity (Goodman et al., 2014), and a growing number of built environment interventions aim to promote walking and cycling as active modes of transport by implementation of a walking and/or bicycling trail (Stappers et al., 2018; Ahmed-Dobson and Richards, 2022). The effectiveness of these interventions presents mostly a positive result on physical activity outcomes. Literature suggests that walking and cycling interventions increase walking and/or cycling, but the scale of the intervention, the context in which the intervention has happened, proximity to

the intervention, and the accompanying non-physical initiatives (e.g., media campaigns, and training) may increase the effectiveness of these interventions.

Three case studies (Connect 2, Fitter for Walking, and Cambridgeshire Guided Busway) were reviewed to better understand the effectiveness of UK-based interventions aimed at promoting active transportation by the implementation of a walking and/or bicycling trail. The reviewed case studies suggest that improved and newly introduced routes for walking and cycling help to increase overall physical activity levels in the local population. However, it may take time and may require additional marketing and outreach activities to increase the use and effectiveness of the improved and/or newly introduced routes. Living nearer the intervention may increase the effectiveness of interventions in increasing physical activity. Engaging communities in identifying barriers to walking and cycling on local routes and asking them to suggest solutions may increase the success of the intervention for increased active transportation.

In regard to outdoor gyms, there is some evidence that outdoor gyms improve physical activity, fitness and have other health-related outcomes, although few studies have been conducted to date. Outdoor gyms are free facilities for public use and improving physical health is central to the experiences of outdoor gym users. Increasing social connectedness is another outcome of using outdoor gyms. Evidence shows that most outdoor gym users were living in close proximity to the outdoor gym. In terms of age and gender, there was no consensus in the literature regarding which age or gender groups are most likely to use outdoor gym equipment.

Two outdoor gym interventions, one US-based and one UK-based, were reviewed to understand the effectiveness of this type of intervention. Evaluation of these two interventions suggest that providing outdoor gym equipment increases physical activity. Observation findings of these interventions confirm that users of outdoor gyms increased after the improvement was implemented. A range of health and social benefits were observed to be associated with the outdoor gym interventions. Improvements to health included increased physical activity, losing weight, and feeling fitter. In terms of social aspects, the outdoor gyms are perceived as spaces where local people can find social connectedness while participating in structured physical activity at no cost. The UK case study confirms that participants reported attending with friends and family which may be associated with being more confident and feeling supported when using the equipment.

As discussed by systematic reviews, playground interventions are effective in promoting physical activity and reducing sedentary time in children and adolescents. Boys and younger children seem to gain more benefits from playground interventions. Hence, interests and

preferences of different age groups and genders should be considered when designing a playground. The design of the playground can play an important role in the effectiveness of the playground in promoting physical activity. The effectiveness of playground interventions in promoting physical activity may decrease in the long term as the novelty of the playground equipment may decrease over time.

Two playground interventions, one in New Zealand and the other one in Belgium, were reviewed to understand the effectiveness of playground interventions in increasing physical activity of children. Evaluation of these two case studies suggest that there is a positive effect in reducing sedentary time and increasing moderate-to-vigorous physical activity of children after the introduction of a playground intervention in a neighbourhood. However, this positive effect may benefit children with lower BMIs more than those with higher BMIs, and those living closer to the intervention.

Given the use of various study design and reporting methods, as well as the wide array of outcome measures reported, drawing conclusions on the effectiveness of built environment interventions on physical activity is challenging but mostly positive (MacMillan et al., 2018). Furthermore, variations in the extent, content and context of interventions may have a significant impact on the results of the studies (Stappers et al., 2018) and mean that outcomes may not necessarily be transferable to other contexts. For example, European countries often have a higher prevalence of active modes of transport when compared to countries like the US and Australia, and this may influence the effectiveness of walking or cycling interventions in those contexts (Pucher and Buehler, 2008).

Although most of the studies use moderate-to-vigorous physical activity (MVPA) as a standard by which to measure physical activity, promoting any activity regardless of intensity becomes beneficial where there is a need to decrease sedentary behaviours. Few studies have investigated the health benefits of light intensity interventions although they seem as important as moderate and vigorous activities. Light activity should be promoted, evaluated, and studied as it can contribute to an increase in active behaviour (Suga et al., 2021).

Literature suggests that it is important to consider the social environment (e.g., social support, social capital) alongside the built environment in the initiation and maintenance of physical activity behaviour change (Hunter et al., 2015). There is also a perception that the social environment is an inherent part of physical activity programmes, for example, walking groups, where people can meet and get out and about (Prior et al., 2014) can increase physical activity.

The evidence also suggests that it is important to add programmes to the built environment interventions to maximise their effectiveness. For example, Hunter et al. (2015)'s systematic review shows the positive effect when a physical change to the built environment is combined with a physical activity programme for increasing urban green space use and physical activity of users. In addition, social media campaigns can provide effective support for behavioural changes (Smith et al., 2017).

Evidence for the effectiveness of built environment interventions on physical activity of different population groups is limited. Associations between the built environment interventions and physical activity for children seem to be more complex than for adults, and some studies report inconsistencies in terms of their evidence base (McGrath et al., 2015). According to Smith et al. (2017), even less is known about the effectiveness of built environment interventions on physical activity of older adults.

The findings of this report suggest that the built environment has great potential not only to improve health outcomes but also to have wider social impacts (PHE, 2017), including building social connections and promoting social interaction. Hence, allocating substantial resources to invest in the built environment in the places most in need should be a priority (The Commission on Creating Healthy Cities, 2022). Organisations such as housing associations with long term stewardship responsibilities, like Places for People, are in a pivotal position to continually create, improve, and maintain the physical environments that support communities to be healthy. However, providing the physical infrastructure may not be sufficient on its own, and promoting the use of facilities through local programmes and media communication can support communities to make the most of the investment made in their local built environment.

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