Public Health England

Protecting and improving the nation's health

Improving access to greenspace
A new review for 2020

About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing and reduce health inequalities. We do this through world-leading science, research, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health, and a distinct delivery organisation with operational autonomy to advise and support government, local authorities and the NHS in a professionally independent manner.

Public Health England
Wellington House
133-155 Waterloo Road
London SE1 8UG
Tel: 020 7654 8000
www.gov.uk/phe
Twitter: @PHE_uk
Facebook: www.facebook.com/PublicHealthEngland

Published March 2020
PHE publications
gateway number: GW-1158

PHE supports the UN
Sustainable Development Goals

Contributors

Harmony Ridgley – Public Health England

Angela Hands – Public Health England

Rebecca Lovell – European Centre for Environment and Human Health, University of Exeter

Carl Petrokofsky – Public Health England

Aimee Stimpson – Public Health England

Alison Feeley – Public Health England

Andrew Bedford – Camden and Islington Councils

Ben Fenech – Public Health England

David Leeman – Public Health England

Eleanor Sykes – Public Health England

Gabriele Price – Public Health England

Hamira Sultan – Birmingham City Council

Helen Macintyre – Public Health England

John Thorne – Camden and Islington Councils

Julie Hammon – Dorset AONB

Karen Exley – Public Health England

Martin Seymour – Norfolk County Council

Michael Brannan – Public Health England

Collaborators

Alice Stonham – Public Health England

Allan Baker – Public Health England

Anita Counsell – Public Health England

Benjamin Brown – Landscape Institute

Clare Olver – The Mersey Forest

Clare Warburton – Natural England

Dave Solly – Natural England

Dave Stone – Natural England

Delia Beck – Sport England

Graham Duxbury – Groundwork

Gunveer Plahe – Public Health England

James Stuart-Evans – Public Health England

Jane Houghton – Natural England

Judith Eling – Surrey County Council

Julia Thrift – Town and Country Planning Association

Karen Saunders – Public Health England

Michael Chang – Public Health England

Nick Clarke – Public Health England

Nick Grayson – Birmingham City Council

Peter Massini – Greater London Authority

Rachel Partridge – Dorset County Council

Rachel Toms – Public Health England

Raquel Duarte-Davidson – Public Health England

Robert Pearce – The Parks Alliance

Robie Kamanyire – Public Health England

Sarah Preston – Natural England

Sari Kovats – London School of Hygiene and Tropical Medicine

Trudi Else – Sport England

Contents

Glossary

Term	Definitions
25YEP	25 Year Environment Plan.
AONB	Area of Outstanding Natural Beauty.
BAME/ BME	Black and Minority Ethnic.
Bluespace/ Blue infrastructure	Outdoor environments, either natural or built, that prominently feature water such as streams, ponds, canals and other water bodies.
CIL	The Community Infrastructure Levy is a levy that local authorities can choose to charge on new developments in their area. The money should be used to support development by funding infrastructure that the council, local community and neighbourhoods want.
Ecosystem services	The components of nature that are directly and indirectly enjoyed, consumed, or used in order to maintain or enhance human well-being.
Environmental net gain	Environmental Net Gain means improving all aspects of environmental quality through a scheme or project.
GLUD	The Generalised Land Use Database classification has been developed which allocates all identifiable land features on Ordnance Survey MasterMap into simplified land categories.
Green infrastructure	A network of multi-functional green space, urban and rural, which can deliver a wide range of environmental and quality of life benefits for local communities. References to green infrastructure in this guidance also apply to different types of blue infrastructure where appropriate.
Greenspace	Any area of vegetated land, urban or rural. This includes both public and private spaces such as parks, gardens, playing fields, children's play areas, woods and other natural areas, grassed areas, cemeteries and allotments, green corridors, disused railway lines, rivers and canals, derelict, vacant and contaminated land which has the potential to be transformed.
Green stormwater Infrastructure (GSI)	An approach to moving stormwater away from the built environment aiming to reduce surface water flooding, improve water quality and enhance the amenity and biodiversity value of the environment. GSI attempts to mimic nature and uses simple landscaping features such as green roofs, rain gardens and bioswales to slow, collect, infiltrate, and filter stormwater. Similar to Sustainable Urban Drainage Systems (SuDS).

H2020	Horizon 2020 is the main European funding programme for research and innovation and aims to ensure that Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.
HiAP	Health in All Policies is an approach to policies that systematically and explicitly takes into account the health implications of the decisions we make; targets the key social determinants of health; looks for synergies between health and other core objectives and the work we do with partners; and tries to avoid causing harm with the aim of improving the health of the population and reducing inequity.
HWB	A Health and Wellbeing Board is a forum where key leaders from the health and care system work together to improve the health and wellbeing of their local population and reduce health inequalities. Each Local Authority in England has a fully operational Health and Wellbeing Board.
HWBS	The Health and Wellbeing Strategy outlines the priority areas and how to work together to improve people's health and reduce health inequalities that exist in the population.
ICS	Integrated Care Systems are a way of working, collaboratively, between a range of health and social care organisations, to help improve people's health. It's when organisations work together in a shared way; sharing budgets, staff, resources where appropriate, to best meet people's needs.
IMD	The Index of Multiple Deprivation, is the official measure of relative deprivation for small areas in England.
JSNA	The Joint Strategic Needs Assessment is produced collaboratively by local leaders and identifies the current and future health and wellbeing needs of the local population.
Local planning authority	The local planning authority is the public authority whose duty it is to carry out specific planning functions for a particular area. All references to local planning authority apply to the district council, London borough council, county council, Broads Authority, National Park Authority and the Greater London Authority, to the extent appropriate to their responsibilities.
LNP	Local Nature Partnerships are a coalition of organisations, businesses and individuals from a variety of sectors tasked with improving the local natural environment.

Local plan	**Local Plans set out the strategic priorities for development of an area and cover housing, commercial, public and private development, including transport infrastructure, along with protection for the local environment. They comprise a series of documents that should set out clear guidance on what development will and won't be permitted in your area.**
MENE survey	The Monitor of Engagement with the Natural Environment survey provides trend data for how people experience the natural environment in England.
MET	One metabolic equivalent (MET) is defined as the amount of oxygen consumed while sitting at rest and is equal to 3.5 ml O2 per kg body weight x min.
Natural capital	The elements of nature that directly or indirectly produce value to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions.
Natural capital accounting (NCA)	Provides a variety of mechanisms to calculate the total stocks and flows of natural assets, resources and services within a designated area or ecosystem, allowing environmental considerations to be taken into account in making policy and investment decisions. NCA produces formal accounts using methods and reports that are recognisable to those working within finance and management.
Nature connection	Connection to nature refers to an individual's subjective sense of their relationship with the natural world. There is emerging evidence that connection to nature is associated with certain wellbeing, educational outcomes and pro-environmental behaviours.
NDVI	The Normalised Difference Vegetation Index is an index that describes the difference between visible and near-infrared reflectance of vegetation cover and can be used to estimate the density of green on an area of land.
NERC	The Natural Environment Research Council commissions new research, infrastructure and training to advance environmental science.
NIHR	The National Institute for Health Research funds health and care research and works in partnership with the NHS, universities, local government, other research funders, patients and the public.
NPPF	The National Planning Policy Framework (NPPF) sets out the Government's economic, environmental and social planning policies for England.
ORVAL	The Outdoor Recreation Valuation tool is a web-based tool that predicts the number of visits to existing and new greenspaces in England and estimates the welfare value of those visits in monetary terms.

Pocket park	Pocket parks are small green areas of public space, mostly seen in urban settings.
Public realm	All parts of the built environment where the public has free access. It encompasses all streets, squares, and other rights of way, and are the everyday spaces that are used by people to socialise, play, work, shop, traverse and use for a range of activities.
QALY	A Quality Adjusted Life Year is a measure of the state of health of a person or group in which the benefits, in terms of length of life, are adjusted to reflect the quality of life. One QALY is equal to 1 year of life in perfect health.
REAT	The Residential Environment Assessment Tool is a measure of quality of the built environment in the UK at postcode level.
Section 106	Section 106 of the Town and Country Planning Act 1990 (as amended), commonly known as s106 agreements, are a mechanism which make a development proposal acceptable in planning terms, that would not otherwise be acceptable. They are focused on site specific mitigation of the impact of development.
Social prescribing	Social prescribing enables GPs, nurses, link workers and other professionals to refer people to a range of local, non-clinical services. It seeks to address people's needs in a holistic way and can involve a variety of activities which are typically provided by voluntary and community sector organisations.
SPD	Supplementary Planning Documents add further detail to the policies in the Local Plan. They can be used to provide further guidance for development on specific sites, or on particular issues, such as design.
Systematic review	A systematic review attempts to identify, appraise and synthesize all the empirical evidence that meets pre-specified eligibility criteria to answer a specific research question. Researchers conducting systematic reviews use explicit, systematic methods that are selected with a view aimed at minimizing bias, to produce more reliable findings to inform decision making.
UN Sustainable Development Goals	The Sustainable Development Goals (SDGs) are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, peace and justice.
VCSE	Voluntary, Community and Social Enterprise.

Foreword


© Guzelian

From the moment we are born, through to old age, the environments we live in shape our lives and our wellbeing. Having a safe home, a sufficient income and support networks around us make a substantial contribution to a life in good health. And the importance of our surroundings also extends to our natural environment. The COVID-19 pandemic has made many of us all the more aware of how much we value and rely on our outdoor spaces to support our health and wellbeing.

There is increasingly compelling evidence showing that access to greenspaces really matters for our health.

Anyone who loves being outdoors might instinctively feel a boost from spending some time in our parks or woodlands, but it is now formally recognised that green environments are associated with reduced levels of depression, anxiety and fatigue and can enhance quality of life for both children and adults.

We gain physically too. People with better access to greenspace enjoy a wide range of health benefits from lower levels of cardiovascular disease through to maintaining a healthier weight.

It should be a concern for all of us, however, that evidence also shows access to good quality greenspaces such as parks, woodlands, fields or allotments varies greatly depending on where we live. The most economically deprived areas often have less available public greenspace, meaning people in those communities have fewer opportunities to reap the benefits.

But there is much we can and must do, and Improving Access to Greenspace – A new review for 2020 builds on our 2014 briefing on this topic, highlighting new evidence and actions to help local areas consider how good-quality greenspace can support the delivery of health, social, environmental and economic priorities, at a relatively low cost.

We hope this report will help you identify levers that are relevant to you locally and that can be used to build and support a case for creating and maintaining quality greenspaces, ultimately improving the wellbeing of local communities and helping to reduce health inequalities.

Executive summary

Greenspace, such as parks, woodland, fields and allotments as well as natural elements including green walls, roofs and incidental vegetation, are increasingly being recognised as an important asset for supporting health and wellbeing. This ‘natural capital’ can help local authorities address local issues that they face, including improving health and wellbeing, managing health and social care costs, reducing health inequalities, improving social cohesion and taking positive action to address climate change.

Evidence shows that living in a greener environment can promote and protect good health, and aid in recovery from illness and help with managing poor health. People who have greater exposure to greenspace have a range of more favourable physiological outcomes. Greener environments are also associated with better mental health and wellbeing outcomes including reduced levels of depression, anxiety, and fatigue, and enhanced quality of life for both children and adults. Greenspace can help to bind communities together, reduce loneliness, and mitigate the negative effects of air pollution, excessive noise, heat and flooding. Disadvantaged groups appear to gain a larger health benefit and have reduced socioeconomic-related inequalities in health when living in greener communities, so greenspace and a greener urban environment can also be used as an important tool in the drive to build a fairer society.

However, population growth and consequent urbanisation combined with competing demands for land use and budgetary constraints, are putting much of our existing local, accessible greenspace under threat. This report makes the case that we must not lose sight of our growing population’s need for it. It is intended to provide Local Authorities, particularly public health teams, with the tools to make the case for maintaining or even increasing provision of and equitable access to greenspace and growing the wider network of green infrastructure, especially through the planning system.

In supporting the delivery of local health, social, environmental and economic priorities, good quality greenspace has the potential to deliver substantial benefits for public health and for wider local priorities at a relatively low cost. Despite this, it can be challenging to make a compelling case, and often greenspace is still seen as a liability rather than an asset. The full extent of the benefits can be unrealised because they are difficult to measure, cross local authority boundaries, or are accumulated over an extended time period. Natural capital accounting methodology and tools have now evolved to support local government to understand the true value of their green estate.

Some recent valuations have estimated that:

- £2.1 billion per year could be saved in health costs if everyone in England had good access to greenspace, due to increased physical activity in those spaces
- in Birmingham, the annual net benefit to society of their parks and greenspace is nearly £600 million, which includes £192 million in health benefits
- in Sheffield, for every £1 spent on maintaining parks, there is a benefit of £34 in health costs saved, with local residents being the primary beneficiaries
- in England and Wales, houses and flats within 100 metres of public greenspace are an average of £2,500 more expensive than they would be if they were more than 500 metres away – an average premium of 1.1% in 2016, suggesting that the public places a value on being near to greenspace

Local authorities play a vital role in:

- providing new, good quality greenspace that is inclusive and equitable
- improving, maintaining and protecting existing greenspace
- increasing green infrastructure within public spaces and promoting healthy streets
- improving transport links, pathways and other means of access to greenspace, and providing imaginative routes linking areas of greenspace for active travel

Achieving these outcomes requires concerted effort and close partnership with other agencies, bringing public health and local healthcare and social care providers together with planning departments, parks and leisure management, transport providers, architects, developers, and the communities who will be using these spaces. Local policies and strategies that include requirements for greenspace based on local needs, will help councils and the local NHS deliver on ambitions for healthy communities, whilst contributing to wider local priorities such as tackling climate change, reducing social isolation and improving the local economy.

This report offers policy, practice and research recommendations for local government and those working in partnership with it.

Policy

Consider local green (and blue) space to be critical assets for maintaining and supporting health and wellbeing in local communities. The evidence base linking health and greenspace is compelling and encourages fresh thinking about the way these spaces can help meet local priorities.

Ensure that local policies and strategies are informed by evidence of need for sufficient access to greenspace . Local strategies, such as the Joint Strategic Needs Assessment (JSNA) and the Joint Health and Wellbeing Strategy (JHWS) can define

how greenspace can be used to meet the current and future health needs of the population, and the part green infrastructure can play in wider health and wellbeing strategies. It is crucial that health priorities laid out in the JSNA and JHWS are reflected in local planning strategies, especially the Local Plan, which sets out the strategic priorities for development of an area. This will support the case for specific planning standards to be implemented to address health needs, or help to defend planning decisions based on health and wellbeing grounds. Developing a green infrastructure strategy and supplementary planning documents (SPDs), if appropriate, will also support the protection and enhancement of green infrastructure.

Prioritise improving access to greenspace and creating greener communities especially in areas of deprivation or where there is poor or unequal access, as an important part of the wider plan to reduce health inequalities locally. Greener neighbourhoods benefit everyone, but appear to disproportionately benefit disadvantaged groups, and socioeconomic-related inequalities in health are lower in areas with greater access to greenspace. Improvements must be carefully planned and purposeful consultation must occur at all stages in order to provide equitable, sustainable benefits and to ensure health inequalities are not inadvertently exacerbated.

Local practice

Support meaningful engagement across local government functions and the community to understand the actual and potential local benefits of greenspace and reveal the complex and diverse ways greenspace is thought about and used. This knowledge will lay the groundwork for conducting a valuation exercise.

Consider whether a formal valuation of benefits is necessary to strengthen the case for the creation, revitalisation and maintenance of greenspace. This may be done using monetary, non-monetary or a combination of valuation techniques. Being able to demonstrate the value of greenspaces will help to ensure they are taken into account when difficult local finance decisions must be made

Identify and factor in resilient funding arrangements for the maintenance of greenspace as early as possible, so that it can continue to provide benefits in the long term. Spending or investment decisions need to take account of the potential impact on health and wellbeing as well as future financial sustainability, and this gives local public health teams and the NHS an opportunity to engage in the decision-making process.

Establish interventions, such as green social prescribing initiatives, that will support people who do not use greenspace to begin using it. Programmes to support social engagement or to facilitate participation in activities coupled with improvements to the physical environment, are an effective approach to enable people to start using these spaces and to continue to use them.

Work with local NHS systems and professionals, including Sustainability and Transformation Partnerships and Integrated Care Systems, to promote the role greenspace plays in both individual and population health outcomes. This will support the health service's ambition to take more action to prevent poor health and to use green assets, through initiatives such as social prescribing, as part of the overall plan to achieve this aim.

Local research

Develop persuasive, evidence-informed case studies that highlight the impact that accessible greenspace has on local health outcomes, especially for disadvantaged groups. Monitoring and evaluating local changes in access to greenspace, in conjunction with health data over time, will cultivate a better understanding of the benefits and value of greenspace for health. . This information can be developed into useful case studies to highlight what works, for whom and how.

Support robust evaluation of local greenspace interventions to help build a broader evidence base. It is vital to use valid and reliable measures of data collection. This will help to reduce the heterogeneity of research on health inequality and access to greenspace. Wherever possible, embed a thorough evaluation from the inception of new schemes.

Improving access to greenspace: A new review for 2020 was undertaken in 2019, prior to the COVID-19 pandemic. Data collected during the lockdown period has captured information about people's ability to access greenspace, inequalities in access, and feelings and values about the natural environment. This data continues to be gathered and analysed. PHE intends to collaborate with other governments departments to present the new evidence in a future publication.

1. Introduction

"One touch of nature makes the whole world kin."

– William Shakespeare

A time of challenge and opportunity

Greenspace can play an important role in our daily experience of life – be it playing, being active, relaxing, or even commuting through a greenspace on the way to work. There is now a substantial body of evidence supporting the value of green (and blue) spaces to our health, and these spaces are also important for helping to maintain or enhance the wider environment and to support biodiversity.

Although we all use public space every time we step outside our front door, much of the public realm comprises streets and communal amenity space that is not designed to promote good public health (1, 2). Traditionally, there has been a reliance on community parks to underpin many aspects of people's health in urban environments, rather than looking at the totality of an area's network of multifunctional greenspace - its green infrastructure (GI).

As urban areas expand or become denser, the amount of good quality greenspace is likely to decline, unless determined efforts are made to maintain and/or increase it. The Committee on Climate Change found that the total proportion of urban greenspace in England declined by 8 percentage points between 2001 and 2018, from 63% to 55% (3). But this is not just an urban issue. Access to greenspace is also relevant in the rural context, where it might refer to decisions around common land, rights of way, enclosing areas for farming and development of green belt areas.

Today we can look at greenspace with a deeper understanding of the wider determinants of health, of which both the built and the natural environment are fundamental pillars. Broadly, it is thought that greenspace is linked to health and wellbeing in a number of ways:(4, 5)

- improving access to greenspace promotes healthy behaviours, such as engaging in physical activity and other recreation, and connecting those spaces together can encourage active travel
- greenspace also can improve social contacts and give people a sense of familiarity and belonging – cleaner, greener communities are places where people wish to live and work: they can promote social contact and connectivity, foster a sense of belonging, reduce isolation and loneliness and encourage a connection to nature
- greenspace supports the development of skills and capabilities – particularly for young people, there is emerging evidence that spending time in greenspace is

associated with a range of benefits including improved motor skills, better academic performance and increased concentration

- nearby greenspace, and green features such as pocket parks, street trees, green walls and roof gardens, also mediate potential harms posed by the local environment – it can help to reduce exposure to air pollution, reduce the urban heat island effect, and mitigate excessive noise and reduce flood risk, all of which can impair both physical and mental health

Figure 1: Ways in which greenspace may be linked to positive health outcomes

For all these reasons, improving access to quality greenspace has the potential to improve health outcomes for the whole population. However this is particularly true for disadvantaged communities, who appear to accrue an even greater health benefit from living in a greener environment (5). This means that greenspace also can be an important tool in the ambition to increase healthy life expectancy and narrow the gap between the life chances of the richest and poorest in society (6).

This report aims to bring these disparate strands together in one document. It presents a summary of evidence linking greenspace and health that furthers understanding of the benefits greenspace can provide. It looks at ways that greenspace can be formally valued so that fair and informed decisions can be made at a local level and considers how local authorities and public health teams can help communities have better access to high quality greenspaces and support everyone to use the green spaces available to

them. The report offers practical advice on levers local authorities and other bodies can use to support the creation of new greenspace or to improve or maintain existing greenspace. It presents case study examples from local areas that have taken imaginative steps to build on the evidence and examines different ways in which high-quality greenspace can both promote public health and wellbeing, save public money and deliver on ambitions for healthy communities while contributing to wider local priorities around climate change, social isolation and the local economy.

Greenspace and green infrastructure

Definitions of greenspace vary, and similar concepts can be described by different names within the literature, with terms such as ‘natural environment’, ‘open space’ and ‘green infrastructure’ often used interchangeably. For the purpose of this document, the following definitions are used.

Greenspace is any area of vegetated land, urban or rural.

Green infrastructure is “a network of multi-functional greenspace, urban and rural, which is capable of delivering a wide range of environmental and quality of life benefits for local communities.”(7) It can include parks, playing fields, other areas of open space, woodland, allotments, private gardens, sustainable drainage features, and ‘blue infrastructure’ such as streams, ponds, canals and other water bodies. It also includes ‘incidental’ features such as green roofs and walls, street trees, and small pockets of vegetation that contribute to a green urban fabric.

Types of greenspaces (8, 9) are:

- public parks and gardens – including urban and country parks, and formal gardens
- private gardens or grounds – private gardens and school and institutional grounds
- amenity greenspace – residential, business and transport amenity space, including communal recreation spaces, domestic gardens, informal recreation space, greenspace around housing, town and village greens
- play space for children and teenagers
- sports areas – playing fields, golf courses, tennis courts, bowling greens and other sports areas
- green corridors – green access routes including green cycle ways, and routes along canals and rivers
- natural and semi-natural greenspace – woodland, open semi-natural, open water, beach, foreshore or manmade
- allotments and community growing spaces
- burial grounds – churchyards and cemeteries
- other functional greenspace camping and caravan parks, and areas undergoing land use change

Blue space

It is becoming increasingly clear that time spent in ‘blue space’ – near water – may also improve our mental and physical health (10). Blue space includes the sea, coastlines, rivers, lakes, canals, waterfalls and fountains. This report does not specifically review the evidence for blue space and health and wellbeing, however blue spaces were included in the wider literature review on health equities (see Appendix C).

When designing and planning greenspace and parks and other aspects of the natural environment, blue spaces should be considered as part of the whole. A water feature can help revitalise an urban area and have dramatic impacts on people’s behaviour. A good example is the ‘Mirror Pool’ fountain, which acts as a public forum for Bradford city centre, particularly in summer(11). The fountain is part of a wider, multi-feature landscaped area which inspires physical activity and social connection through its openness and accessibility: interaction with the water, for example, is encouraged.

Wider ecosystems

There are several benefits greenspace can provide that contribute to health, for example through carbon capture, water purification and improving biodiversity. This report recognises these wider ecosystem services but focusses on the health benefits that result from access to greenspace, which is defined here as proximity to, accessibility or use of greenspace.

The national policy context

Government policy increasingly recognises the importance of greenspace in people’s health and wellbeing for promoting good health, prevention of poor health and treatment and recovery from illness and injury. The Government’s 25 Year Environment Plan, ‘A green future: Our 25-year plan to improve the environment’ (25YEP) (12) acknowledges the essential role that the natural environment and greenspace play in people’s physical and mental health, and aims to improve population health and wellbeing by forging a closer connection between people and the natural environment.

Commitments to action include those that aim to improve access to greenspace, for instance by creating better green infrastructure, and those that encourage people to engage more, for example through structured programmes that link them to greenspace. The NHS has committed to take more action on prevention and sees the use of green assets as part of the overall plan to achieve this goal. The NHS Long-term Plan (LTP) outlines how Integrated Care Systems will increasingly work with local government at ‘place’ level, focusing on population health, in recognition of the role which the wider determinants of health play in supporting good health and preventing illness (13). The NHS LTP describes the intention to expand the use of social

prescribing including using green social prescriptions, supported by local accessible greenspace.

Both the NHS and other government departments recognise the crucial importance of access to good quality greenspace as a key factor for health. This is reflected in a wide range of policies across Government including the Childhood Obesity Strategy (14); Everybody Active, Every Day (15); Loneliness Strategy (16); Clean Air Strategy (17); Sporting Future (18); Prevention is Better than Cure (19); Cycling and Walking Investment Strategy (20); 5-year Forward View for Mental Health (21); Integrated Communities Action Plan (22) ; and is one of the UN Sustainable Development Goals (23). It will also be key in achieving the mission laid out in the Industrial Strategy Grand Challenge to ensure that people can enjoy at least 5 extra healthy, independent years of life by 2035, while narrowing the gap between the experience of the richest and poorest (6).

Government has made a commitment to develop a practical framework of green infrastructure standards that will help deliver more good quality green infrastructure consistently across England to achieve health and other outcomes (12). These standards are expected to be incorporated into national Planning Practice Guidance (PPG) (see Chapter 6). The government is also exploring ways to secure the future of parks, one of the most frequently visited types of greenspace, by examining new approaches to the financing and management of parks now and for the future (24).

Recent resources include NHS England's Healthy New Towns Putting Health into Place, which gives detailed lessons from NHS England's Healthy New Towns Programme (25). A key component of the programme is to ensure that all major new housing developments have easy access to greenspace to create the right conditions for people to engage in physical activity, healthy play, active travel and to inspire healthy eating. It also puts strong emphasis on connecting and involving communities.

2. Understanding the benefits of greenspace

"Spending time in the natural environment – as a resident or a visitor – improves our mental health and feelings of wellbeing. It can reduce stress, fatigue, anxiety and depression. It can help boost immune systems, encourage physical activity and may reduce the risk of chronic diseases such as asthma. It can combat loneliness and bind communities together."

– 25 Year Environment Plan (12)

There is general recognition that much of what keeps us healthy lies outside the NHS and social care system, from good housing to well-designed high streets and transport systems that promote active travel. We know that there are a range of 'green' design factors in the built environment which help keep people healthy and can make healthier lifestyles an easier option (25-27).

Many of the greatest health challenges in society today have changed since 19th century health campaigners first saw the benefit of securing open spaces to act as the lungs of our cities; creating purer air and giving people places for healthful exercise and social engagement (28, 29). Our new challenges still include clean air, but now also include physical inactivity and social isolation as well as non-communicable health conditions such as dementia, obesity, type 2 diabetes, cardiovascular disease and mental ill-health. (30) The financial costs to the NHS and other agencies is significant. It has been estimated that the cost to the NHS just to manage these conditions is £62 billion per year, with the cost to wider society being £184 billion per year (30, 119-120). There is also an increasing impact on local authorities' social care budgets to care for those who are affected (121).

Since the first publication of Improving Access to Greenspace in 2014, there has been a substantial increase in the quantity of research focused on the linkages between greenspace and health outcomes, as well as on the ways in which the environment can be used, designed or managed to promote health outcomes. The evidence base is now developed enough to allow evidence syntheses and meta-analyses. These have investigated linkages between exposure to greenspace and both physical and mental health outcomes including mortality, stroke, coronary heart disease, maternal outcomes, stress and cognitive function; greenspace and health behaviours such as engaging in physical activity and recreation; the health impact of specific types of greenspace and proximity; factors determining use of greenspace and outcomes of specific types of greenspace interventions. The improved evidence base has extended our understanding of who benefits and how, to what extent, and in what ways.

As the field matures, there is a greater use of robust study designs, particularly in relation to the health, wellbeing and behavioural outcomes of environmental interventions. However, there are still limitations within the evidence base including high levels of heterogeneity, poor quality studies, uncertainty about transferability between contexts and populations, inconsistent terminology and lack of evidence relating to certain subgroups. There is a need for greater focus on what works, understanding causal pathways, and clarifying the health associations for different settings and population groups. More information about the evolution of the evidence base can be found in Appendix A.

However, despite the limitations, there is still substantial evidence of a range of positive outcomes linked to living in greener communities and having greater exposure to greenspace. Below is a summary highlighting some of these physical and mental health benefits. Within this report, all associations described are statistically significant. Evidence from systematic reviews was used where possible. Further detail can be found in Appendix B.

The physical health benefits of greenspace

Our findings suggest:

- there is a small body of evidence that has investigated the linkages between greener living environments and mortality – a robust meta-analysis found an association between people living in high versus low greenspace neighbourhoods and all-cause and cardiovascular mortality in adults, with outcomes found to be strongest for those in the most deprived groups (31, 32)
- there is generally consistent evidence from good or adequate quality studies, of positive associations between greener living environments and higher self-assessed general health (33, 34) – positive associations were also found between the quality of the greenspace and self-assessed general health
- an extensive systematic review and meta-analysis found that people who have greater exposure to greenspace have more favourable salivary cortisol (a physiological marker of stress), heart rate and heart rate variability, diastolic blood pressure, high-density lipoprotein (HDL) cholesterol and incidence of type 2 diabetes – the greatest benefit was found for groups with lower socioeconomic status and for those living in the most deprived areas (33)
- several studies, including two systematic reviews, have looked at associations between residential greenspace and maternal and birth outcomes – these found that higher levels of greenspace in the living environment are associated with more favourable birth weight (33, 35, 36)
- a systematic review found that, although there is some variation by demographic factors, greener urban neighbourhoods are associated with maintaining a healthier weight and may improve obesity-related health outcomes (37)

- several systematic reviews have shown that, although evidence is mixed, people living in greener urban environments are more likely to meet the national physical activity recommendations and less likely to be overweight or obese (38, 39), with the strength of the association varying across demographic groups and contexts – there is also some evidence that physical activity in greenspace is more beneficial than activity in other settings, with reduced feelings of tension, confusion, anger and depression, and increased energy and feelings of revitalisation and positive engagement (40)
- there is evidence from individual studies of a relationship between exposure to natural environments and the maintenance of a healthy immune system and reduction of inflammatory-based diseases (41-43)
- there is some evidence, though inconsistent, of a positive association between greater exposure to greenspace and attention and working memory in children and young people (33, 44, 45)

The mental health benefits of greenspace

Our findings indicate:

- systematic reviews have found that greater exposure to greenspace enhances quality of life for both children and adults through multiple social, economic, and environmental means (46-48)
- several systematic reviews have found positive associations between a greener living environment and mental wellbeing outcomes in children and young people, this includes: emotional wellbeing, reduced stress and improved resilience, and higher health-related quality of life – several reviews found evidence of a link between greater exposure to greenspace and reduced rates of hyperactivity and inattention (44-46)
- in adults, several systematic reviews have found an association between nature in the urban environment and positive emotions – evidence also shows links between a greener living environment and higher life satisfaction and reduced mental distress, and strong evidence of improved self-rated mental health and reported stress (32, 49, 50)
- greener environments have been shown to reduce levels of depression, anxiety, and fatigue (4, 5) – the beneficial effects are greatest for socioeconomically disadvantaged groups, with inequality in mental wellbeing narrower in deprived groups with good access to greenspace, compared to those with less access (51, 52)
- for children and young people, the effects of greenspace are influenced by developmental stage and both the type and accessibility of greenspace (5, 44)
- for adults, factors such as age, gender and physical activity behaviours appear to moderate relationships between greenspace exposures and mental health outcomes (5)

Mental ill-health

The physical health, social and economic consequences of poor mental health are substantial. Compared to the general population, people with mental illness are more likely to have physical health conditions, a lower life expectancy, higher rates of health risk factors such as smoking, alcohol and drug misuse, and are more likely to experience social inequalities such as isolation, unemployment and homelessness or poor housing (111).

Poor mental health is estimated to incur an economic and social cost of £105 billion a year in England, with treatment costs expected to double in the next 20 years (112-114). In addition to these costs there are incalculable costs to individuals, families and communities due to lost potential and limited life chances.

Ways greenspace can promote positive health and wellbeing outcomes

Physical activity

Physical activity is one of the cheapest and most effective forms of medicine and has been described as a ‘miracle cure’ by the UK Chief Medical Officers (53), helping to prevent and manage many common chronic conditions, for example type 2 diabetes, cardiovascular disease, cognitive impairment and some cancers. There is strong evidence that regular physical activity supports both individual and community outcomes such as increasing educational attainment, improving self-esteem and reducing social isolation. Physical inactivity is a top 10 cause of the disease burden in England (117). It is responsible for one in 6 UK deaths and is estimated to cost the UK £7.4 billion annually (including £0.9 billion to the NHS alone) (118).

Greenspace can support higher levels of physical activity, and there are indications that people may enjoy and be more likely to repeat an activity if it takes place in a natural setting (40). The National Institute for Health and Care Excellence (NICE) suggests that greenspace should be used whenever possible to support people of all ages and abilities to move more, improving their health and wellbeing and reducing the need for direct, more costly interventions (54). Particularly for older people, physical activity can support sustained independence through increasing strength, stamina and balance, and by contributing to improved social functioning, reducing loneliness and social isolation (55). Improving conditions for walking and cycling, for instance by providing accessible, well designed green infrastructure and ‘healthy streets’, has been identified as one of the easiest ways – at population level – to build health-promoting physical activity into daily life (20).

Recreational activities

The Monitor of Engagement with the Natural Environment (MENE) survey gives an annual snapshot of people's recreational visits to the natural environment in England (56). The survey, which was undertaken between 2009 to 2019, identifies a variety of reasons people visit these spaces, with health and exercise, walking the dog, to relax and unwind, or just to enjoy the scenery being most popular (56). Recent analysis of data from the MENE survey indicates that adults who had 2 hours of recreational activity per week in greenspace are more likely to have better self-reported health and wellbeing than those who do not (57). Benefits occur regardless of how those 2 hours are achieved (one long, or several short visits), demographic characteristics (urban or rural, high or low deprivation background, age, with or without a long-term condition or disability), or the type of natural environment visited. This positive effect is unlikely to be attributable solely to undertaking physical activity while they are there. The effect on health was shown as comparable to the effects of (a) living in an area of low vs. high deprivation; (b) being employed in a high vs. low social grade occupation; and (c) achieving vs. not achieving recommended levels of physical activity in the last week.

Recreational opportunities in greenspace are also vital for children. The MENE survey shows that play is the main motivation for younger children's time outdoors, and that this usually takes place in local parks, recreation grounds, and playgrounds, and to a lesser extent more natural settings such as woods, nature reserves and the wider countryside (56). Evidence is still evolving, but there are indications of positive impacts of outdoor recreation including improved self-perceived competence, learning and identity, positive wellbeing and increased family cohesion (58).

Nature connection

'Nature connection' is not just spending time in nature, but is an individual's subjective sense of their relationship with the natural world and feelings of interconnectedness with nature or a sense of inclusion in nature (59). Evidence indicates that people who report feeling more 'connected to nature' tend to have a more positive outlook on life (positive affect), increased vitality, life satisfaction, feelings that life is worthwhile and of personal growth compared to those who feel less connected. There is also an association with more pro-environmental and pro-conservation behaviours (60-62).

Contact with the natural world, childhood experience and socio-cultural status may all be factors influencing a sense of nature connection (59). Life stage also seems to play a role. Recent analysis of the MENE data shows that reported nature connection is high in young children, dips during adolescence and then slowly rises again through adulthood, though never achieving the same level as is shown in children (60). Further work is being undertaken to understand if this is a consistent trend, and to identify whether there are any actions that can be taken to mitigate the drop in nature connection during the teenage years.

Community and social cohesion

Natural spaces improve social cohesion and can help bring communities together. Greenspace, especially in urban settings, can provide places where people can come together to engage in social activities, help people feel connected to their communities, and help minority groups become better integrated and identify with their new communities. Reviews have shown that greenspace can reduce isolation and loneliness by providing the opportunity to participate in shared social activities, again leading to greater social cohesion (63) (64). Research suggests that social interaction within the neighbourhood environment can help to build familiarity and a sense of commonality, which sets the groundwork for future engagement (65). These spaces also facilitate both formal and informal interactions with people from different cultural backgrounds, and this in turn may lead to increased social cohesion and inclusion.

Quality, design and maintenance are important factors in people's perceptions of greenspace and may impact on the extent to which social benefits are realised. Studies show that well designed and maintained greenspace can help to reduce antisocial behaviour, while those that are poorly designed or not maintained tend to do the opposite (66). In turn, evidence indicates that the health benefits of greenspace are dependent on people's feelings of safety and the behaviour of other users (39, 67). When aiming to maximise the potential for community and social ties within a greenspace, location, structure, activities, versatility, maintenance, facilities and access all need to be considered (26, 63).

What does 'quality' mean?

Quality of greenspace can be considered in 2 principal ways:

1) The ecological quality, which describes the level of biodiversity within the area. There is some evidence that ecological quality contributes to better mental health, increased health-promoting behaviours and prevalence of good health, while degraded environments appear to have a negative effect on health (4).

2) The condition of the space. This is a measure of how well the site is maintained and the amenities it offers, making it safe, attractive and welcoming to visitors. Studies have shown that inadequate maintenance of sites, such as poor-quality footpaths, vandalism, litter, and issues with cleanliness negatively influence the use of parks. Aesthetics, perceived safety and the social environment found within a site play a key role in people wanting to use it (68).

Some quality standards include:

- Green Flag Award and Green Flag Community Award – an internationally recognised awards scheme that recognises and rewards well managed parks and greenspace, and sets a quality benchmark and standard for the management of recreational outdoor spaces (69)
- Building with Nature – a set of standards that promote high quality green infrastructure at each stage of the development process, from planning and design, through to long-term management and maintenance (70)
- The Place Standard tool – provides a simple framework to holistically assess the physical and social aspects of a place, It is supported by the WHO, and it is now being used in up to 18 countries in the WHO European region (71)
- Building for Life –an initiative created within the home building industry to promote improved standards within the industry. Accreditation requires meeting 12 design conditions, including on the design of public and private spaces (72)

Government is also developing a set of national green infrastructure standards to establish a common understanding of what 'good' GI looks like and help local authorities, developers and communities plan and design good quality GI to meet local needs. Local areas will be able to assess their GI provision against these new standards to drive improvement and enhancement.

Developing children's skills and capabilities

There is a small body of evidence showing that spending time in greenspace, often within a school setting, may be associated with improvements in children's skills and development (5). Greener school grounds have been found to be linked to improved motor skills, and better learning processes and outcomes (73). A greener school environment has also been shown to be associated with better behavioural outcomes and attention restoration (74). Children learning in natural environments (outdoor learning) have been found to have higher achievement than their peers in reading, mathematics, science and social studies, physical education and drama, with a greater motivation to learn, increased concentration and engagement with their lessons (75).

Although there are limitations within the evidence base, it tends to demonstrate that there are a range of positive outcomes for children that come from spending more time in a greener school setting or by learning in natural environments. Thoughtful consideration of how to increase children's exposure to greenspace as part of their school day, as one element of a local government approach, may be valuable in helping to achieve educational and development priorities for children and young people.

Mediating potential harm

Air pollution

Air pollution is the top environmental risk to human health in the UK. and the fourth greatest threat to public health after cancer, heart disease and obesity. It can cause and worsen health effects in all individuals, particularly society's most vulnerable populations. Air pollution can exacerbate existing health conditions, affecting both physical and mental health, and lead to reduced life expectancy over the long-term (17). Conditions caused or exacerbated by air pollution include asthma, chronic bronchitis, chronic heart disease (CHD), and stroke.

In 2018, PHE estimated that between 2017 and 2025 the total cost to the NHS and social care system due to the health impacts of PM2.5 and NO2 in England will be £1.69 billion. This figure is for where there is robust evidence for an association between exposure and disease. Where there is less robust evidence for an association, then the estimate is increased to an overall total of £5.5 billion for PM2.5 and NO2 in England between 2017 and 2025 (115).

It is estimated that a 1 µg/m3 reduction in fine particulate air pollution in England could prevent around 50,900 cases of coronary heart disease, 16,500 strokes, 9,300 cases of asthma and 4,200 lung cancers over an 18-year period (116).

In 2017, urban green and blue space in Great Britain removed 27,900 tonnes of 5 key air pollutants. The avoided health costs were estimated at £162.6 million, with 70% of the avoided costs due to the positive effects of urban woodland (76). Greenspace can also control the flow and distribution of air pollution (77). People's exposure can be substantially reduced through carefully positioned green infrastructure that incorporates the right type of vegetation, separates people from pollution by introducing barriers and extends the distance between the pollution source and individuals (78). Redesigning road and pavement layouts, delivering well-designed urban greening schemes, and providing active travel routes through greenspace all help reduce exposure to air pollution and improve health (79).

Noise

Environmental noise exposure can have a significant effect on health and quality of life(122). Long-term exposure is linked to sleep disturbance, chronic annoyance (impaired quality of life) and cardiovascular disease (122, 123). There is also increasing evidence that noise is linked to metabolic health outcomes such as type 2 diabetes, and poorer cognitive outcomes, such as children's reading comprehension and long-term memory (124). Children, elderly people and those with existing poor physical and mental health are considered to be more vulnerable to the effects of noise (122). Noise

is the second worst environmental cause of ill health in Western Europe, with Government estimating the annual social cost of urban road traffic noise in England to be £7 billion to £10 billion (12, 81, 125).

Greenspace has a direct positive effect on health outcomes due to noise attenuation – the UK Urban Natural Capital Accounts estimated the total annual value of noise reduction in England was £14 million in avoided loss of quality-adjusted life years (QALY) during 2017 (80, 81). People in urban areas value the ability to enjoy areas of quiet or relative quiet, away from the sounds of urban life. There is evidence to suggest that relative quiet has a number of important and often co-related benefits including improved creativity, problem solving, mental health, concentration and undisturbed sleep (82). There is also evidence to suggest that tranquil greenspace can compensate for the adverse health effects of noise in the residential environment. For example, people living in noisy areas appear to have a greater need for areas offering quiet than people not exposed to noise at home, and that perceived 'better' access to nearby greenspace can reduce the prevalence of noise-related psychosocial symptoms through use of those spaces (83-88).

Conversely, emerging evidence suggests that the use of greenspace can decrease as a result of increased noise levels and that the restorative benefits are reduced (89-94). This is thought to be due to the wider behavioural changes that may take place as a result of elevated noise levels. Increased noise levels may affect the decision to visit a public open space, the length of time spent there, activities, and the quality of the relaxation enjoyed.

Certain types of green infrastructure reduce exposure to noise through the absorption, dispersal and destructive interference of sound waves(95-97). Greenspace and green features also appear to attenuate people's negative perception of noise, perhaps beyond what the actual vegetation may achieve (98, 99).

Reduced noise is considered an important feature of healthy streets, contributing to improved health, more active travel and better human interaction (1, 100). The Department for Environment, Food and Rural Affairs (DEFRA) has published guidance for eligible local authorities applying for the identification of a space as a quiet area under the terms of the Environmental Noise Directive (82).

Urban heat islands

The higher temperatures found in built-up areas compared to their rural surroundings is known as the urban heat island (UHI) effect. The UHI results from changes in land use and human activity, such as concentrated areas of asphalt, relatively small areas of greenspace, and heat produced by human activities such as heating buildings, cars and the use of air conditioning. This increase in temperature can exacerbate the adverse health

impacts of heat exposure and increase the risk of illness and mortality. For example, the heat wave in August 2003 has been associated with around 70,000 excess deaths across Europe and a recent study showed that, during this heat wave, up to half of the heat-related mortality in the West Midlands region could be attributed to UHI (101, 102).

UK climate projections predict that heatwaves are likely to become more intense and more frequent in the future (106). Heat-related deaths are expected to rise by 257% by 2050, in the absence of any adaptation (126). Older age groups are more susceptible to the effects of heat, and there are indications that more deprived populations may often be disproportionately affected (101, 127-129).

There is strong evidence that in an urban context greenspace is associated with heat reduction (49). Research indicates there is a 'park cool island' effect of between 1.5-3.5°C, with a stronger cooling effect for larger urban greenspace, and that shade-giving street trees also provide an important means of heat relief (103). Access to these 'cool islands' can help to offset the detrimental health effects of extreme heat. Greenspace also increase the cooling effect derived from water and wind sources (104). Other elements of green infrastructure such as roof gardens have demonstrated a reduction in the UHI effect (104, 105).

Flood risk

Climate change and urban development are predicted to lead to an increase in flooding events (106). Assuming no population growth and current levels of adaptation continue, it is estimated that by 2080 there will be a 40% increase in residential properties at risk of flooding (defined as the risk of flooding more frequently than once every 75 years on average). This would be an increase from 860,000 to 1.2 million properties based on a 2^{o}C temperature rise, and a 93% increase to 1.7 million properties based on a 4^{o}C increase (107).

Flooding has significant and long-lasting effects on mental health caused either by the direct experience of a home being flooded or the disruption caused by a flooding event such as being evacuated. The English flooding and health study found a sustained increase in the prevalence of psychological ill-health amongst those affected by flooding. People who were flooded were approximately 6- to 7-fold more likely to have depression, anxiety or PTSD a year on than those who were not affected by flooding (108).

Green infrastructure can help to prevent floods from occurring and reduce their severity when they do (109). The evidence base for wider health benefits related to specific forms of 'green stormwater infrastructure' such as rain gardens, bioswales, and green roofs is still developing (110). However publicly accessible spaces that help to mitigate flooding, for example floodplains or wetlands, may contribute to health by providing opportunities for recreation (109).

3. Inequalities and greenspace

"Why is it that just because I am poor, I have to live in an ugly place?"
– Question asked of Derek Antrobus, Salford City Council by a constituent.
Natural England Green Infrastructure Month Atrium event, 28 September 2016

A century ago, public health and spatial planning were statutorily bound together, and health and wellbeing is still a principal consideration within planning (130). Planning with health in mind seeks to address and reduce health inequalities - avoidable and unfair differences in health status between groups – by providing places, including greenspace, that allow everyone to have the same opportunities to lead a healthy life.

This is particularly important within the current national context. The report Health equity in England: The Marmot Review 10 years on highlights that for those living in more deprived districts and regions, health is getting worse and health inequalities are increasing, with the lives of those at the bottom of the social gradient becoming more challenging across many domains in the past decade (131). Evidence shows that there continues to be disparities among groups in both the quality and quantity of greenspace, and differences in the way and frequency that certain groups use greenspace (132).

We know that:

- the most economically deprived areas have less available good quality public greenspace (133, 134)
- people exposed to poor quality environments are more likely to experience poorer health outcomes than people who enjoy good quality environments (135)
- unequal provision of good quality greenspace means those who are at greatest risk of poor physical and mental health may have the least opportunity to reap the health benefits of greenspace (132)
- all demographic groups benefit, but deprived groups appear to gain the most health benefit and socioeconomic inequalities in health are lower in greener communities – providing greener environments for deprived groups could help to reduce health inequalities (5)
- analysis of MENE survey data across multiple years found that infrequent users of greenspace tend to be – people who are female; older; in poor health; of lower socioeconomic status; with a physical disability; ethnic minorities; people living in deprived areas; those with less local access to greenspace; and people living further from the coast (136)

The current national policy focus on prevention creates opportunities for ambitious, co-ordinated action across all of government to address health inequalities. Local policies and strategies have the opportunity to reflect a commitment to addressing access to greenspace as a key determinant of health, particularly for the most

disadvantaged communities, aiming to create the conditions for good health to exist and make reductions in health inequalities possible.

Literature review – health inequalities and access to greenspace

The Marmot Review 'Fair Society Healthy Lives,'(135) proposed an evidence-based strategy to address the social determinants of health. This included a policy recommendation that to reduce inequalities we need to improve the availability of good quality open and greenspace across the social gradient (135). In 2014, PHE worked with the Marmot team to explore the implications of their original report to improve access to greenspace and jointly published the evidence and briefing "Improving Access to Greenspace". Due to the evolution of the evidence base since that time, PHE conducted a new literature search of studies in the UK to explore inequities in access to greenspace and its relationship with health outcomes.

Details of the methodology used in this literature review are included in Appendix C.

Study findings

The study found there was a wide variety of data collection methods, definitions of 'access' and 'greenspace', and health outcomes. This heterogeneity makes it challenging to compare studies in order to better understand associations and resolve uncertainty. Standardised valid and reliable measures of data collection should be developed to reduce the heterogeneity of research on this topic (137).

Across the studies identified in the literature review, a range of data collection methods were used to assess the outcomes of interest, namely health; inequality; deprivation, types of greenspace; and access to greenspace.

Local area deprivation is a strong predictor for health outcomes (135). Therefore, to address health inequality, it is necessary to use a valid and reliable measure to inform policy and intervention development. The Index of Multiple Deprivation (IMD) is a widely used measure of relative deprivation in England and was used to explain health inequalities in the Marmot Review. Other measures found in the literature review included socio economic classification and social grading (ABC1).

Access to greenspace was measured in a variety of ways, including straight line distance, network distance (brief description); land area (brief description) and perceptions of access (brief description). Furthermore, the type of greenspace measured was quantified via a range of techniques. Domestic gardens were not always included, some used satellite imagery, and several developed their own databases. The heterogeneity in measurement requires some refinement to allow comparison of data.

Health outcome measurements were also mixed with a variety of data collection measures identified, from a wide range of questionnaires to objective measures of physical activity or analysis of clinical samples. Moreover, the measurements were often collected over different time periods.

Finally, the literature review also identified that access to greenspace may be influenced by a range of demographic variables including age; gender; education level; employment status; ethnicity and disability. These findings are supported by Natural England's National Survey, the Monitor of Engagement with the Natural Environment (MENE) (56).

4. Understanding the value of greenspace

"We cannot continue to invest in the same service models of the past. We will not meet our mission with 'business as usual'... Greater focus, and spending, is needed on prevention, not just cure… This includes recognising… how the wider environment we live in determines our health"

– Prevention is better than cure, Department of Health and Social Care (19)

An increasing body of evidence demonstrates a positive relationship between the provision of greenspace and both improvements to population welfare and reduced costs for local areas and health authorities, businesses and central government:

- Natural England has estimated that £2.1 billion per year could be saved in health costs if everyone in England had good access to greenspace, due to increased physical activity in those spaces (138)
- people meeting the weekly physical activity guidelines in a greenspace setting experienced improvements to quality of life that could be quantified at approximately £2 billion per year (139)
- for urban greenspace settings in England, a welfare gain (QALY) of £1.2 billion was found for those undertaking one or more 'active' visits (30 minutes, moderate intensity activity daily) – it is further estimated that in England there would be an annual savings of about £760 million in avoidable medical costs if people had one or more 'active' visits per week to a greenspace (140)
- in a review of the benefits of London's greenspace, it was found that each year, greenspace save some £580 million by contributing to better physical health, and £370 million by contributing to better mental health – health benefits comprised approximately 20% of the total economic value of London's greenspace (141)
- in a Birmingham valuation it was found that the annual net benefit to society of their parks and greenspace was nearly £600 million, which includes £192 million in health benefits (142)
- a valuation of urban parks in Sheffield showed that, for every £1 spent on maintaining parks, there was a benefit of £34 in health costs saved, with local residents being the primary beneficiaries (143)
- a study of walking on the Wales Coastal Path found that there was a protective benefit of £18.3 million per year, due to the prevention of premature death (144)
- estimates of individual benefits include £135 to 452 per person per year derived from having a view of greenspace from home, and £171 to 575 per person per year derived from access to a garden (145)
- in England and Wales, houses and flats within 100 metres of public greenspace are an average of £2,500 more expensive than they would be if they were more than 500 metres away – an average premium of 1.1% in 2016 (146)

Yet despite these promising figures, local government is facing huge challenges in funding the maintenance of their existing green infrastructure, let alone funding the creation of more. Reduced local government budgets are of course one reason investment in green infrastructure is under pressure. But it is also because greenspace has traditionally been viewed as a liability, with the social, economic, health and environmental contributions to society rarely being acknowledged. Local areas need first to recognise and understand the wide range of benefits people accrue from green infrastructure, and then be able to capture and demonstrate their value so that they are not overlooked or forgotten when difficult local finance decisions must be made.

Valuation of greenspace and wider green infrastructure can take either a monetary (assigning a traditional value using money) or a non-monetary (using qualitative and quantitative measures other than money) approach, or a combination of the two. The method selected should match the requirements needed locally for informed decisions to be made, and the capabilities and skills of those who will undertake the valuation exercise. For any valuation, the approach must be robust and the processes and assumptions transparent.

Enabling a Natural Capital Approach

DEFRA's suite of resources, Enabling a Natural Capital Approach (ENCA), supports those who want to learn more about natural capital and environmental valuation and need practical guidance (147). It presents evidence, guidance, case studies and tools that will help people to understand natural capital and learn how to take it into account during decision making. ENCA includes information on different natural capital valuation approaches.

Public health teams may be called upon to help assess the suitability and impact of adding, removing or changing green infrastructure within a community. In order to do this, it can be helpful to know:

- where existing greenspace assets are
- how a change will impact health benefits
- what further potential a particular area may provide
- the value of the plurality of benefits to make a business case (148)

Combining this knowledge with evidence of local health needs and inequalities will help public health to strengthen the case for greenspace in local policies and strategies (see chapter 6), and also during consultation on development proposals.

Bicester tools for planning and evaluating urban green infrastructure
Recent work undertaken for Cherwell District Council (Bicester) aimed to identify relatively quick and simple asset and opportunity mapping, design and valuation tools that could be applied by local councils with limited time and resources, either with in-house expertise or using third party consultants (148). The tools that were identified, both free and at cost, can support a deeper exploration of greenspace assets, look at the impact of land use changes and help a local area to conduct a valuation of their green estate. As part of the Healthy New Towns Programme, Bicester has shown how taking an approach like this can support the development of green infrastructure to support the health and wellbeing of its population.

A fundamental change in thinking about greenspace is now required. Greenspace needs to be planned for, provided and sustained for the value it delivers. This will require a clear vision of greenspace as natural capital, and for local government to work together with the health, voluntary and community sector to develop strategies for effectively financing and managing their greenspace.

Alternative models of delivery, rather than exclusively local government-led initiatives, are now being suggested and trialled around the country. Examples can be found through the NESTA Rethinking Parks project, the National Trust/National Lottery Heritage Fund Future Parks initiative, and within the work undertaken by the Parks Action Group, all of which look at innovative ways of sustaining parks and greenspace and ensuring they meet the needs of the local community (150, 151). Some case studies featuring this innovative work can be found in Appendix D.

5. Engagement with greenspace

“The tree which moves some to tears of joy is in the eyes of others only a green thing that stands in the way. Some see nature all ridicule and deformity... and some scarce see nature at all.”

– William Blake

Increasing access to greenspace can give people more opportunities to engage with the natural environment, however there may still be barriers to engagement for some populations. For instance, there may be local circumstances, cultural beliefs, or deeply held values that discourage or stop people from interacting with greenspace, which in turn can impact on health and wellbeing. Meaningful consultation with target populations can provide particular insight into what is most needed to initiate engagement with the natural environment and can guide the development of interventions.

Barriers to using greenspace

There is a growing body of evidence aiming to understand why certain groups are less likely to use greenspace. There is variation in who visits greenspace that may be a result of different factors such as physical barriers including lack of proximity, personal values, cultural norms, perceptions of safety, awareness or interest. Studies have shown that some of the key barriers to using greenspace include the following. (4, 5, 136, 152-156)

Physical barriers

Physical barriers include:

- proximity – lack of good quality greenspace near to home; MENE data shows that two-thirds of visits to greenspace are within 2 miles of home
- physical obstacles – lack of or poorly maintained road or path networks, challenging topography
- transport – lack of public transportation or private vehicle, cost of parking at a site
- lack of facilities – toilets, benches, cafes; this particularly applies to older groups and those living with disability

Social and cultural barriers

Social and cultural barriers include:

- social experiences – being out in a natural setting is not part of social expectations or background; discomfort over perceptions of what is seen as 'appropriate' behaviour in such spaces; feeling unwelcome or out of place
- cultural experiences – experiences of racism; fear of bullying; presence of dogs; failure to provide for the needs of a mixed community, for example, areas where Muslim women can meet away from men
- different values – differences in the way people perceive greenspace as a contributing factor to health

Perceptions, awareness, self-efficacy and interest

Perceptions, awareness, self-efficacy and interest include:

- perception of safety – antisocial behaviour, vandalism, litter, poor maintenance, lack of lighting
- lack of awareness – limited awareness of opportunities to visit greenspace, particularly for low income groups
- low confidence – lack of experience and confidence in being in a natural setting
- time constraints – multiple, competing time pressures and interests; MENE data shows that for those who tend not to visit the natural environment, being either "too busy at work" or "too busy at home" comprised a combined 36% of responses
- lack of interest – MENE data again shows that for those not visiting regularly, "not interested" and "no particular reason" together comprise 21% of responses

Although there is now a well-evidenced list of barriers to accessing greenspace, there is a need for further research to investigate the deeply held personal values and perceptions that influence both motivations and self-reported barriers to visiting greenspace (157).

Facilitating engagement with greenspace

To help people get out into greenspace, they need to have the opportunity to use it, feel they have the capability to do so, and see a benefit to their lives. This may be through thoughtful and purposeful physical design, for example, to support more active lifestyles, to have enriched experiences or simply to normalise greenspace within the community. Or it may be through well-planned interventions to raise awareness or raise confidence in using their local greenspace. Well-designed greenspace will appeal to different groups. It is inclusive and accommodates people with a range of needs, offering opportunities for play, relaxation, social interaction and stimulation (26).

Some general approaches that have had success are outlined below, and further practical examples can be found in the case studies in Appendix D.

Physical design

Design to normalise greenspace

Much of the evidence on the health and wellbeing benefits of greenspace considers the overall greenness of the living environment or community, and there is emerging evidence of the role that incidental greenspace might play. Incidental greenspace can take many forms, ranging from street trees, to pocket parks, to green walls and roofs and other planting in public places (26). There is some evidence that groups who do not access parks or where parks cannot be provided (in densely developed parts of towns and cities, for example) may benefit from increasing the amount of incidental greenspace as part of an overall plan to have a greener urban environment (64). These features, if well-designed, may also help to reduce the health impacts of air pollution, the urban heat island and excess noise (7, 26).

Design for inclusivity

Greenspace should be designed for a variety of user interests and capabilities. Engaging the community in the design process is important. Often small details can make a big difference to those with health or mobility needs, and these groups can provide valuable insights that might be overlooked by those not directly affected (152). These groups will also be able to advise on what is needed to enhance the potential for social interactions within the space. Community insight can improve opportunities for future engagement and help in the delivery of any interventions.

Brief principles of inclusive design

The goal of inclusive design is to create places where everyone can participate equally, independently and with confidence and dignity.

The Commission for Architecture and the Built Environment (CABE) (158) developed 5 principles of inclusive design which are:

- place people at the heart of the design process – involve as many people as possible in the design so that it meets the local needs and promotes social cohesion
- acknowledge diversity and difference – understand the range of needs and design to overcome barriers
- offer choice, rather than a single design solution that cannot accommodate all users – it’s not possible to meet every need, but provide solutions that welcome everyone on equal terms

- provide for flexibility in use – understand how the space will be used, and ensure it is adaptable according to changing needs
- provide environments that are convenient and enjoyable to use for everyone – ensure people have appropriate signage, lighting, walkways, transport routes, and can access sufficient information to make them feel confident using the space

Designing according to these principles will help all people to be able to participate and experience a place equally and with confidence.

Design for enriched experiences

Sensory pleasures – experiencing the natural environment not only through sight but also through sounds, smells, and touch – have been linked to improvements in positive emotions and feelings of physical and mental relief. Different types of sensory gardens, for example tactile planting, scented trails or acoustic or seasonal gardens can enhance people's enjoyment and give them the opportunity to interact with nature in a different way (152). Greenspace can also be designed to facilitate different opportunities for social interaction, or for a sense of purpose and achievement gained from activities such as volunteer gardening or physical activity challenges.

Designing and managing greenspace for this diverse range of needs and preferences can be a challenge, especially if there is restricted space. Conflicts over preferences can be minimised by separating areas as much as possible, for instance, providing some areas where dogs are not allowed can encourage use by those people and cultures that are not comfortable around dogs. Creating a welcoming and accessible space with a range of different environments allows for both tranquil areas, and areas where more lively activity can take place (159).

Design for more active lifestyles

Good design makes it easy and attractive to be active, and creates opportunities within our communities to have active and healthy lifestyles, providing enticing open spaces in locations that are easy to access, with activities for all to enjoy, such as play, gardening, recreation and sport (1).

Sport England developed 3 active-design high level objectives that aim to ensure the physical environment is planned to give more opportunities to be active (160). These spaces should:

- be accessible – provide greenspace that is safe, easy and convenient to access for the whole community
- enhance amenity – greenspace is of good quality, appropriate to local need and allows a range of activities

- increase awareness – the design and layout raise prominence and awareness of opportunities to be active

A key part of active design is creating routes for active travel. Green infrastructure should prioritise and encourage active travel by making walking and cycling more pleasant. Both incidental and specific areas of greenspace should be planned along routes people commonly use to get to their jobs, schools and local facilities such as GP surgeries, leisure centres or shops (25, 27).

Green gentrification

Although we have evidence for general approaches to encourage use of greenspace, there is still a need for further research to understand the variation in outcomes and identify what is effective for different demographic groups (see Appendix C). It is important not to assume that the health benefits of greenspace will be the same across all population groups (37, 39, 161). Any action needs to be carefully planned and evaluated to make sure the benefits are maximised while not increasing the health inequalities it is trying to eliminate (4, 162).

One potential risk is of 'green gentrification'. This unintended consequence of improvements to greenspace, leads to changes in the social environment, local culture and demographics (163). While new or improved greenspace provide opportunities for a range of social and health benefits, gentrification may result in contentious local social relations and displacement of long-term residents, particularly among the most vulnerable urban residents, and may actually worsen health and other inequalities (164). This 'green paradox' complicates the nature of greening as a 'win-win' intervention.

Policy makers need to consider the complex and dynamic social and political contexts in which improving greenspace takes place, understand who will benefit in the short- and long-term, and try to anticipate and reduce or eliminate unintended consequences so that greenspace provide equitable, sustainable benefits for the whole population (163).

Ensuring equitable greenspace

The World Health Organization suggests the following steps should be taken to ensure all population groups have access to and benefit equally from urban greenspace and that unintended effects are minimised (162). In brief they are to:

- develop a common understanding of equity among the stakeholders
- define the objectives of the greenspace, in terms of equity, and compile supporting data
- understand the population profile using the smallest possible spatial unit
- look at distribution of local benefits and resources, as well as disadvantages and deprivation levels

- use data on greenspace availability and accessibility, if available, to assess any potential changes to equity
- involve the community, particularly vulnerable or disadvantaged groups, from the start – during the planning phase, this may help to ensure benefits are realised and avoid social conflicts about future use of the greenspace; during the implementation phase, this may help with increasing feelings of ownership and responsibility (using local champions should be considered

Interventions

Greenspace interventions can help people realise a wide variety of social and health benefits. There are 3 basic types of interventions, those that:

1. increase the amount, quality or improve accessibility to greenspace
2. increase use of or engagement with the natural environment
3. use targeted health interventions based in greenspace (4)

Greenspace interventions are context-specific, and the outcomes can vary depending on the setting and the population, leading to the question, “what works, in which circumstances and for whom”?

Interventions that increase the amount and quality of greenspace and improve accessibility

This type of intervention modifies the physical environment. Examples of interventions of this type are: adding a new greenway, improving a park, planting new street trees and vegetation, adding benches or lighting, improving facilities, improving parking or adding bus routes. There is mixed evidence of positive impact on health or usage associated with creating, modifying or improving the physical environment alone (5). The WHO suggests that a dual approach, where improvements to the physical environment are coupled with social engagement and participation, is most effective (162).

Interventions that increase use/engagement

These can be particularly useful for those who have little experience accessing greenspace, or for whom its use is not part of their cultural norm. Simply providing a natural setting will not necessarily lead to increased use – it may be necessary to provide programmes that encourage people both to start using these spaces, and to maintain them long-term.

Evidence suggests that ‘facilitated access’, that is organised transport to a site, followed by a supported led activity, can be successful in reaching underrepresented groups. The social value of regularly scheduled group activities can be a strong motivator for participation and encourage continued involvement. Facilitated access was seen to be

particularly effective for enabling use amongst Black and Minority Ethnic (BAME) groups (especially women in these groups), older adults (particularly those coping with recent bereavement) and those with no previous experience of visiting woodlands (165, 166).

Targeted health interventions based in greenspace

Nature-based interventions encompass a wide variety of activities, from therapeutic horticulture, wilderness therapy and conservation activities, to walking in the park or spending time in your own garden. A systematic review of nature-based interventions found participation in these programmes was associated with a significant positive effect on psychological, social, physical, and intellectual outcomes and suggest these are a valuable resource for public health (167). This evidence is reflected in the commitments the 25YEP, which aims to explore how 'green prescribing', a type of social prescribing using nature-based interventions, can be used within mental health services. It will also be important in achieving the NHS LTP aim to extend social prescribing to 2.5 million more people within the next 5 years.

Tailored information sources

Care should be taken in creating sensitively designed materials used to promote and encourage access to greenspace. Visual imagery and wording should aim to be inclusive, resonate with the target groups' views of who they are in the outdoors, and allow them to 'see themselves' in the images provided. The clothing, gender and ethnicities of the people in photos should be carefully considered, as well as testing wording so that it is not perceived as being intimidating or condescending (168). There is some evidence that persuasive messaging techniques may be effective in changing the way people think about activities in greenspace, and help to build their confidence to undertake these (169).

When planning interventions that aim to increase access for disadvantaged groups, it is critical to have a detailed knowledge of local needs, cultural contexts and attitudes, with clear objectives and strong targeting. Without this, there is a risk that the intervention could negatively impact those it is trying to help. For example, a scheme to increase community participation in Derbyshire's forests led to a large increase in visitor numbers, but not by the intended groups who were most in need (170).

There is now a good understanding of the barriers people may face in accessing and using their local greenspaces. Through ongoing engagement with targeted communities, thoughtful planning and design, and sensitively developed interventions, local government can help people to overcome these barriers. Below are the guiding principles set out within this chapter that have been shown to help people engage more with local greenspace.

Guiding principles to encourage engagement with greenspace

These inlude to:

- have ongoing and meaningful consultation with target populations to understand the barriers that are preventing them from using greenspace, such as physical barriers, social and cultural issues, perceptions of safety, awareness or interest in greenspace – work systematically and jointly to identify solutions to these barriers
- consider the range of factors which have been shown to improve use of local greenspace, such as using inclusive design principles that make it easy and attractive for people to be in these spaces, and how design can help to achieve wider health and wellbeing priorities
- work with the target populations to identify the types of interventions that would be most likely to help them start or increase their engagement with greenspace, for example through facilitated access schemes, and use their expertise to understand how to promote them effectively and sensitively within the community
- consider taking a dual approach to get people out into greenspace – making improvements to the physical environment to address barriers, along with providing interventions that promote social engagement and participation – as evidence suggests this is an effective approach
- carefully plan and evaluate any proposed changes to greenspace to make sure the benefits are equitable and do not increase the health inequalities they are trying to eliminate

6. A practical call to action

“Public health needs to make connections with planners by understanding what is important to them. We need to relate the planning applications to local data and explain how improving access to greenspace contributes to the wider council’s agenda like physical activity, obesity and mental health.”

– Local government public health specialist

“The planners were talking about developing a green infrastructure SPD (supplementary planning document), so I contacted them directly. I said that greenspace is a real public health issue, please can we comment. That’s how it started. You just have to be brave enough to pick up the phone and ask how to feed into the planning process.”

– Local government public health specialist

In light of the evidence, government strategies are now supporting a longer-term focus on the prevention of illness, supported by planning and investment that makes population health a priority (171). The challenge now is to put this into practice both locally and nationally.

Local authorities play a vital role in:

- providing new, good quality greenspace that is inclusive and equitable
- improving, maintaining and protecting existing greenspace
- increasing green infrastructure within public spaces and promoting healthy streets
- improving transport links, pathways and other means of access to greenspace, and providing imaginative routes linking areas of greenspace for active travel

Working to improve access to green and bluespace involves many complex and inextricably linked problems that require extensive collaboration between national and local government and a range of stakeholders in order to achieve an impact. Public health teams, as part of local government, need to be essential partners in the planning and development of their local greenspace. Their specialist knowledge is essential for a whole-systems approach to developing healthy communities (25). Public health teams can provide context and evidence about the needs of the community, make sure that reducing health inequalities is high on the agenda and support councillors to understand local health and social care issues.

A strategic approach will help teams integrate local health needs and health and wellbeing strategy aims into local plans and planning policies, which in turn will support masterplans, major developments, planning negotiations and decision-making processes. Access to good quality greenspace and a greener public realm need to be

specified in both local plans and strategies in order for this to be a consideration in planning authority decisions.

Understanding national policy levers, as well as the purpose and contents of local policies and strategies is critical in order to address provision of sufficient access to greenspace and its longer-term sustainability. Local documents should reflect how greenspace is integral to meeting health and wider priorities, and support the protection and enhancement of them.

Because of the many factors involved, local authorities may consider taking a Health in all Policies (HiAP) approach (172). HiAP is designed to ensure that health improvement and the reduction of health inequalities are built into the assessment of all new policies. Making health an explicit criterion within policies helps to ensure there is a common understanding and consideration of health and health inequalities, an agreed way of analysing the health impact of local actions, policies and strategies, and a common commitment to identifying and using greenspace for the greatest health and wellbeing impact through policy. Using such an approach can help local government and partners bring together individuals, organisations and communities to identify and pool their capacity, skills, knowledge, connections, assets and resources to improve population health.

Below is a brief overview of some of the levers and partnerships that can be used to build and support a case for creating and maintaining greenspace. These include:

1. National planning policy levers
2. Local planning policy and strategy levers
3. Developer contributions toward greenspace
4. Key partnerships

Public health teams can work together with local planning authorities to learn more about local greenspace plans and strategies. This will allow them to engage at the most appropriate point in the process.

1. National planning policy

National Planning Policy Framework

The National Planning Policy Framework (NPPF) sets out government planning policy for England and how this is expected to be applied. It provides a framework within which locally prepared plans for development can be produced. The NPPF is a material consideration in deciding planning applications and supports positive development of greenspace and green infrastructure. The heart of the framework is a presumption in favour of ‘sustainable development’.

The key policies around greenspace for health, community cohesion and recreation are:

- para 91 c
- para 92 b
- para 96

Planning Practice Guidance

Since the first publication of the NPPF, a series of Planning Practice Guidance (PPG) documents have also been published to support local authorities as they use the Framework. Relevant PPGs include:

- healthy and safe communities
- design
- natural environment
- open space, sports and recreation facilities, public rights of way and local greenspace
- climate change

Access standards

Access standards for greenspace can help with understanding current provision, which in turn can help to identify the need/demand within an area and gaps that may exist. Access standards can include guidance on greenspace size, proximity/opportunity and quality. They may also take services and amenities into account.

Evidence shows that having opportunities for both direct and indirect contact with different sized greenspace at different distances, called “cumulative opportunity”, is a stronger and more consistent measure linking greenspace with health and wellbeing, compared to residential proximity alone (173).

Quality is also an important part of people’s perceptions of greenspace. Areas that are well designed, maintained and feel safe are associated with better health and social outcomes (66).

Several organisations have produced access standards, for example, Natural England’s Accessible Natural Greenspace Standard (ANGSt), Fields in Trust’s Guidance for Outdoor Sport and Play, The Woodland Trust’s Woodland Access Standards and the London Plan (174-177). These all present a cumulative opportunity approach to access. Fields in Trust further includes standards for quality. ANGSt is the most comprehensive, not only setting standards for access, quantity and quality, but for services as well.

2. Local planning policy and strategies as drivers of greenspace

Joint Health and Wellbeing Strategy and Joint Strategic Needs Assessment

Health and Wellbeing Boards are responsible for producing both the Joint Strategic Needs Assessment (JSNA), and the Joint Health and Wellbeing Strategy (JHWS) for their area. The outputs of JSNA and JHWSs are statutory requirements that help to determine the actions local authorities need to take to address the wider determinants of health.

The JHWS sets out the vision, priorities and actions to improve the health, care and wellbeing of local communities and reduce inequalities. The JHWS usually provides the strategic context for how a local area will implement the NHS Long Term Plan (178). The JHWS can specify how access to greenspace can help to achieve the wider ambitions for the locality, for example reducing health inequalities or implementing green social prescribing.

Local Plan

The policies in a Local Plan are one of the key ways to create a healthier natural environment in a locality. Local Plans set out the priorities for development of an area including residential, commercial, educational and industrial uses, including transport infrastructure, along with protection for the local environment. The Local Plan is a powerful and important influence on new development in an area, so it is critical that it states clearly that all sections of the population should have access to good quality greenspace near where they live, work and play. The NPPF provides the structure for producing Local Plans and must be in accordance with it.

The Local Plan must include strategic policies to address priorities for the development and use of land in its area. The NPPF states these strategic policies should set out an overall strategy for the pattern, scale and quality of development. These strategic policies should address ‘sufficient provision for conservation and enhancement of the natural, built and historic environment’. This includes landscapes and green infrastructure (paragraph 20d): note that factors such as health service provision are also required (para 20c).

The Local Plan should be underpinned by relevant health evidence, which Directors of Public Health have a role to play in providing. Future health needs, including access to greenspace and use of outdoor space for exercise/ health reasons (see Public Health Outcomes Framework Indicator B16), should be embedded within it. If the community’s’ health priorities are not reflected within the plan, it is likely to be difficult to ensure new development can properly support wellbeing needs.

Local Plans must be updated every 5 years, giving regular opportunities to review and strengthen policies on greenspace and health. The Local Plans' importance as a statutory document is reflected in the time and level of resource devoted to preparing it. Local authority planners and Directors of Public Health can work together to make sure that local health priorities and evidence on health and greenspace are put into practice through statutory planning policy.

Is health reflected in your Local Plan?

In 2018 the Town and Country Planning Association (TCPA) undertook a high-level review of all Local Plans/Local Development Plans in England and Wales to assess whether they reflect local health policies and strategies (179). This review found that, for England, the majority of Plans recognised the importance of open spaces, play and recreational opportunities for health and wellbeing. However, there were some significant opportunities that are being missed which were:

- 77% of Local Plans did not take local health strategies into account, that is the statutory JHWS, despite this being a NPPF requirement
- 73% did not refer to local health needs assessments such as the JSNA, or highlight them as part of their evidence base
- 55% refer to the health and wellbeing benefits of good design in developments, but 45% have adopted design policies that do not mention health and wellbeing

When local health priorities are not reflected within the Local Plan, it can be difficult to make the case for specific planning standards to be implemented to address health needs, or to defend planning decisions made on health grounds. Public health teams can work with the planning authority to ensure the Local Plan reflects how greenspace can help meet local health objectives.

Supplementary planning documents (SPD)

SPDs build upon and provide more detailed advice or guidance on the policies in the Local Plan and are a material consideration when determining planning applications. Following the adoption of the Local Plan by a local planning authority, the next stage of planning policy is, where appropriate, to develop supplementary planning documents (SPD).

Greenspace strategy

To support positive development of greenspace and green infrastructure, the NPPF suggests local planning authorities prepare an authority-wide, evidence-based greenspace strategy that includes an assessment of current greenspace provision. This will help identify gaps in the network and opportunities for improvement. This

strategy can go by other titles, for example, open space or green infrastructure strategy. This strategy can inform other plan policies and infrastructure delivery requirements, so authorities need to collaborate with neighbouring authorities and stakeholders such as Local Nature Partnerships and Health and Wellbeing Boards when developing green infrastructure strategies.

Some local planning authorities choose to use their greenspace strategy to develop a SPD that will guide future development. A greenspace/green infrastructure SPD can set out how the planning, design and management components of the area strategy will be delivered.

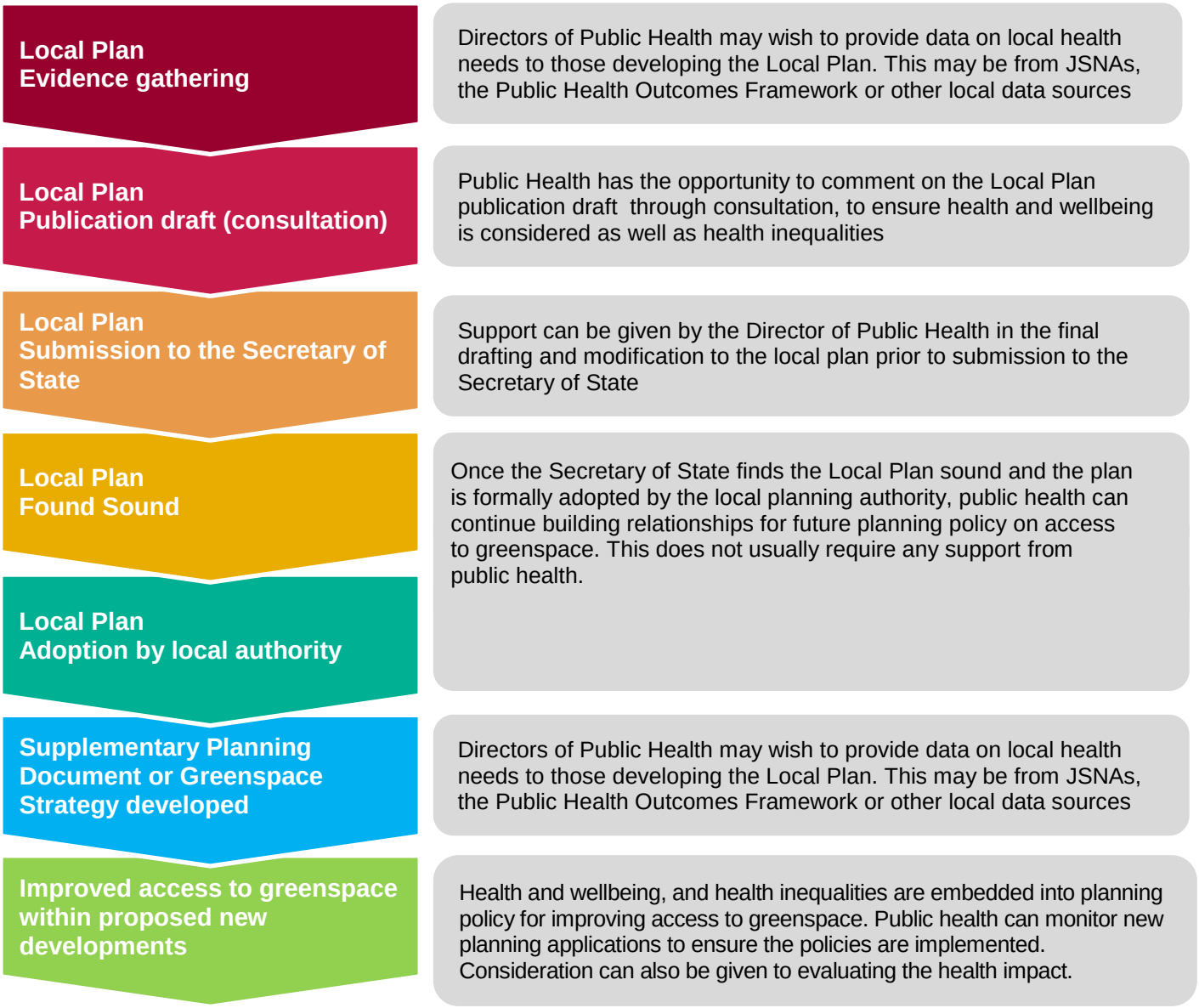
Local greenspace designation

The NPPF includes a Local Greenspace designation (LGS) to protect local green areas that are of particular importance to local communities. This will enable communities, in certain circumstances, to identify and protect those areas that are of special value to them through local and neighbourhood plans.

Neighbourhood plans

As part of the development plan for the local area, the neighbourhood development plan provides further opportunities for specific planning for the creation and management of local green spaces. The Localism Act 2011 provides further powers for local communities (parish and town councils, or in areas with them designated neighbourhood forums) to develop a plan for their area for sustainable development. These neighbourhood groups, especially those in areas with poorer outcomes in terms of access to quality green spaces, can bring forward planning policies and standards to secure better provision and access for health and wellbeing benefit of local people.

Figure 3: The role of public health in developing the Local Plan and other greenspace strategies



3. Developer contributions toward greenspace

Developers may be asked to provide contributions for infrastructure, and this can provide an opportunity to channel funding to support local greenspace. There are 2 types of developer contributions, both of which are administered by the local authority as part of their regulatory role. These are:

- Community Infrastructure Levy (CIL)
- planning obligations through Section 106 agreements

Community Infrastructure Levy (CIL)

Local authorities can apply the CIL on certain types of new development in their area. The levy can be used to fund a broad range of infrastructure such as play areas, open spaces, parks and greenspace and cultural and sports facilities, or to maintain or upgrade existing spaces. This can be used as a long-term planning opportunity to link up with the local authority's greenspace or parks strategy, giving more certainty over what infrastructure can be funded. However, not all planning authorities use CIL.

Section 106 agreements

When a development proposal fails to meet local criteria, the local authorities may consider whether the development could be made acceptable through the use of planning obligations. Planning obligations are legal obligations entered into to mitigate the impacts of a development proposal and are commonly referred to as 'section 106', 's106', as well as 'developer contributions'. Funding from s106 agreements can provide financial support to develop public greenspace and recreation projects.

4. Partnerships

Health and Wellbeing Boards

The Health and Wellbeing Board (HWB) is responsible for addressing the health needs of their population. HWBs are constituted within local authorities, and their purpose is to establish collaborative decision making, planning and commissioning across councils and the NHS to address health needs in an integrated manner. Many are using this opportunity to work with partners in public services and the voluntary and community sector to tackle the wider determinants of health (25).

Local Nature Partnerships

Local Nature Partnerships (LNPs) are partnerships of a broad range of local organisations, businesses and people who aim to help bring about improvements in their local natural environment. Directors of Public Health can engage with and contribute to discussions with the Local Nature Partnership in their area. Strategic policy-making authorities, which include both LNPs and local planning authorities, are required to cooperate with each other, and other bodies, when preparing, or supporting the preparation of policies which address strategic matters (the Duty to Cooperate). This includes those policies contained in the Local Plan.

The NPPF states that planning policies and decisions should plan for the "enhancement of natural capital… across local authority boundaries". Therefore, neighbouring authorities may wish to consider how wider strategies for their areas can help address cross-boundary issues. This could be done by working collaboratively through LNPs. The LNP also should work closely with Health and Wellbeing Boards and Directors of Public Health to contribute to enhancing green infrastructure in their area.

Working with the Local Nature Partnership

A Director of Public Health in the north east is successfully engaging with the North East Local Nature Partnership. The introduction was made through the local planning authority and has led to collaboration on healthy weight workshops and creating a joint evidence base. The LNP supported the DPH annual report on local action to reduce obesity using a complex systems approach, which included access to greenspace with a focus on health inequalities.

In summary, factors to consider within the local context that support planning, creating and maintaining greenspace are:

- learning about how greenspace and green infrastructure issues are addressed in national planning policy and how these can apply locally
- understanding how greenspace is reflected in local policies and strategies, especially the Local Plan, and consider how this might be strengthened
- ensuring that public health, spatial planning and others (for example urban designers, landscape architects) work together to better understand where and when changes in policy and strategy can most effectively take place, and the expertise each can put forward to support this
- being familiar with other elements of the planning system such as developer contributions and how these can be maximised to improve health through greenspace
- engaging with other local stakeholder and community groups such as Local Nature Partnerships and neighbourhood planning groups

NHS Healthy New Towns

The NHS Healthy New Towns initiative (25) found that:

- the public sector needs to work with both private and community sectors to address local health and wellbeing needs with appropriate design – it may be useful to build on partnerships and groups that are already in place; each should have a specific defined role and contribution
- leadership should be established early on, and remain as consistent as possible throughout
- partners need to develop a shared understanding of one another's processes and requirements, and agree a common language
- partners should commit to a shared vision and goals, and to delivering them

Further resources

- Plain English guide to the planning system
- Planning Portal
- Healthy New Towns
- Spatial planning for health: evidence review

PHE's Healthy Places team has produced a range of advice and guidance on the built and natural environment on health and wellbeing. These can be found on their website. To support local decision-making, a wide range of health and wellbeing-related data at local authority level is available through PHE's Fingertips tool, giving detailed local indicators on factors that protect and create health. These include:

- local authority health profiles
- local health (neighbourhood) profiles
- public health outcomes framework data

PHE also provides several tools that can be used to understand local health data and assets:

- wider determinants of health tool
- strategic health asset planning and evaluation (SHAPE) tool
- Health Inequalities Dashboard and Segment Tool

The Local Government Association (LGA), in association with PHE and the Association of Directors of Public Health (ADPH), provides support for sector-led improvement in public health, prevention and health improvement. The programmes and training are free, and provide help to take action on the wider determinants of health, enhance

leadership skills, effectively target public health resources and support elected members to understand the impact of health improvement and prevention (180). The full range of training and support opportunities is available on the LGA website.

The Ecosystems Knowledge Network's Tool Assessor holds information on a range of tools for analysing ecosystem services, natural capital and green infrastructure (149).

7. Conclusion and recommendations

In 2014, PHE published guidance on ‘Improving Access to Greenspace’. It found that access to greenspace is associated with a range of positive health and social outcomes, but that benefits were unequally distributed, with more deprived communities having less access to greenspace and with less opportunity to gain the associated health benefits. The guidance called for joint working between the local authority functions of public health, spatial planning, transport, and parks and leisure to improve the use of good quality greenspace for all social groups to achieve better health outcomes and to reduce health inequalities.

Since that time the evidence base for the links between health and greenspace has grown and our understanding of who benefits, how and to what extent has improved. There is also a greater recognition in national policy of the importance of greenspace in meeting multiple objectives, from connecting people to the environment for their mental health and wellbeing, to reducing loneliness, to creating healthier high streets, and addressing air quality – all of which contribute to the aim of preventing poor health and reducing health inequalities.

Inequalities in the distribution, quality, quantity and use of greenspace remain. Some of the groups that have the greatest challenges – older people, those in poor health, with a physical disability, of lower socioeconomic status, ethnic minorities, and those who live in deprived areas – continue to use greenspace less often and so continue to have less opportunity to benefit from it. Recognising that greener neighbourhood environments convey a disproportionate health benefit to disadvantaged groups, well-planned green infrastructure can be one approach toward reducing health inequalities. This is particularly salient in the context of widening health inequalities in England.

However, the financial climate continues to present a challenge and has found local government struggling to maintain their greenspace. To sustain it requires new thinking about greenspace as critical infrastructure to achieve wider local priorities, and creativity in how it will be funded, managed and delivered to meet the needs of the population. These times require strong local leadership and political will that recognises the true value of local greenspace as essential assets in the delivery of health, social, environment and economic outcomes to ensure greenspace survive and thrive. Public health, along with other local authority teams, can work collaboratively on the work they have started – understanding their green infrastructure, exploring the full range of benefits and then methodically valuing them. This will enable a stronger case to be made for greenspace, and ensure it is not left out or forgotten, but rather is a vital part of the overall decision-making process.

This report has discussed ways that local authorities, and local authority public health teams in particular, can reconsider the wider purpose of, and make the case for, high quality, accessible greenspace. In many places, public health and spatial planning teams are already working together and have developed a shared understanding of one another's processes and requirements to achieve common objectives. It is essential that these professions, together with landscape architects, recreation and leisure managers and others in local authorities, create opportunities to work together. This can help to ensure that health improvement underpins local decision-making processes and that new and existing communities have good quality green infrastructure at their heart.

Good design integrates green infrastructure into the holistic masterplan in ways that promote active travel, recreation and leisure, and support community and social engagement. Greenspace must be recognised as critical infrastructure that will help meet a range of local priorities and is not just something 'nice to have'.

It is vital that the local plan and greenspace/green infrastructure strategy are informed by local health data, the Joint Strategic Needs Assessment and the Joint Health and Wellbeing Strategy and take a wider view of the multifaceted benefits of greenspace. Without reference to health policies and strategies within these documents, it becomes very difficult to support the development of planning standards for health, or to defend planning decisions made on health grounds.

When public health teams are conversant with the planning system, they can use the levers that are available to them. Over time, the evidence base for greenspace and local health outcomes will develop as the planning system is used as an intervention to improve access. Local authorities will then be able to develop robust evidence-informed cases of how greenspace has led to measurable differences.

In many urban environments, it may not be feasible to create large new areas of greenspace. Fortunately, it is not only distinct greenspace that are associated with health benefits, but more generally by having greener neighbourhoods through threading different types of green – and blue – infrastructure throughout our communities including schools, our hospitals, our workplaces and our homes. This greener urban fabric would benefit everyone but may be most valuable to those who do not normally engage with greenspace.

Providing accessible, good quality greenspace tends to attract people to use it, but this may not be enough. There will always be people who, for personal or cultural reasons, are unlikely to use greenspace, and these may be those who could benefit the most. Thoughtful and inclusive physical design, coupled with programmes of social engagement and participation, have been shown to be most effective at delivering on multiple outcomes and attracting different population groups.

The spatial planning process is being used to improve access to greenspace, however there is a gap in the evidence on how access to greenspace affects different population groups and consequently the impact on health inequalities for specific groups. This would be greatly aided by using consistent definitions and standardised valid and reliable measures of data collection. Robust design and evaluation are needed to examine the health outcomes of interventions to promote individual behaviour change, especially with regard to demographic characteristics. This will help to better understand what works, in which circumstances, and for whom.

This report offers the following policy, practice and research recommendations for local government and those working in partnership with it.

Policy

Consider local green (and blue) space to be critical assets for maintaining and supporting health and wellbeing in local communities. The evidence base linking health and greenspace is compelling, and supports innovative thinking about its potential to help achieve local priorities.

Ensure that local policies and strategies are informed by evidence of need for sufficient access to greenspace . This can be done by:

- ensuring the Joint Strategic Needs Assessment (JSNA) and Joint Health and Wellbeing Strategy (JHWS) define how local greenspace can be used to meet the current and future health needs of the population – JHWSs can reflect the part green infrastructure has to play in wider health and wellbeing strategies and how local stakeholders can contribute to improving access to, and use of, such greenspaces
- ensuring the Local Plan reflects the health priorities laid out in the JSNA and JHWS – if local health priorities are not included within the Plan, it can be difficult to make the case for specific planning standards to be implemented to address health needs, or to defend planning decisions based on health and wellbeing grounds
- developing a green infrastructure strategy and, as appropriate, supplementary planning documents (SPDs) to support policies for the protection and enhancement of green infrastructure

Prioritise improving access to greenspace and creating greener communities especially in areas of deprivation or where there is poor or unequal access, as part of the wider plan to reduce health inequalities locally. Disadvantaged groups appear to gain the most health benefit and socioeconomic inequalities in health are lower in greener neighbourhoods. Improvements must be carefully planned and purposeful consultation must occur at all stages in order to provide equitable, sustainable benefits and ensure health inequalities are not inadvertently exacerbated.

Local practice

Support meaningful engagement across local government functions and the community to understand the actual and potential local benefits of greenspace and reveal the complex and diverse ways greenspace is thought about and used. Understanding the range of benefits greenspace delivers to the community lays the groundwork for conducting a valuation exercise.

Consider whether a formal valuation of benefits is necessary to strengthen the case for the creation, revitalisation and maintenance of greenspace. This may be done using monetary, non-monetary or a combination of valuation techniques. Natural capital accounting is one approach supported by Government.

Identify and factor in resilient funding arrangements for the maintenance of greenspace as early as possible, so that it can continue to provide benefits in the long term. Any decision on spending or investment in local areas needs to take account of the potential impact on health and wellbeing as well as future financial sustainability, giving local public health teams and the NHS an opportunity to engage in the decision-making process.

Establish interventions, such as green social prescribing initiatives, that will support people who do not use greenspace to begin using it. Programmes to support social engagement or to facilitate participation in activities, which may be jointly provided by local authorities, the NHS and/or VCSE organisations, coupled with improvements to the physical environment are most effective in enabling people to start using these spaces and to continue to use them.

Work with local NHS systems and professionals, including Sustainability and Transformation Partnerships and Integrated Care Systems, to promote the role greenspace plays in both individual and population health outcomes. This aligns with the health service's aim to take more action on prevention and use green assets, through initiatives such as social prescribing, as part of the overall plan to achieve this aim.

Local research

Develop persuasive, evidence-informed case studies that highlight the impact that accessible greenspace has on local health outcomes, especially for disadvantaged groups. Monitoring and evaluating local changes in access to greenspace, in conjunction with health data over time, will improve understanding of what works, for whom and how. This information can be developed into useful case studies that explore and highlight the benefits and value of greenspace for health.

Support robust evaluation of local greenspace interventions to help build a broader evidence base. This can be done by:

- using valid and reliable measures of data collection to reduce the heterogeneity of research on health inequality and access to greenspace
- embedding thorough evaluation in costings and plans from the inception of new schemes wherever possible

The recommendations above are for local areas including local government, local NHS bodies and their system partners to consider based on current and future health needs of populations and in the context of local systems.

In the PHE Strategic Plan, 2020-25, there is a commitment to supporting the creation of healthy communities by supporting local areas through work at a national level. This includes influencing agendas across government, shaping development of new national policy, promoting effective evidence-based solutions, and fostering research and innovation.

Improving access to greenspace for all communities requires leadership, partnership and development of shared agendas across organisational boundaries and between professions in the public and private sector. To enable healthier, more equitable and sustainable communities, we need to develop a shared vision for improved access to greenspace. In turn this will lead to improved local spaces, better health outcomes and reduced health inequalities.

Appendix A: Evolution of evidence on health and greenspace

A maturing evidence base

The evidence reviews cited in Appendix B identified that, since the publication of PHE's 2014 Improving Access to Green Spaces report (181), there has been a substantial increase in the quantity of research which has focused on the linkages between greenspaces and health outcomes, as well as on the ways in which the environment can be used, designed or manged to promote health outcomes. Web of Science searches on key terminology such as 'greenspace' show year on year increases in volume of research findings produced and the recent investment in the topic by UK research councils and Europe Horizon 2020 (H2020) framework will result in further high-quality evidence, for example National Institute for Health Research (NIHR), and Natural Environment Research Council (NERC). The improved evidence base has extended our understanding of who benefits and how, to what extent, and in what ways.

Pooling the evidence base

The expansion in the quantity of available research has meant that are now a number of good quality evidence syntheses (including one which was carried out through the Cochrane Collaboration (182)), and, where there is suitable evidence, meta-analyses.

Evidence syntheses have, or are considering the linkages between greenspace exposures and use, and outcomes such as: mortality (31-33, 36, 49); stroke (33); coronary heart disease (33); diabetes type 2 (33); maternal outcomes (35, 36); cancer (183); mental health (32, 44-46, 49, 51, 63, 184-186); stress and psychological restoration (187, 188); cognitive function (189, 190) and neurological disability (191); self-perceived general health (32, 33); and on recuperation from poor health (192) and quality of life (48).

Reviews have also been produced on the linkages between greenspace and health behaviours, most notably on physical activity and recreation (63, 193-197). Reviews have considered the value of greenspace to the health of specific demographic sub-groups including those with mobility impairment (198), children and young people (44-46), older people (190, 199, 200), and in relation to gender (201).

Syntheses of the benefits of specific types of greenspaces have also been produced (185). Types considered include green infrastructure (98, 110, 202, 203), urban forests

(204), and in relation to the ecological state (205, 206). Further reviews have considered questions relating to necessary proximity to greenspace for benefit (173, 207).

Finally, there are also a number of syntheses of the determinants of greenspace use (39, 58, 208, 209), and in relation to the outcomes of health-focused greenspace actions and interventions (182, 190, 199, 209-217).

An improved understanding of the relationships between greenspace and health

The expansion of the number of studies produced, and efforts to synthesise across the evidence base is to be welcomed. The linkages between greenspace and health outcomes are complex with indications of high levels of heterogeneity in the relationships according to a multitude of factors such as environmental, social and cultural context, the type, frequency and duration of exposure, and in relation to interactions with other health determinants.

There is a greater use of robust study designs, particularly in relation to the health, wellbeing and behavioural outcomes of environmental interventions (218-220). These studies are helping inform what works, where, how and why, and are revealing the active ingredients of interventions. Analysis of longitudinal and cohort data is helping to unpick the causal relationships between greenspace and health (221-231). Studies are also critically questioning the explanatory potential of pathways such as attention restoration theory (188), as well as addressing questions of equity and the distribution of resource and benefit (221, 232-234). Qualitative studies are revealing the meanings of greenspace to individuals and communities (192, 200, 232, 235) and adding depth to intervention evaluations (220). New explanatory theories, such as the role of biodiverse environmental microbiomes in promoting positive human health, are being explored (236-239). Involvement of ecological specialists is improving the ways in which we consider the types and states of environments to which people are exposed, clarifying the role of biodiversity and environmental complexity (240). Finally, our understanding of the dis-benefits of exposure to greenspace is improving. For instance, new studies are clarifying the interactions between urban vegetation and form and air pollution on outcomes such as asthma (241, 242), and the potential for urban greenspaces to provide habitats for zoonotic disease vectors (243).

We now have 10 years of Natural England's Monitor of Engagement with the Natural Environment (MENE) data (56). This is an important resource and has been used to clarify who does and does not visit greenspace and why (136), interactions between use type and benefit (139, 244), and the impacts of different types and availabilities of environments (245-247). MENE data has been used to build tools, such as the Outdoor Recreation Valuation Tool (ORVal). ORVal provides economic values and visit estimates for existing and new greenspaces.

Challenges in the evidence base

Many of the reviews listed above conclude that whilst there is a substantial body of useful evidence, there are certain limitations (see section 11). These include high levels of heterogeneity, poor quality studies and the patchy nature of the evidence base, with a lack of evidence relating to certain sub-groups and pathways. This is not surprising in a relatively young research area but does limit the potential applicability of the evidence.

One of the most pressing issues is the lack of clarity in terminology and of the 'exposure'. One review found that only about half of the studies included in the synthesis provided a definition of how 'greenspace' was conceptualised (248). Typically greenspace has been considered in one of 6 key ways 1) amount of local area greenspace, 2) greenspace type, 3) visits to greenspace, 4) views of greenspace, 5) greenspace proximity and accessibility, and 6) 'connection to nature' (184). Within each of these categories are numbers approaches to measurement and assessment. Clarity in how the environmental exposure is understood and measured is important as there some evidence that different conceptions of greenspace affect the nature of outcomes observed (249).

A further issue relates to how transferable evidence is between contexts and whether outcomes relating to one population or setting will be consistent with and applicable to another population or setting. It is currently not clear, for example, whether the associations between residential greenspace exposure and psychiatric outcomes in a Danish population demonstrated in a recent study (250) can be applied to the British context. Differences in urban form, socio-cultural norms in greenspace use throughout the life course, and the availability of health care between the 2 nations mean that we must be cautious. Replication of studies between nations is limited by factors such as data availability.

There is a need for a greater focus on what works, unpicking causal pathways, clarifying how consistent relationships are between settings/populations etc., critical modes, times (for example childhood) and durations of exposures for benefit.

Appendix B: Health benefits associated with access to and use of green spaces

This review of evidence is a summary of the evidence presented in 2 reports:

1. Health and the natural environment: A review of evidence, policy, practice and opportunities for the future (4)
2. A rapid scoping review of health and wellbeing evidence for the Green Infrastructure Standards (5).

The methods used to develop those reports are detailed within those documents.

All associations are statistically significant unless otherwise noted.

Mortality

There is a small body of evidence which has investigated the linkages between exposure to greenspaces in the living environment and mortality (31-33, 49).

The robust meta-analysis by Twohig-Bennett and Jones (33) found associations between living in high versus low greenspace neighbourhoods and all cause and cardiovascular mortality in adulthood. A higher quantity of objectively assessed greenspace in the living environment was also found to be positively associated with reduced cardiovascular and all-cause mortality in earlier reviews, with the strongest associations for more deprived groups (31, 32). No association with lung cancer mortality was found in the review by Gascon, Triguero-Mas (31). Analysis of a cohort of women in the US found that living in the greenest neighbourhoods (the highest quartile) was associated with reduced incidence of overall cancer mortality and respiratory mortality (33, 251). Two studies found associations between environmental conditions, including higher levels of greenspace, and reduced mortality in neonates and infants (252, 253).

van den Berg, Wendel-Vos (32) found no studies that had investigated the impact of the quality of greenspace on all-cause mortality. One study found increased rates of cardiovascular mortality in women was associated with the loss of urban trees due to an invasive pest in the US (254). Gascon, Triguero-Mas (31) found no evidence which clarified the necessary proximity or size of greenspaces for reduced mortality.

Analysis of US mortality data by James, Hart (251) indicated that the association between greenness and all-cause non-accidental mortality was partly mediated by physical activity, particulate matter < 2.5μm, social engagement, and depression.

Morbidity and physical state or function

A substantial body of evidence has investigated the impacts of the amount of local-area greenspace and greenspace accessibility on a range of outcomes and risk factors (33, 183).

The most extensive and recent review and meta-analysis was carried out by Twohig-Bennett and Jones (33), who reviewed 143 studies. The review combined the associations between a range of different types of exposures to greenspaces and 'health-denoting' levels of salivary cortisol, heart rate and heart rate variability, diastolic blood pressure, and high-density lipoprotein cholesterol. The authors also found reduced incidences of type 2 diabetes. Although reductions in the incidences of stroke, hypertension, dyslipidaemia, asthma and coronary heart disease were found, these were not significant in the pooled analysis (33). Outcomes were found to be strongest for groups with lower socioeconomic status and for those living in the most deprived areas (33). Individual studies have found associations between increased greenness or biodiversity of the living environment and immune-regulatory related health outcomes such as reduced rates of atopic conditions (allergies) and 'healthier' microbiomes post mortem (238, 255).

Mental health

There is a relatively robust and extensive body of evidence regarding the relationships between exposure to, use of, and perceptions of greenspace and a number of mental health outcomes (32, 44-46, 49, 51, 63, 184-186).

The most comprehensive review of the effect of greenspace on positive mental health in adults (over the age of 16) was carried out by Houlden, Weich (184). Their systematic narrative synthesis (meaning they were unable to carry out a formal meta-analysis) of 50 studies (majority of evidence was good or of moderate quality) found:

- some evidence of a positive association between greater amounts of local area greenspace (in relation to the home) and higher life satisfaction and reduced mental distress
- limited evidence of the impact of different types of greenspace on mental health and wellbeing
- limited evidence that more frequent visits to greenspaces are associated with mental health and wellbeing
- greenspace closer to the home 'may be most strongly' associated with mental health but the evidence is currently limited
- while views of nature and subjective connection to nature may be associated with mental wellbeing the evidence was rated as inadequate

The review by Gascon, Triguero-Mas (51), which went beyond positive mental health and wellbeing to also consider poor mental health, found some evidence that greenspace in the local area is associated with mental health in adults, but that the evidence linking 'access' to greenspace and mental health was inadequate and insufficient to draw conclusions. Further reviews have found evidence for links between nature in the urban environment and positive emotions (affect) and strong evidence of positive associations between the quantity of greenspace in the living environment and self-rated mental health and reduced rates of reported stress (32, 49, 50). Factors such as age, gender and physical activity behaviours appear to moderate relationships between greenspace exposures and mental health outcomes in adulthood (32).

There is some evidence from controlled trials to indicate that physical activity in greenspace is more beneficial than activity in other settings, with reduced feelings of tension, confusion, anger, and depression, and increased energy and feelings of revitalization and positive engagement (40).

Several systematic reviews have found positive associations between the presence of greenspaces in the living environment and mental wellbeing (self- and parent-rated) outcomes in children and young people (44-46). Tillmann, Tobin (46) found positive associations with emotional wellbeing, reduced stress and improved resilience (resulting from adventure activities) and higher health-related quality of life. Several reviews found evidence of positive associations between greater exposure to, or accessibility of greenspace and reduced rates of hyperactivity and inattention (44-46). Vanaken and Danckaerts (44) found that the effects of greenspace on children and young people's mental health and wellbeing appears to vary according to developmental stage and in relation to the type and accessibility of greenspaces.

Maternal outcomes

There are a number of studies, including 2 systematic reviews, which have investigated the associations between residential greenspace and a number of maternal and birth outcomes (33, 35, 36).

Two systematic reviews and meta-analyses found positive and relatively consistent associations between higher levels of greenspace in the living environment and more favourable birth weight (33, 35). Dzhambov, Dimitrova (35) found that greenspace within 100 metres of the home was associated with higher birth weight and Twohig-Bennett and Jones (33) found lower rates of pre-term birth in greener areas. The review by Banay, Bezold (36) found relatively inconsistent evidence of an association between greenspace and gestational length and no consistent association with pre-term birth. There was inadequate evidence to draw any conclusions about associations with maternal outcomes such as preeclampsia or gestational diabetes (36).

The review by Banay, Bezold (36) found that the associations between greenspace exposures and birth outcomes were lower in groups with lower socioeconomic status and educational levels. Physical activity was found to be a mediator of the effect of the amount of greenspace on post-partum depression in one UK study (227). Other potential mediators include traffic, air quality and environmental conditions such as walkability (36).

Self-rated general health and wellbeing and quality of life

A small number of studies have considered the impacts of greenspaces on self-rated general health (32, 33).

The review by van den Berg, Wendel-Vos (32) found moderate, generally consistent evidence, from good or adequate quality studies, of positive associations between the quantity of greenspace in the living environment and self-rated health. Positive associations were also consistently (though only from moderate quality studies) found between the quality of greenspaces, whether objectively assessed or perceived, and self-rated general health by van den Berg, Wendel-Vos (32).

Most studies found some variation according to socio-demographics. Although people with lower levels of educational achievement appeared to benefit more from greenspace in the living environment than people with higher levels of education, the effects of socio-economic status, gender and age were less consistent (49).

Developmental and cognitive outcomes

A small body of research has considered the impacts of greenspace exposure on cognitive function and developmental indicators (33, 189-191).

There is some, inconsistent, evidence of a positive association between greater exposure to greenspace and neuropsychological development of attention and working memory in children and young people (33, 44, 45). Analysis of German data found that children living in areas with the lowest percentage of natural area were significantly more likely to have deficits in motor development in comparison to children living in greener areas (33, 256).

Dis-benefits

There is a small body of research which has sought to clarify the potential dis-benefits of exposure to greenspace on various health outcomes.

Greenspaces may provide a habitat for zoonotic vector species (such as ticks and Lyme disease) (243) or allergenic plants. Urban trees have been associated with increase in air pollutant concentrations in certain types of urban form (particularly ‘urban canyons’)

(242). There is some evidence that suggests that air pollutants and pollen interact exacerbating the negative effect to health (257). An individual study linked greenspace to increased rates of skin cancer risk via greater sun exposure (Australian study) (258). There is some evidence to suggest that feelings of insecurity and fear are associated with presence of dense urban greenspaces in the living environment for some populations (259, 260).

Appendix C: Literature review on inequalities and access to greenspace in the UK

A literature review was conducted to scope out the current state of evidence in the UK on inequities and inequalities in access to greenspace. This section provides the findings of this review. The quality of individual studies was not assessed.

Methods

This review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (261).

Search strategy

The search strategy comprised combinations of synonyms for green/blue space, health and wellbeing, inequality, population and place as shown below.

Search strategy for the literature review

Green* OR *env OR park OR natur* OR blue
AND
Health OR wellbeing OR well being
AND
Inequal* OR equal* OR depriv* OR SES OR socio*
AND
Spatial OR space OR place
AND
Population

Searches were conducted in 4 electronic databases (MEDLINE, SCOPUS, HMIC and PsychInfo), and reference lists were checked for the purpose of locating other suitable studies. The searches were undertaken of studies published between 1 January 2008 and 21 December 2018. The year 2008 was selected as the start date because it was the year the World Health Organisation's Commission on Social Determinants of Health was published (262). This report was recognised as leading to the publication of England's first evidence-based strategy on addressing the social determinants of health (135).

Inclusion and exclusion criteria

The PICO format was used to define inclusion criteria. To be included in the review, the population of interest (P) had to be people in the UK, disengaged with the natural environment as defined by Natural England (154); include at least one aspect of green infrastructure (I),that is greenspace, blue space, parks and gardens; and any measure of health inequality from access to green infrastructure (O). Comparator studies (C) were classed as any other study examining green infrastructure. All empirical qualitative and quantitative studies investigating access to greenspace, health inequality and health outcomes were eligible for inclusion in the review. This includes, cohort, case-control, cross-sectional, observational, RCTs and quasi-experimental studies. Only peer-reviewed published empirical data was included. Only literature in English and conducted in the UK was included.

Study selection

Screening was completed using EndNote X8 (Clarivate Analytics, Philadelphia, USA). After deduplicating references, title and abstract screening was completed, followed by full text screening.

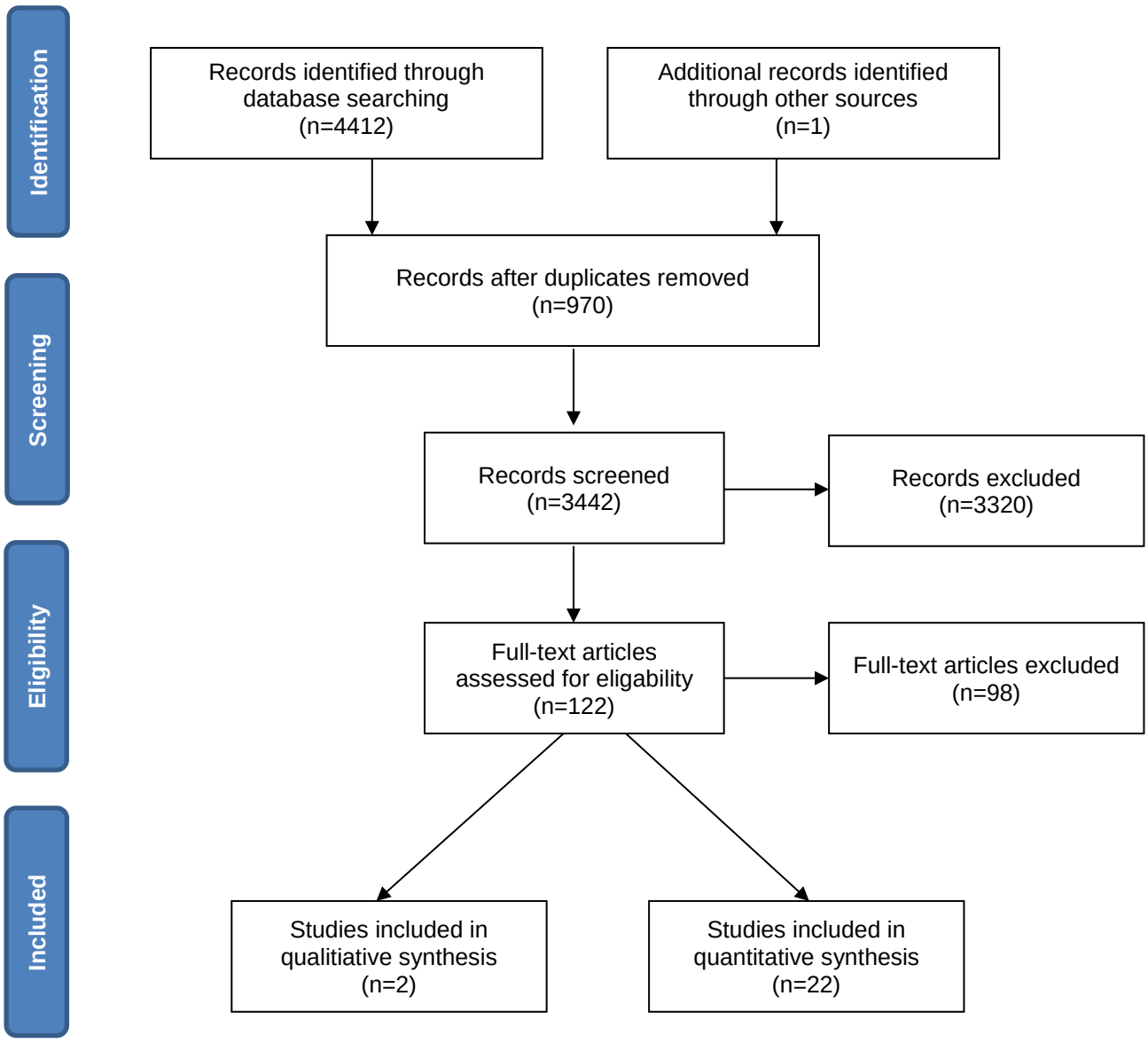
Data extraction

Study characteristics from included publications were extracted by one author (AH) including study design; location; population (sample size, gender, ethnicity and child age); health outcome measure; type of green infrastructure; statistical measure of association where appropriate.

Results

4412 references were identified through searching the databases. After deduplication (n=970), 3441 titles and abstracts were screened against the inclusion criteria and 3320 excluded. Full text articles of 122 studies were screened for inclusion, with 71 papers being included in the review. These were all written in English. This process is shown in Figure 4 (261).

Figure 4: PRISMA Flow Chart



Data collection measures

Deprivation

The most popular measure of deprivation was the English Indices of Multiple Deprivation (IMD) (136, 168, 263-270). Others used the Carstairs Index (271-273); the Townsend Score (274-276); National Statistics Socio-Economic Classification (NS-SEC) (277, 278); the Welsh Indices of Multiple Deprivation (WIMD) (279); ONS household deprivation (233) and the Market Research Society Social Grade (ABC1) (233). Furthermore, income was also used as a proxy for socio-economic position (280).

Health outcomes

Across the studies identified in this review, many different health outcomes were examined. The most common health outcome assessed was mental health, and the Perceived Stress Scale (PSS) was the most popular measure, along with salivary cortisol (271-273) followed by the Warwick and Edinburgh Well-Being Scale (WEMWBS) (266, 273). Other measures of mental health used in the research included cognitive function (264); the 5 question Mental Health Inventory (MHI-5) (270); the Patient Health Questionnaire (PHQ) (275); the UCLA loneliness scale (269); social wellbeing and anxiety disorders (263).

Physical activity was the next most popular health outcome studied. To investigate associations between physical activity and green infrastructure in different populations, the most common measures were those developed by the British Heart Foundation (BHF) (269, 273), and International Physical Activity Questionnaire (IPAQ) (264, 277). The BHF methodology comprised the number of days over the last 4 weeks that the participant reported over 30 minutes of physical activity, whereas the IPAQ questionnaire examined the number of MET hours per week. Similarly, the Scottish Physical Activity Questionnaire was also used (22). Other objective measures of physical activity were collected by assessing the number of days per week participants were active (276); and by the results of the Active People Survey (268). Furthermore, the provision of green infrastructure for physical activity was also examined (278).

Further health outcomes examined included various measures of self-reported health (269, 271, 279), with some explaining that they used self-report data as provided by the ONS Census (274, 280). Some studies looked at whether health was a facilitator for access to greenspace (281), or similarly, poor health a barrier for access (136). Mortality (267), morbidity, years of life lost (YLL), and illness & disability ratio (263) were also investigated.

Green infrastructure

A number of different measures of green infrastructure were identified across the UK literature. The most common measure of green infrastructure in this review was the Generalised Land Use Database (GLUD) (263, 266, 267, 269) which classifies all land use in England into 9 categories. One of these categories is greenspace, and includes parks, open spaces and agricultural land, but excludes domestic gardens. Several studies from Scotland used publicly accessible greenspace as their measure, including parks, woodlands, scrubs and other natural environments and excluding public gardens (271-273).

The next most popular measure was the Normalised Difference Vegetation Index (NDVI) (263, 275), an indicator of greenness based on land surface reflectance of visible (red) and near infrared parts of the spectrum. Others measures of green infrastructure used by studies in this review include the Urban Atlas (268, 270); Residential Environment Assessment Tool (REAT) (279); and local authority greenspace databases. Some studies used their own measures including natural areas defined as parks, beaches and agricultural land (274); play areas and allotments (278); or areas of land open to public access (168, 267) greenspace (263), a relative proportion of greenspace between 0 and 1 (266). In Scotland the percentage of greenspace per Census Area Statistic (CAS) ward was used as a measure of accessibility (271, 272, 274).

Means of access

Means of access to green infrastructure was measured in a variety of ways across studies. The majority of studies measured access by using a straight-line distance (Euclidean) (265, 267, 268, 275-278, 280). Others used network distances (266, 269, 276, 277). Furthermore, some used different calculations derived from lower level super output areas (LSOA), including percentage of land area classified as greenspace (267), total greenspace (263), and a relative proportion of greenspace between 0 and 1 (168). In Scotland, the percentage of greenspace per Census Area Statistic (CAS) ward was used to measure means of access (271, 272).

Demographic inequalities

Gender

Women are less likely to report that they are infrequent visitors to greenspace, and less likely to report that they are not interested in visiting greenspace (136).

Residential surrounding greenness was positively associated with global cognition in men but not women. Conversely, there was a positive association between the NDVI and a change in cognition for women, but not men (264).

The association between Residential Environment Assessment Tool (REAT) score and poor health was not affected by gender (279). Furthermore, the association between the availability of greenspace and physical activity was not significantly different between males and females (280). Additionally, there was no significant difference between exposure to greenspace and either mental health or physical health for both men and women (270). Likewise, although the percentage greenspace in the ward of residence was associated with self-reported stress and physical activity, there was no significant difference between males and females (273).

Both men and women's levels of perceived stress was higher in low greenspace areas. However, women's perceived stress was significantly higher in low greenspace areas compared to men. Furthermore, not having a garden was associated with higher (perceived?) stress for men, but not women (272). When an objective measurement of blood cortisol was taken, there was no significant overall association between neighbourhood greenspace and average blood cortisol levels. However, where there was a higher percentage of neighbourhood greenspace, this was associated with higher average blood cortisol levels among females, but not males. This may indicate higher stress amongst females (272). The association between residential greenness and major depressive disorder was only seen amongst females (282).

Visits to beach environments for sunbathing and paddling were more popular amongst females than males. Women also preferred recreational walking in all types of green infrastructure, including rivers, lakes and canals; urban spaces and woodlands or forests. Other coastline environments were more popular amongst males. Furthermore, males were more common visitors to rivers, lakes or canals, particularly for fishing and water sports (282).

Age

Older adults were more likely to report that they are infrequent visitors to greenspace, with no particular reason given as their motivation (136). However, older adults were less likely to report that they were not interested in visiting greenspace (136). One reason given for infrequent visits by people living near the coast was poor health (136). It could be argued that this is due to older people being more likely to live near the coast.

The association between poor health and the REAT score became stronger with age for women (279).

Different types and uses of green infrastructure were more popular at different points across the life course. Visits to rivers, lakes or canals and the beach environment were more popular for those aged 35-64 years compared to 16-34 year olds, yet visits to other coastline environments were more popular for older people. Furthermore, woodlands and forests were more popular amongst 35-64 year olds compared to those aged 16-34 and over 65 (282).

Fishing in coastal environments and recreational walking along rivers, lakes and canals was more popular amongst 35-64 year olds compared to 16-34 year olds. However, recreational walking in urban spaces was more likely amongst younger adults, and walking in woodlands and forests was preferred by 35-64 year olds. Also, sunbathing and paddling, and water sports in coastal environments were more popular amongst 35 -64 year olds compared to those older than 65. On the other hand, swimming in marine and coastal environments was more popular amongst 16 – 34 year olds, and less popular amongst people aged 65 and over (282).
As age increases, a higher level of greenspace was associated with a greater diurnal cortisol decline (that is less stress) (272). A different study looked at why people do different things to relive stress depending upon their age and associations with their access to and satisfaction with greenspace. They found that despite having good access to greenspace, high stress - mid aged people (25-47 years) expressed poor satisfaction with local greenspace and were less likely to visit for exercise, relaxation or social reasons (271). Conversely, low stress – youth with good access and reasonable satisfaction levels reported that they used urban greenspace for exercise, relaxation or social reasons. Low stress - seniors with good access, used the greenspace for relaxation (271). One study found no differences between health and neighbourhood greenspace when comparing the elderly and younger age group (270).

A protective effect was seen for residential greenness on major depressive disorder amongst people aged less than 60 years. Those with greater accessibility to greenness were significantly less likely to experience a major depressive disorder (275).

Education

Residential greenness was negatively associated with a series of cognitive scores at baseline and over time became positively associated with a University education. Those with a secondary education saw a positive association with cognitive scores at baseline and over time. Those with low education also saw a positive association with cognitive scores at baseline, however no association was seen over time (264).

The effect of neighbourhood greenspace varied between population groups of different educational levels. Low educated residents reported poor general health significantly more when living in neighbourhoods where there was objectively better quality greenspace, but no differences were found for the amount of greenspace in the

neighbourhood (270). However, there was some evidence that low education residents benefit more from greenspace in their neighbourhood compared to high educated residents (270).

Employment

When compared to full time employment, all other categories were less likely to report being an infrequent visitor to greenspace and were less likely to report they are too busy at work to visit greenspace. Therefore, full time employment may be a barrier. However, those not in full time employment were more likely to report they are not interested in visiting greenspace (136). Those in part time employment were more likely to report other barriers including being too busy at home, or poor health (136).

When comparing women who were not working to those who are working, there was a weaker association between poor health and REAT score (279). However, one study found no difference in the association between neighbourhood greenspace and health by employment status (270).

Ethnicity

Access to greenspace may be shaped by many dynamics, including broader socio-cultural influences on people's awareness of nature connection. There may also be varying priorities to the extent that time is spent in nature (136). Those of white British ethnicity were less likely to report visiting greenspace less than once per month, and less likely to report time as a barrier (136).

Following an equity analysis of the UK Healthy Towns project, good access to new infrastructure including green infrastructure was not available in areas with high non-white British populations (Black Minority Ethnic)(BME). This was despite BME populations being a target group, meaning they were spatially disadvantaged by the project (278).

One study examined the association between expected deaths and access to greenspace. This study found that residents of more ethnically diverse LSOAs were at a higher risk of poor access to greenspace, predicting 8-11 deaths per 100,000 persons. When compared to White populations, there were 1-2 expected deaths per 100,000 population (268). However, a different study found that the relationship between higher residential surrounding greenness and cognitive decline was not affected by ethnicity (264).

The quality of, access to and use of greenspace was a significant predictor of general health in a mixed BME population (non-Indian/ White British), that is if people from a mixed BME population were more satisfied with their local greenspace, this was

associated with better health. People from a mixed BME population have significantly more negative perceptions and are less satisfied with urban greenspace quality, particularly those from a Bangladeshi origin. People of White British and people of Indian origin rate their neighbourhood more positively than mixed BME. However, perceived quality of greenspace predicts health across all ethnicities. Easy access to greenspace by walking was associated with very good health for people of Indian origin and good health for White British populations (269).

In one study, the LSOAs with above median street tree density were characterised by a higher proportion of Asian/Asian British populations living nearby and a lower proportion of White British. Conversely, LSOAs with higher accessibility to greenspace had more white residents than those with low accessibility (233). However, when population density was taken into account the association was no longer significant, which suggests ethnicity does not play a part, only population density. Furthermore, greenspace quality was positively associated with the proportion of Asian/Asian British population, and a limited negative association was found with the proportion of White British population (233).

Some non-White populations felt excluded from marketing material, as they felt it was not ethnically diverse. This may be a barrier to some populations accessing and using greenspace (168).

Housing tenure

Two studies considered housing tenure. An equity analysis of the Heathy Towns Project identified that new infrastructure such as greenspace tended to be located in areas with a greater amount of social housing (278). However, the association between a poorer residential environment assessment tool (REAT) score, and self-reported poor health was not influenced by housing tenure (279)(19).

Disability

Research examining the reasons why people have infrequent contact with greenspace found that those with long term illness or disability, were more likely to report being infrequent visitors, and more likely to report their reasons as poor health; they were not interested; or they had no particular reason. On the other hand, this population were less likely to report their reasons for not visiting greenspace as being too busy at work or home (136).

Summary

Whilst there is strong evidence showing the links between health and exposure to/use of greenspace, as presented in Appendix B, the evidence from this literature review on associations between access to greenspace and health inequality in the UK is less robust.

The review found that most studies identified do suggest associations between access to greenspace and health inequality, yet some found no clear relationship. This may be due to measurement variability and the cross-sectional nature of studies.

Therefore, to improve the quality of evidence in this area, we suggest:

- developing consistency in measurement for health inequality, access to greenspace and health outcomes to allow comparison of project outcomes across the UK
- conducting robust evaluations of spatial planning policy and implementation that include health inequality and access to greenspace
- including variables to measure health inequality as well as health outcomes when assessing the influence of individual behaviour change interventions,
- collecting data to assess the impact of interventions over longer periods of time, for example at least 1-2 years
- encouraging the publication of evidence on associations between improving access to greenspace and health inequality

This will influence and inform UK policy makers and practitioners to promote equitable usage of green spaces; and overcome barriers for target populations which may face difficulties in accessing or using the natural environment.

Appendix D: Case studies

The following case studies are presented in this appendix:

Focus: Targeting communities to reduce health inequalities
- Study 1: The Mersey Forest Nature4Health
- Study 2: Dorset Stepping into Nature

Focus: Rethinking parks as a health asset
- Study 3: Camden and Islington Parks for Health
- Study 4: Naturally Birmingham

Focus: Joint working across local government and the health service
- Study 5: Norfolk Planning in Health Protocol

Focus: Targeting communities to reduce health inequalities

Study 1: The Mersey Forest: Nature4Health

Nature4Health, a 3-year £420,000 project funded by the Big Lottery's Reaching Communities programme, was delivered by The Mersey Forest.

What is 'The Mersey Forest'? The Mersey Forest is both a Place and a Partnership. It is a network of woodlands and green spaces across Cheshire and Merseyside, and a wide-ranging partnership of different organisations including local authorities, community groups, landowners and businesses. For 25 years, the partnership has been taking every opportunity it can to create 'woodlands on your doorstep', planting over 9 million trees.

The Forest is made up of post-industrial land such as Collier's Moss, as well as traditional parks and outdoor community spaces. The Mersey Forest actively promotes itself as a reason to invest in the area, and is quick to say it is improving the image of the region's towns and cities. Rather than a traditional funding model, it uses an investment model which may be of interest to other organisations (see link below).

Nature4Health was a Lottery funded project within the remit of the wider 'Natural Health Service', targeting specific communities with the aim of reducing health inequalities through 5 different evidence-based activities, all taking place in a green, therapeutic environment. This broad-ranging intervention included forest schools (allowing children time and scope to explore the natural environment), woodland walks, therapeutic gardening and practical conservation sessions to get the heart pumping. Participants were also offered the opportunity to learn mindfulness techniques in a natural setting.

The activities were provided in 8 to 12-week blocks, with highly targeted, tailored sessions. Some focused on particular groups (for example, children) or health conditions (for example, adults with dementia).

Evaluation shows the programme brought a significant increase in levels of physical activity and positive mental wellbeing, and had a major impact on a positive sense of community.

Says project manager Clare Olver: ‘We found that if we did things right, we might do much more to help people move on with their lives. They might make the project sustainable by managing it themselves, boosting their experience for the job market.’

According to Olver, it’s important not to simply ‘helicopter in’ interventions. ‘We learnt to tailor activities to fit in with the local culture, and according to local need. In St.Helens, for instance, we had to reach some groups we know are difficult. Bespoke men’s walks with Saints RFL were a big success: dubbed ‘walking rugby’ they attracted this hard-to-reach group in a way that a ‘health walk’ wouldn’t.

‘Effective monitoring and evaluation is vital. We learnt to listen and adapt as we developed, so we could be both proactive and flexible in delivery.’

IPAQ questionnaires assessed levels of self-reported physical activity. The overall increase in ‘MET-minutes’ per week was 31.1%. All participants were also asked to complete WEMWBS questionnaires, and showed a marked improvement in scores of mental wellbeing of over 6 points.

According to Olver, their data showed that a physical health focus wasn’t enough. ‘Social interaction is what is critical to success.’ This is a theme that emerges time and again in the case studies made for this report. When it comes to evaluation compliance, she says: ‘There is absolutely nothing better than encouraging people to sit down with a cup of tea. And put the pencil in their hand…’

Top Tips

These factors were key:

- safe, welcoming and easy to access venues in the natural environment
- identifying local need and responding in a localised way
- taking a holistic approach
- engaging the target group and understanding barriers to participants’ involvement.
- the right project staff, empathetic and enthusiastic, are crucial. They also need to be right for specific groups
- your current participants may become your future volunteers
- participants are more likely to re-attend when the group is close to where they live

Further resources

Project website: www.nature4health.org.uk/
Online evaluation report: http://nature4health.impacts.report/ and the opportunity to see short videos that give fuller context
The investment model: www.merseyforest.org.uk/about/who-funds-the-forest/
Cheshire's Natural Health Service

Study 2: Dorset Stepping into Nature

Stepping into Nature is a project led by Dorset Area of Outstanding Natural Beauty and is funded by The National Lottery Community Fund, Dorset AONB & Dorset Council. The project aims to improve engagement opportunities with nature for Dorset's older adults, including people living with dementia and their carers. In addition, the project delivers a community dementia-friendly greenspace grant which has supported 19 projects with £28k in funding, matched by £43k in kind or match, including 672 volunteer hours.

They live in an 'Area of Outstanding Natural Beauty'. Yet for the 13,400 people in Dorset who are living with dementia*, or for those isolated older people who can't drive or don't have transport, living in this public transport-light part of the world can be tough. In Dorset, 1 in 5 older adults are vulnerable to social isolation*. This can cause physical or psychosocial stress resulting in damage to people's physical and mental health.

Stepping into Nature is a project that has recognised these problems and taken active steps to reconnect people living with dementia to nature. With guided activities, Dorset's older adults are supported to access and enjoy the sensory-rich places in the surrounding landscape, wildlife and local historic culture. This multi-platform project funds community groups, small activity providers and local organisations to improve inclusivity of nature-based activities and publicise inclusive green spaces. Since April 2017, over 500 dementia friendly nature-based activities have been delivered through a range of partners.

Marketing the project proved a challenge, but one where new tools of engagement are effective. It was a matter of reaching not just those living with dementia, but their carers and those in the wider community who would pass the message on. Using highly local providers with strong local networks helped; they would circulate local pamphlets, leaflets and community board messages.

The project has improved the wellbeing of not just the people affected by the condition, but of their carers and families. It takes, says Julie Hammon project officer at Dorset AONB, 'a philosophy of positive risk taking'.

Longer term aims include forging new partnerships with the health sector in Dorset and linking more closely with social prescribing.

Top tips

Julie Hammon says, ‘early, on-going evaluation will help you adjust the things you need to, fast. For instance, we found that headlining something as ‘a dementia walk’ was a turn-off. People didn’t like being labelled – and it made it less inclusive. The activity itself has to be the draw, and in your marketing, you can just add subtle reminders that the activity is dementia-friendly.

‘We found that this project has been a great opportunity to up-skill some of our providers, who weren’t quite sure how to engage with this audience. Also, it helps if everyone is ready to be flexible. Work with your providers on the evaluation side from the very beginning. They may be reluctant at first, but they soon see that the quicker they gather robust data, the quicker they can adjust their offer and the more effective they can be.

‘With dementia it takes a while to overcome barriers, and to build an audience. Once you have done that, it all gets a bit easier. You can use what you learn to improve your offer, making it more inclusive for all.’

Further resources

Stepping into Nature website: www.stepin2nature.org
Facebook, Twitter, Instagram @stepin2nature
Pilot reports can be downloaded through the website.
For more information contact stepin2nature@dorsetcouncil.gov.uk

* Dorset CCG, 2019

Focus: Rethinking parks as a health asset

The Future Parks initiative is a joint venture between the National Lottery Heritage Fund and the National Trust, with additional funding from MHCLG, and aims to secure the future of the UK's urban parks and green spaces. This 2-year programme, which began in 2019, is enabling 8 areas to explore new ways to fund and manage local parks sustainably. It draws upon expertise in local government, conservation, fundraising, volunteering and greenspace management to find creative solutions that can be shared with other councils to ensure green spaces are able to be managed effectively now and in the future.

Parks for Health, in the London boroughs of Camden and Islington, and Naturally Birmingham are 2 of the projects looking specifically at how their local parks can be used as a health asset for the community. At the time of publication, these projects were within their first year, and these case studies reflect what has been learned so far.

Information: National Lottery Heritage Fund – Future Parks Initiative

Study 3: Camden and Islington Parks for Health

Parks for Health is being led by Camden and Islington Councils and is funded by the National Lottery Heritage Fund, National Trust, Ministry of Housing, Communities and Local Government, Camden and Islington Councils, Camden and Islington Public Health, Greater London Authority and London Sport

Camden and Islington Councils' Parks for Health project was developed to address local health priorities including high leves of mental ill-health, physical inactivity and health inequalities, and to increase social cohesion and respond to social isolation.

The community's parks were well-used and enjoyed, however the vision is to shift the thinking about these spaces as passive enablers of positive physical and mental health outcomes to playing a central role in achieving better health for the local population.

The project aims to:

- develop a new infrastructure to deliver health-focused green space provision
- develop closer links to the NHS, health providers and doctors
- build a strong understanding of community infrastructure to enable engagement with, and pathways into, social networks
- produce a baseline assessment of the current health opportunities of our green spaces
- identify and test innovative opportunities in the active use of green spaces for wellbeing

Securing senior-level and political buy-in has been important for the project to proceed and the project board, as the decision-making body, includes senior councillors and officers from both boroughs. This is supported by a project steering group, which includes heads of greenspace for the 2 boroughs. The project is managed by a dedicated project team.

There are 5 workstreams that are key to the delivery of programme activities: strategy, communication and marketing, networks and partnerships, insight and innovation and workforce transformation. Each has officers representing different areas of expertise within the councils, including parks, public health, sports and communications teams. Each workstream is co-designing an action plan that identifies what will be done to engage the target groups and achieve the vision as it relates to that workstream. Engagement with both the workforce and communities is key to this work. The project will also be complemented by a valuation of the social and economic value of local green infrastructure.

Engaging stakeholders across both boroughs is a critically important part of the work in order to demonstrate how the project can help to achieve health and wider priorities. Internal and external partners have been willing to give their time and commitment to the project.

The National Lottery Heritage Fund and the National Trust have provided support and insight to the project that is very valuable. For example, in a project called Parks Challenge, National Trust officers visited 40 parks across Camden and Islington and talked to officers and external partners. Their findings were fed back and will help influence the action plans that are being designed.

Further resources:

For further information contact John Thorne, Parks for Health Project Manager, john.thorne@islington.gov.uk

Study 4: Naturally Birmingham

Naturally Birmingham is being led by Birmingham City Council with funding by the National Lottery Heritage Fund, National Trust, and the Ministry of Housing, Communities and Local Government.

Birmingham is the UK's largest authority, with 1.1 million people and diverse communities speaking 108 languages. This is a city of complex needs that requires joined-up working and innovative solutions to local challenges. The Naturally Birmingham programme aims to show how cities can move the environment to the centre of their decision-making, to ensure parks have a sustainable future. It is being

run as an early exemplar for how cross-council working can happen, with the broader health and wellbeing offer that parks can provide at its core.

Birmingham has built up a good knowledge of its parks and green spaces but has struggled to engage the rest of the council, or to provide a sufficiently clear picture to local politicians of the wide-ranging opportunities for parks to meet multiple local objectives. The Naturally Birmingham project intends to achieve corporate and political recognition by identifying and promoting both the well-known and hidden benefits of parks and the value of these, allowing the true worth of the city's green estate to be better understood and communicated. It is expected that this will provide an opportunity to build much broader partnerships and identify new income and investment streams.

The programme is working in 4 neighbourhoods, focussing on 4 city council strategic themes – Children, Housing, Employment and Skills and Public Health – all to develop a new approach on how greenspace can become an integral part of how they work and what they provide. This includes how greenspace can support children through their early development, engaging young and vulnerable people and empowering them to influence the future direction of the city, achieving good quality greenspace in housing developments, connecting skills and employment programmes to environmental programmes, and embedding green interventions into the local social prescribing offer. The work done through Naturally Birmingham will also support the public health team to create a new joint outcomes framework for the city.

Foundational to the work is the development of a baselining methodology of local greenspace from multiple perspectives, for example physical attributes of the greenspace including ecological diversity, how the community view it, what other needs for the community exist and local health issues. There are many very positive and productive activities happening in parks, and this project looks to join these up further to maximise the short and the long-term benefits and outcomes for both the parks and local communities. As the workstreams mature, synergies across the 4 areas will be identified and strengthened.

Such a broad remit has posed challenges. The organisational effort needed to work across the council's directorates and teams has been significant. Additionally, council departments' culture and ways of working can be very different from one another, and this had to be recognised and negotiated in order to make a joint approach for Naturally Birmingham possible.

Having cabinet approval and support of the Chief Executive - recognising the project helps meet high-level strategic priorities - has been fundamental, allowing resources to be secured and encouraging working outside of traditional silos toward this common delivery goal. The National Trust Account Manager has also been instrumental in providing support and guidance to get the project started.

The project is working with the council's finance team to identify a longer-term model of sustainability beyond the 2-year Future Parks funding. One approach could be to secure investment from different parts of the Council. They are also exploring partnerships with alternative financing providers with a focus on social return of investment to help develop alternative business models for greenspace management.

Further resources

Press release, Birmingham City Council

Focus: Joint working across local government and the health service

Study 5: Norfolk Planning in Health Protocol

The Norfolk Planning in Health protocol was developed in 2016 and provides a structure to enable greater collaboration between local planning authorities, health service organisations and public health agencies to plan for future growth and to promote health

Norfolk county has a two-tier system of local government with public health located in the County Council, 8 planning authorities comprising 7 district councils and the Broads Authority and 5 Clinical Commissioning Groups (CCGs).[1] Like many areas the population of Norfolk is growing, and along with this economic growth there is an increased demand for new housing and other developments. Over three-quarters of the total projected population increase between 2014 and 2036 is expected to be in the over 65s age group. It was important to create an environment that would support extending healthy life expectancy as well as to consider that appropriate provision was made within the health infrastructure to meet the increased demand.

Public health recognised the key role that spatial planning plays in population health – the potential for substantial positive impacts if development progressed with health and wellbeing in mind, and conversely, the adverse impacts if it was not adequately considered. There was recognition that through the local plan process, neighbourhood plans and the processing of planning applications a positive health impact could be achieved by making provision across a range of issues such as street layout and active travel, access to services, access to greenspace, healthy food environment, reducing inequalities, climate change, job opportunities and others.

Planning and public health had already established a working relationship but there was a growing consensus that a formalised approach would bring better coordination and consistency across the tiers of local government and with the health sector. The Norfolk Health Overview and Scrutiny Committee had recommended producing a protocol in order to improve collaboration and there was support across public health and strategic planners across the districts and at the county council. The protocol aimed to briefly describe:

- for planners, the health system and the roles of various organisations
- for public health and the health sector, the local authority planning system, and the process of plan making and planning decision making
- the process for public health and health sector engagement in the planning process in Norfolk

[1] The 5 CCGs are currently being restructured into one, which will also include the Waveney District of Suffolk, within Suffolk County Council.

A task and finish group was established to take the work forward, with representation from districts and the county. Three workstreams were identified and taken forward which were:

- development of the protocol, which provided an agreed standardised procedure outlining the process for public health input into development management by district councils
- an assessment of future health care needs based on projections for population increases and house-building rates in Norfolk, to enable informed decision-making about future health services commissioning
- development of a healthy planning checklist that would be a practical tool to assist developers and their agents when preparing development proposals, local planning authorities in planning policy making and in the application process, and for public health when responding on the health and wellbeing impact of development plans and planning applications

The protocol was developed and tested over time with input from all parties. This consultation included discussions with development managers to explore the practical application within the development management setting.

The public health intelligence team at Norfolk County Council provided an analysis of population growth data adapting the London Healthy Urban Development Unit (HUDU) planning contribution model for Norfolk.

The healthy planning checklist was based on an adaptation of the London HUDU Rapid Health Impact Assessment Toolkit and the Royal Town Planning Institute's (RTPI) Planning Principles for Healthy Communities, and from similar approaches in other local authorities. It was developed in consultation with public health and planning colleagues.

To support the process, planning authorities were asked to formally adopt the protocol. At the same time the CCGs were also asked to formally adopt the approach. With 7 districts and 5 CCGs it took some time for this to be completed.

The protocol has been updated twice, most recently to reflect the new structures within the NHS and the increased opportunity for engagement with the planning system that this has provided. The Sustainability and Transformation Partnership (STP) now takes the lead in updating and revising the data analysis tools to better reflect the health infrastructure needs, and coordinates responses to proposals across the local health system.

The protocol provides a process for engagement, and the protocol is kept alive by planning and health continuing to work together. Responses to planning applications reflect the healthy planning checklist, and this helps to maintain awareness of its content. Public health is also contributing to Continuing Professional Development content for planning officers and will include the checklist in this training.

Further resources

The Planning in Health protocol, which includes the healthy planning checklist

References

1. Public Health England. Healthy High Streets: Good place-making in an urban setting. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/699295/26.01.18_Healthy_High_Streets_Full_Report_Final_version_3.pdf. 2018.

2. Town and Country Planning Association. Planning 2020. Final report of the Raynsford Review of planning in England. November 2018. https://www.tcpa.org.uk/raynsford-review. 2018

3. Committee on Climate Change. Progress in preparing for climate change: 2019. Report to Parliament. https://www.theccc.org.uk/publication/progress-in-preparing-for-climate-change-2019-progress-report-to-parliament/. 2019.

4. Lovell R, and Depledge, Michael., Health and the natural environment: A review of evidence, policy, practice and opportunities for the future. European Centre for Environment and Human Health University of Exeter Medical School. 2018.

5. Lovell, R., White, M.P., Wheeler, B., Taylor, T., Elliott, L. (2020) A rapid scoping review of health and wellbeing evidence for the Green Infrastructure Standards European Centre for Environment and Human Health, University of Exeter Medical School. For: Natural England, Department for the Environment, Food and Rural Affairs, Public Health England, and Ministry for Housing, Communities and Local Government, England.

6. Department for Business EaIS. Industrial Strategy: The Grand Challenges. . https://www.gov.uk/government/publications/industrial-strategy-the-grand-challenges/industrial-strategy-the-grand-challenges. 2019.

7. Ministry of Housing CaLG. Planning Practice Guidance: Natural Environment. www.gov.uk/guidance/natural-environment. 2019.

8. The Scottish Government. Planning Advice Note 65. Planning and Open Space. https://www.gov.scot/publications/planning-advice-note-pan-65-planning-open-space/. 2008.

9. Ordnance Survey. Mastermap Greenspace Layer. https://www.getoutside.ordnancesurvey.co.uk/greenspaces/. 2019.

10. Gascon M, Zijlema W, Vert C, White MP, Nieuwenhuijsen MJ. Outdoor blue spaces, human health and well-being: A systematic review of quantitative studies. International Journal of Hygiene and Environmental Health. 2017;220(8):1207-21.

11. University of Bradford. ‘The Great Meeting Place’: A Study of Bradford’s City Park. 2014.

12. HM Government. A Green Future: Our 25 Year Plan to Improve the Environment. Crown Copyright,. 2018; www.gov.uk/government/publications/25-year-environment-plan

13. NHS. The NHS Long Term Plan.

www.longtermplan.nhs.uk/wp-content/uploads/2019/08/nhs-long-term-plan-version-1.2.pdf. 2019.

14. HM Government. Childhood obesity: a plan for action, chapter 2,. www.gov.uk/government/publications/childhood-obesity-a-plan-for-action-chapter-2. 2018.

15. Public Health England. Everybody active, every day: framework for physical activity. www.gov.uk/government/publications/everybody-active-every-day-a-framework-to-embed-physical-activity-into-daily-life. 2014.

16. HM Government. A connected society: A strategy for tackling loneliness – laying the foundations for change. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/750909/6.4882_DCMS_Loneliness_Strategy_web_Update.pdf. 2018.

17. Department for Food EaRA. Clean air strategy 2019. Crown Copyright, 2019; www.gov.uk/government/publications/clean-air-strategy-2019.

18. HM Government. Sporting Future – A new strategy for an active nation. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/486622/Sporting_Future_ACCESSIBLE.pdf. 2015.

19. Department of Health and Social Care. Prevention is better than cure: our vision to help you live well for longer. www.gov.uk/government/publications/prevention-is-better-than-cure-our-vision-to-help-you-live-well-for-longer. Crown Copyright,. 2018. .

20. Department for Transport. Cyling and Walking Investment Strategy: Safety Review. Crown Copyright,. 2018; www.gov.uk/government/publications/25-year-environment-plan

21. The Mental Health Taskforce. The five year forward view for mental health. A report from the independent Mental Health Taskforce to the NHS in England. www.england.nhs.uk/wp-content/uploads/2016/02/Mental-Health-Taskforce-FYFV-final.pdf. 2016.

22. Ministry of Housing CaLG. Integrated Communities Action Plan. www.gov.uk/government/publications/integrated-communities-action-plan. 2019.

23. United Nations. SUSTAINABLE DEVELOPMENT GOAL 11. Make cities and human settlements inclusive, safe, resilient and sustainable. https://sustainabledevelopment.un.org/sdg11. 2019.

24. Ministry of Housing CaLG. Government pledges £500,000 for new action group to grow future of public parks. https://www.gov.uk/government/news/government-pledges-500000-for-new-action-group-to-grow-future-of-public-parks. 2017.
25. NHS England. Putting Health into Place. Introducing NHS England's Healthy New Towns programme. www.kingsfund.org.uk/sites/default/files/2018-09/putting-health-into-place-nhs-england.pdf. 2019.
26. Ministry of Housing CaLG. National Design Guide. Planning practice guidance for beautiful, enduring and successful places. . Crown Copyright. 2019; https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/843468/National_Design_Guide.pdf.
27. Public Health England. Spatial Planning for Health: An evidence resource for planning and designing healthier places. www.gov.uk/government/publications/spatial-planning-for-health-evidence-review. 2018.
28. Meath. L. Lungs for our great cities. The New Review, 2 (12), pp. 432-443. 1890.
29. Hansard HC Deb 21 February 1833 vol 15 cc1049-59.
30. Pretty J, Barton J, Pervez Bharucha Z, Bragg R, Pencheon D, Wood C, et al. Improving health and well-being independently of GDP: dividends of greener and prosocial economies. International Journal of Environmental Health Research. 2016;26(1):11-36.
31. Gascon M, Triguero-Mas M, Martínez D, Dadvand P, Rojas-Rueda D, Plasència A, et al. Residential green spaces and mortality: A systematic review. Environment International. 2016;86:60-7.
32. van den Berg M, Wendel-Vos W, van Poppel M, Kemper H, van Mechelen W, Maas J. Health Benefits of Green Spaces in the Living Environment: A Systematic Review of Epidemiological Studies. Urban Forestry & Urban Greening. 2015;14(4):806-16.
33. Twohig-Bennett C, Jones A. The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. Environmental Research. 2018;166:628-37.
34. James P, Banay RF, Hart JE, Laden F. A Review of the Health Benefits of Greenness. Curr Epidemiol Rep. 2015;2(2):131-42.
35. Dzhambov AM, Dimitrova DD, Dimitrakova ED. Association between residential greenness and birth weight: Systematic review and meta-analysis. Urban Forestry & Urban Greening. 2014;13(4):621-9.

36. Banay RF, Bezold CP, James P, Hart JE, Laden F. Residential greenness: current perspectives on its impact on maternal health and pregnancy outcomes. International journal of women's health. 2017;9:133-44.
37. Lachowycz K, Jones AP. Greenspace and obesity: a systematic review of the evidence. Obesity Reviews. 2011;12(5):e183-e9.
38. Coombes E, Jones A, Hillsdon M. The relationship of physical activity and overweight to objectively measured green space accessibility and use. Social science & medicine (1982). 2010;70:816-22.
39. Van Hecke L, Ghekiere A, Veitch J, Van Dyck D, Van Cauwenberg J, Clarys P, et al. Public open space characteristics influencing adolescents' use and physical activity: A systematic literature review of qualitative and quantitative studies. Health & Place. 2018;51:158-73.
40. Thompson Coon J, Boddy K, Stein K, Whear R, Barton J, Depledge MH. Does participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review. Environ Sci Technol. 2011;45(5):1761-72.
41. Sandifer PA, Sutton-Grier AE, Ward BP. Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. Ecosystem Services. 2015;12:1-15.
42. Rook GA. Regulation of the immune system by biodiversity from the natural environment: An ecosystem service essential to health. Proceedings of the National Academy of Sciences. 2013;110(46):18360.
43. Ruokolainen L, von Hertzen L, Fyhrquist N, Laatikainen T, Lehtomäki J, Auvinen P, et al. Green areas around homes reduce atopic sensitization in children. Allergy. 2015;70(2):195-202.
44. Vanaken GJ, Danckaerts M. Impact of Green Space Exposure on Children's and Adolescents' Mental Health: A Systematic Review. Int J Environ Res Public Health. 2018;15(12).
45. McCormick R. Does Access to Green Space Impact the Mental Well-being of Children: A Systematic Review. Journal of pediatric nursing. 2017;37:3-7.
46. Tillmann S, Tobin D, Avison W, Gilliland J. Mental health benefits of interactions with nature in children and teenagers: a systematic review. Journal of epidemiology and community health. 2018;72(10):958-66.

47. Wang D, MacMillan T. The Benefits of Gardening for Older Adults: A Systematic Review of the Literature. Activities, Adaptation & Aging. 2013;37(2):153-81.
48. Mensah CA, Andres L, Perera U, Roji A. Enhancing quality of life through the lens of green spaces: A systematic review approach. International Journal of Wellbeing. 2016;6(1).
49. van den Bosch M, Ode Sang Å. Urban natural environments as nature-based solutions for improved public health – A systematic review of reviews. Environmental Research. 2017;158:373-84.
50. Kondo M, Fluehr J, McKeon T, Branas C. Urban Green Space and Its Impact on Human Health. International Journal of Environmental Research and Public Health. 2018;15(3):445.
51. Gascon M, Triguero-Mas M, Martínez D, Dadvand P, Forns J, Plasència A, et al. Mental Health Benefits of Long-Term Exposure to Residential Green and Blue Spaces: A Systematic Review. International Journal of Environmental Research and Public Health. 2015;12(4):4354-79.
52. Natural England. Natural England Access to Evidence Information Note EIN018: Links between natural environments and mental health: evidence briefing. 2016
53. Godlee F. The miracle cure. BMJ. 2019;366:l5605.
54. National Institute for Health and Care Excellence. Quality standard [QS183] Physical activity: encouraging activity in the community. https://www.nice.org.uk/guidance/qs183. 2019
55. Department of Health and Social Care. UK Chief Medical Officers' Physical Activity Guidelines,. Crown Copyright,. 2019;7 September 2019.
56. Office of National Statistics. Natural England. Monitor of Engagement with the Natural Environment: The national survey on people and the natural environment: Headline Report 2018-2019. 2019.
57. White MP, Alcock I, Grellier J, Wheeler BW, Hartig T, Warber SL, et al. Spending at least 120 minutes a week in nature is associated with good health and wellbeing. Scientific Reports. 2019;9(1):7730.
58. Mansfield I, et. al. A systematic review of outdoor recreation (in green and blue spaces), families and wellbeing. 2018.
59. Lovell R. Natural England Access to Evidence Information Note EIN015. Connection to Nature: evidence briefing, European Centre for Environment and Human Health and University of Exeter Medical School, 2016.
60. Richardson M, Hunt A, Hinds J, Bragg R, Fido D, Petronzi D, et al. A Measure of Nature Connectedness for Children and Adults: Validation, Performance, and Insights. Sustainability. 2019;11(12):3250.

61. Pritchard A, Richardson M, Sheffield D, McEwan K. The Relationship Between Nature Connectedness and Eudaimonic Well-Being: A Meta-analysis. Journal of Happiness Studies. 2019.
62. Capaldi CA, Dopko RL, Zelenski JM. The relationship between nature connectedness and happiness: a meta-analysis. Frontiers in Psychology. 2014;5(976).
63. Hartig T, Mitchell R, de Vries S, Frumkin H. Nature and Health. Annual Review of Public Health. 2014;35(1):207-28.
64. van Dillen SME, de Vries S, Groenewegen PP, Spreeuwenberg P. Greenspace in urban neighbourhoods and residents' health: adding quality to quantity. Journal of epidemiology and community health. 2012;66(6):e8-e.
65. Bennet SA, Yiannakoulias N, Williams AM, Kitchen P. Playground Accessibility and Neighbourhood Social Interaction Among Parents. Social Indicators Research. 2012;108(2):199-213.
66. ten Brink P. MK, Schweitzer J-P., Kettunen M., Twigger-Ross C., Baker J., Kuipers Y., Emonts M., Tyrväinen L., Hujala T., and Ojala A. (The Health and Social Benefits of Nature and Biodiversity Protection. A report for the European Commission (ENV.B.3/ETU/2014/0039), . Institute for European Environmental Policy, London/Brussels. 2016.
67. Weimann H, Rylander L, van den Bosch MA, Albin M, Skärbäck E, Grahn P, et al. Perception of safety is a prerequisite for the association between neighbourhood green qualities and physical activity: Results from a cross-sectional study in Sweden. Health & Place. 2017;45:124-30.
68. McCormack GR, Rock M, Toohey AM, Hignell D. Characteristics of urban parks associated with park use and physical activity: A review of qualitative research. Health & Place. 2010;16(4):712-26.
69. Green Flag Award. Raising the standard of Parks and Green Spaces. The International mark of quality. www.greenflagaward.org.uk/. 2019.
70. Building with Nature. High quality places for people and wildlife: The UK’s first green infrastructure benchmark. www.buildingwithnature.org.uk/. 2019.
71. Place Standard. Place Standard: How Good is our Place www.placestandard.scot/. 2019.
72. Building for Life. Building for life. www.builtforlifehomes.org/. 2019.
73. Natural England. Links between natural environments and learning: evidence briefing (EIN017). First edition 14 July 2016 2016.

74. FIENNES C, OLIVER, E., DICKSON, K., ESCOBAR, D., ROMANS, A. & OLIVER, S.,. The Existing Evidence-Base about the Effectiveness of Outdoor Learning. . UCL; Giving Evidence; IOL; Blagrave Trust. 2015.

75. Browning MHEM, Rigolon A. School Green Space and Its Impact on Academic Performance: A Systematic Literature Review. International journal of environmental research and public health. 2019;16(3):429.

76. Office for National Statistics. UK natural capital: Ecosystems accounts for urban areas. www.ons.gov.uk/releases/uknaturalcapitalecosystemaccountsforurbanareas. 2019.

77. Mayor of London. USING GREEN INFRASTRUCTURE TO PROTECT PEOPLE FROM AIR POLLUTION. www.london.gov.uk/WHAT-WE-DO/environment/environment-publications/using-green-infrastructure-protect-people-air-pollution. 2019.

78. Public Health England. Improving outdoor air quality and health: review of interventions. www.gov.uk/government/publications/improving-outdoor-air-quality-and-health-review-of-interventions. 2019.

79. Ferranti EJS, MacKenzie, A.R., Levine, J.G., Ashworth K., and Hewitt C.N., First Steps in Urban Air Quality. Second Edition. A Trees and Design Action Group (TDAG) Guidance Document. UK: London. Available from: http://epapers.bham.ac.uk/3069/. 2019.

80. Office for National Statistics. UK natural capital accounts: 2019. www.ons.gov.uk/economy/environmentalaccounts/bulletins/uknaturalcapitalaccounts/2019#asset-valuation. 2019.

81. Department for Environment FaRA. Noise pollution: economic analysis. . https://wwwgovuk/guidance/noise-pollution-economic-analysis 2014.

82. Department for Environment FaRA. Noise Action Plan: Agglomerations (Urban Areas), Appendix D. 2019.

83. Schüle SA, Nanninga S, Dreger S, Bolte G. Relations between Objective and Perceived Built Environments and the Modifying Role of Individual Socioeconomic Position. A Cross-Sectional Study on Traffic Noise and Urban Green Space in a Large German City. International journal of environmental research and public health. 2018;15(8):1562.

84. Dzhambov AM, Markevych I, Tilov B, Arabadzhiev Z, Stoyanov D, Gatseva P, et al. Lower Noise Annoyance Associated with GIS-Derived Greenspace: Pathways through Perceived Greenspace and Residential Noise. International journal of environmental research and public health. 2018;15(7):1533.

85. Gidlöf-Gunnarsson A, Öhrström E. Noise and Well-being in Urban Residential Environments: the potential Role of Perceived Availability to nearby Green Areas. Landscape and Urban Planning. 2007;83:115-26.
86. TNO. The positive effects of quiet facades and quiet urban areas on traffic noise annoyance and sleep disturbance .LIFE09 ENV/NL/000423, QSIDE – Accessed: August 2019 2013.
87. Health Council of the Netherlands. Quiet areas and health. The Hague: Health Council of the Netherlands; publication no. 2006/12 2006.
88. European Co-operation in Science and Technology. Soundscape of European Cities and Landscapes. TD 0804. www.cost.eu/actions/TD0804/#tabs|Name:overview|Name:overview 2013.
89. Tarrant MA, Haas GE, Manfredo MJ. Factors affecting visitor evaluations of aircraft overflights of wilderness areas. Society & Natural Resources. 1995;8(4):351-60.
90. Krog NH, Engdahl B, Tambs K. Effects of changed aircraft noise exposure on experiential qualities of outdoor recreational areas. International journal of environmental research and public health. 2010;7(10):3739-59.
91. Liu J. Soundscape effects on visiting experience in city park: A case study in Fuzhou, China. Urban forestry & urban greening. 2018;v. 31:pp. 38-47-2018 v.31.
92. Rey Gozalo G, Barrigón Morillas JM, Montes González D, Atanasio Moraga P. Relationships among satisfaction, noise perception, and use of urban green spaces. Science of The Total Environment. 2018;624:438-50.
93. Cerwén G, Pedersen E, Pálsdóttir A-M. The Role of Soundscape in Nature-Based Rehabilitation: A Patient Perspective. International journal of environmental research and public health. 2016;13(12):1229.
94. Pilcher E, Newman P, Manning R. Understanding and Managing Experiential Aspects of Soundscapes at Muir Woods National Monument. Environmental management. 2008;43:425-35.
95. Welsh Government. Urban Green Infrastructure and Ecosystem Services. 2017.
96. HOSANNA. Novel solutions for quieter and greener cities. Available from www.greener-cities.eu/ 2013.
97. Kropp W. Urban Sound Planning – the SONORUS project. Available from http://publications.lib.chalmers.se/records/fulltext/242257/local_242257.pdf 2019.

98. Dzhambov AM, Dimitrova DD. Urban green spaces' effectiveness as a psychological buffer for the negative health impact of noise pollution: a systematic review. Noise & Health. 2014;16(70):157-65.
99. Yang F, Bao ZY, Zhu ZJ. An assessment of psychological noise reduction by landscape plants. International journal of environmental research and public health. 2011;8(4):1032-48.
100. Transport for London. Healthy Streets for London, http://content.tfl.gov.uk/healthy-streets-for-london.pdf. 2017.
101. Heaviside C, Vardoulakis S, Cai X. Attribution of mortality to the Urban Heat Island during heatwaves in the West Midlands, UK. Environmental Health. 2016;15.
102. Robine J-M, Cheung SLK, Le Roy S, Van Oyen H, Griffiths C, Michel J-P, et al. Death toll exceeded 70,000 in Europe during the summer of 2003. Comptes Rendus Biologies. 2008;331(2):171-8.
103. Saaroni H, Amorim JH, Hiemstra J, Pearlmutter D. Urban Green Infrastructure as a tool for urban heat mitigation: Survey of research methodologies and findings across different climatic regions. Urban Climate. 2018;24:94-110.
104. Mohajerani A, Bakaric J, Jeffrey-Bailey T. The urban heat island effect, its causes, and mitigation, with reference to the thermal properties of asphalt concrete. Journal of Environmental Management. 2017;197:522-38.
105. United States Environmental Protection Agency. Using Green Roofs to Reduce Heat Islands. www.epa.gov/heat-islands/using-green-roofs-reduce-heat-islands Accessed: 29 October 2019. 2019.
106. Met Office. UK Climate Projections: Headline Findings September 2019. Version 2. www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp-headline-findings-v2.pdf. 2019.
107. Sayers PBH, M; Penning-Roswell, E; McKenzie, A., . Climate Change Risk Assessment 2017: Projections of future flood risks in the UK. . 2015; www.theccc.org.uk/wp-content/uploads/2015/10/CCRA-Future-Flooding-Main-Report-Final-06Oct2015.pdf.pdf.
108. Jermacane D, Waite TD, Beck CR, Bone A, Amlôt R, Reacher M, et al. The English National Cohort Study of Flooding and Health: the change in the prevalence of psychological morbidity at year two. BMC Public Health. 2018;18(1):330.
109. European Environment Agency. Green Infrastructure and Flood ManagementPromoting cost-efficient flood risk reduction via green infrastructure solutions. EEA Report No 14/2017. 2017.

110. Suppakittpaisarn P, Jiang X, Sullivan WC. Green Infrastructure, Green Stormwater Infrastructure, and Human Health: A Review. Current Landscape Ecology Reports. 2017;2(4):96-110.
111. Public Health England. Health matters: reducing health inequalities in mental illness. https://publichealthmatters.blog.gov.uk/2018/12/18/health-matters-reducing-health-inequalities-in-mental-illness/. 2018.
112. HM Government. No health without mental health. a cross-government outcomes strategy. www.gov.uk/government/publications/no-health-without-mental-health-a-cross-government-outcomes-strategy. 2011.
113. NHS. NHS Mental Health Implementation Plan 2019/20 – 2023/24 www.longtermplan.nhs.uk/publication/nhs-mental-health-implementation-plan-2019-20-2023-24/. 2019.
114. NHS England. Five Year Forward View Dashboard. Publication Period Quarter 2 2018/19. 2019.
115. Public Health England. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report. Crown Copyright 2018.
116. Public Health England. Public Health England. Health Matters: Air Pollution. . www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution 2018.
117. Steel N, Ford JA, Newton JN, Davis ACJ, Vos T, Naghavi M, et al. Changes in health in the countries of the UK and 150 English Local Authority areas 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. The Lancet. 2018;392(10158):1647-61.
118. Public Health England. Physical activity: applying All Our Health. www.gov.uk/government/publications/physical-activity-applying-all-our-health/physical-activity-applying-all-our-health. 2019.
119. Public Health England. Health Matters: Obesity and the food environment. www.gov.uk/government/publications/health-matters-obesity-and-the-food-environment/health-matters-obesity-and-the-food-environment--2 [Website accessed 22nd October 2019]. . 2017.
120. Scarborough P, Bhatnagar P, Wickramasinghe KK, Allender S, Foster C, Rayner M. The economic burden of ill health due to diet, physical inactivity, smoking, alcohol and obesity in the UK: an update to 2006–07 NHS costs. Journal of Public Health. 2011;33(4):527-35.
121. Public Health England. Making the case for obesity - Why Invest? 2015. 2015.

122. World Health Organisation. Environmental Noise Guidelines for the European Region. www.euro.who.int/en/health-topics/environment-and-health/noise/environmental-noise-guidelines-for-the-european-region. 2019.
123. Guski R, Schreckenberg D, Schuemer R. WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Annoyance. International Journal of Environmental Research and Public Health. 2017;14(12):1539.
124. Clark C, Paunovic K. WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Cognition. International Journal of Environmental Research and Public Health. 2018;15(2):285.
125. Hänninen O, Knol AB, Jantunen M, Lim T-A, Conrad A, Rappolder M, et al. Environmental burden of disease in Europe: assessing nine risk factors in six countries. Environmental health perspectives. 2014;122(5):439-46.
126. Hajat S, Vardoulakis S, Heaviside C, Eggen B. Climate change effects on human health: projections of temperature-related mortality for the UK during the 2020s, 2050s and 2080s. Journal of epidemiology and community health. 2014;68(7):641-8.
127. Macintyre H, Heaviside C, Taylor J, Picetti R, Symonds P, Cai X, et al. Assessing urban population vulnerability and environmental risks across an urban area during heatwaves – Implications for health protection. Science of The Total Environment. 2017;610-611:678-90.
128. Weber S, Sadoff N, Zell E, de Sherbinin A. Policy-relevant indicators for mapping the vulnerability of urban populations to extreme heat events: A case study of Philadelphia. Applied Geography. 2015;63:231-43.
129. Heaviside C, Macintyre H, Vardoulakis S. The Urban Heat Island: Implications for Health in a Changing Environment. Current environmental health reports. 2017;4.
130. Town and Country Planning Association. Reuniting health with planning – healthier homes, healthier communities. How planning and public health practitioners can work together to implement health and planning reforms in England. 2012. .
131. Marmot M, Allen, J., Boyce, T., Goldblatt, P., Morrison, J.,. Health equity in England: The Marmot Review 10 years on. . London: Institute of Health Equity. 2020.
132. Allen J, and Balfour, R.,. Natural solutions for tackling health inequalities. UCL Institute of Health Equity. 2014.
133. Schüle SA, Hilz LK, Dreger S, Bolte G. Social Inequalities in Environmental Resources of Green and Blue Spaces: A Review of Evidence in the WHO European Region. International journal of environmental research and public health. 2019;16(7):1216.

134. Commission for Architecture and the Built Environment. Urban green nation: Building the evidence base. www.designcouncil.org.uk/sites/default/files/asset/document/urban-green-nation_0_0.pdf. 2010.
135. Marmot M. Fair society, healthy lives : the Marmot Review : strategic review of health inequalities in England post-2010. ISBN 9780956487001. 2010.
136. Boyd F, White MP, Bell SL, Burt J. Who doesn't visit natural environments for recreation and why: A population representative analysis of spatial, individual and temporal factors among adults in England. Landscape and Urban Planning. 2018;175:102-13.
137. Cracknell D, Lovell, R, Wheeler, B and White, M.,. Demystifying Health Metrics, Valuing Nature Paper VNP19 2019.

138. Natural England. An estimate of the value and cost effectiveness of the expanded Walking the Way to Health Initiative scheme 2009 (TIN055). http://publications.naturalengland.org.uk/publication/35009. 2009.
139. White MP, Elliott LR, Taylor T, Wheeler BW, Spencer A, Bone A, et al. Recreational physical activity in natural environments and implications for health: A population based cross-sectional study in England. Preventive medicine. 2016.
140. Economics for the Environment Consultancy Ltd. A Study to Scope and Develop Urban Natural Capital Accounts for the UK. Final Report For Defra June 2017. 2017.
141. Vivid Economics. Natural Capital Accounts for Public Greenspace in London 2017. www.vivideconomics.com/casestudy/natural-capital-accounts-for-public-green-space-in-london/. 2017.
142. Hölzinger OaG, N.,. Birmingham Health Economic Assessment & Natural Capital Accounts: Revealing the True Value of Council-managed Parks and Greenspace. . Birmingham City Council, Birmingham. 2019.
143. Vivid Economics. The contribution made by Sheffield's parks to the wellbeing of the city's citizens. London: Vivid Economics. . 2016.
144. Cavil N, H. Rutter, and Gower, R.,. Economic assessment of the health benefits of walking on the Wales Coast Path. 2016. 2016.
145. Gibbons S, Mourato, S and Resende, G,. The amenity value of English nature: a hedonic price approach. SERC Discussion Papers (SERCDP0074). Spatial Economics Research Centre (SERC),. London School of Economics and Political Sciences, London, UK 2011.

146. Office for National Statistics. Urban greenspace raise nearby house prices by an average of £2,500. Accessed 30/10/2019 www.ons.gov.uk/economy/environmentalaccounts/articles/urbangreenspacesraisenearbyhousepricesbyanaverageof2500/2019-10-14. 2019.
147. Department for Environment FaRA. Enabling a Natural Capital Approach: Guidance, January 2020. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/858808/natural-capital-enca-guidance-pdf.pdf [Website accessed 20th Feb 2020]. Crown Copyright,. 2020.
148. Smith A. Tools for Planning and Evaluating Urban Green Infrastructure Bicester and Beyond. A NERC Green Infrastructure Innovation Project. February 2016 to April 2018. www.eci.ox.ac.uk/research/ecosystems/bio-clim-adaptation/bicester-green-infrastructure.html. 2018.
149. Ecosystems Knowledge Network. Tool Assessor: List of Tools. https://ecosystemsknowledge.net/tool-assessor-list-of-tools. 2019.
150. The National Trust. Our vision for the future of parks www.nationaltrust.org.uk/features/our-vision-for-the-future-of-parks. 2019
151. NESTA. Rethinking Parks project. www.nesta.org.uk/project/rethinking-parks/. 2019.
152. Bell SL. LR, Maclean I., Curtis R., Collings-Costello N. and Wheeler BW.,. Green space, human health and biodiversity: four evidence cards to inform public open space policy making in Cornwall Council. Economic and Social Research Council Impact Acceleration Account-funded project between Cornwall Council and University of Exeter. Available at https://beyondgreenspace.net/. 2016.
153. Commission for Architecture and the Built Environment. Community green: using local spaces to tackle inequality and improve health. www.designcouncil.org.uk/resources/report/community-green. 2010. .
154. Natural England. Natural England Commissioned Report NECR122. Monitor of Engagement with the Natural Environment: The national survey on people and the natural environment. Annual Report from the 2012-13 survey. 2013.
155. Natural England. MENE (2009-2012): Visits to the natural environment - variations in characteristics and behaviours of social groups within the adult English population, DATA005. http://publications.naturalengland.org.uk/publication/5309811965034496. 2013.

156. Natural England. Access to Evidence Information Note EIN019. Links between natural environments and physical activity: evidence briefing. http://publications.naturalengland.org.uk/publication/6719816098906112. 2016.
157. Natural England. Summary of evidence: Access and engagement EIN003. http://publications.naturalengland.org.uk/publication/5035523150184448. 2015.
158. Commission for Architecture and the Built Environment. The principles of inclusive design: They include you. www.designcouncil.org.uk/sites/default/files/asset/document/the-principles-of-inclusive-design.pdf. 2006.
159. Peters K. Living together in multi-ethnic neighbourhoods. . PhD thesis, Wageningen University, Wageningen, the Netherlands. 2011.
160. Sport England. Active Design: Planning for health and wellbeing through sport and physical activity. 2015.
161. Richardson EA, Mitchell R. Gender differences in relationships between urban green space and health in the United Kingdom. Social Science & Medicine. 2010;71(3):568-75.
162. World Health Organisation Regional Office for Europe. Urban Greenspace and Health: Intervention Impacts and Effectiveness. . Report of a meeting Bonn, Germany 20–21 September 2016. 2016.
163. Cole HVS, Garcia Lamarca M, Connolly JJT, Anguelovski I. Are green cities healthy and equitable? Unpacking the relationship between health, green space and gentrification. Journal of epidemiology and community health. 2017;71(11):1118-21.
164. Centres for Disease Control and Prevention. Health Effects of Gentrification. www.cdc.gov/healthyplaces/healthtopics/gentrification.htm. 2012.
165. Morris J, O'Brien L. Encouraging healthy activity amongst under-represented groups: An evaluation of the Active England woodland projects. Urban Forestry & Urban Greening. 2011;10:323-33.
166. O'Brien L. . We have stopped moving: Tackling physical inactivity - a role for the Public Forest Estate in England? www.forestresearch.gov.uk/research/we-have-stopped-moving-tackling-physical-inactivity-a-role-for-the-public-forest-estate-in-england/ Forestry Commission England. 2014.
167. Annerstedt M, Währborg P. Nature-assisted therapy: Systematic review of controlled and observational studies. Scandinavian Journal of Public Health. 2011;39(4):371-88.
168. Kessel A. Multidisciplinary research in public health : a case study of research on access to green space. Public Health. 2009;123(1):32-8.

169. Elliott LR, White MP, Taylor AH, Abraham C. How do brochures encourage walking in natural environments in the UK? A content analysis. Health Promotion International. 2016;33(2):299-310.
170. Kings Fund. Access to green and open spaces and the role of leisure services. www.kingsfund.org.uk/projects/improving-publics-health/access-green-and-open-spaces-and-role-leisure-services. 2019.
171. Elwell-Sutton T, Tinson, A., Greszczuk, C., Finch, D., Holt-White, E., Everest, G., Mihaylova, N., Wood, S and Bibby, J.,. Creating Healthy Lives: A whole-government approach to long-term investment in the nation's health. The Health Foundation. 2019.
172. Public Health England. Local Wellbeing, Local Growth: Overview. http://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/560598/Health_in_All_Policies_overview_paper.pdf. 2016.
173. Ekkel ED, de Vries S. Nearby green space and human health: Evaluating accessibility metrics. Landscape and Urban Planning. 2017;157:214-20.
174. Natural England. Nature Nearby: Accessible natural greenspace guidance. March 2010 www.ukmaburbanforum.co.uk/docunents/other/nature_nearby.pdf. 2010
175. Fields in Trust. Guidance for outdoor sport and play for England: Beyond the 6-acre standard. www.fieldsintrust.org/guidance. 2015.
176. The Woodland Trust. Residential development and trees: A guide for planners and developers. www.woodlandtrust.org.uk/publications/2019/01/residential-developments-and-trees/. 2019.
177. Mayor of London. The London Plan. www.london.gov.uk/sites/default/files/new_london_plan_december_2017.pdf. 2017.
178. Local Government Association. What a difference a place makes: the growing impact of health and wellbeing boards. www.local.gov.uk/what-difference-place-makes-growing-impact-health-and-wellbeing-boards. 2019.
179. Town and Country Planning Association. The state of the union: reuniting health with planning in promoting healthy communities. www.tcpa.org.uk/the-state-of-the-union-reuniting-health-with-planning-1. 2019.
180. Local Government Association. Public health, preventions and health improvement: prospectus 2019/20. www.local.gov.uk/sites/default/files/documents/25.128%20Prevention%20Prospectus%2019-20_03_0.pdf. 2019.

181. Balfour R, Allen J. Local action on health inequalities: Improving access to green spaces. Public Health England 2014.
182. Husk K, Lovell R, Cooper C, Stahl-Timmins W, Garside R. Participation in environmental enhancement and conservation activities for health and well-being in adults: a review of quantitative and qualitative evidence. The Cochrane Library. 2016;5.
183. Porcherie M, Lejeune M, Gaudel M, Pommier J, Faure E, Heritage Z, et al. Urban green spaces and cancer: a protocol for a scoping review. BMJ Open. 2018;8(2):e018851.
184. Houlden V, Weich S, Porto de Albuquerque J, Jarvis S, Rees K. The relationship between greenspace and the mental wellbeing of adults: A systematic review. PloS one. 2018;13(9):e0203000.
185. Barnes MR, Donahue ML, Keeler BL, Shorb CM, Mohtadi TZ, Shelby LJ. Characterizing Nature and Participant Experience in Studies of Nature Exposure for Positive Mental Health: An Integrative Review. Frontiers in Psychology. 2019;9(2617).
186. Gong Y, Palmer S, Gallacher J, Marsden T, Fone D. A systematic review of the relationship between objective measurements of the urban environment and psychological distress. Environment International. 2016;96:48-57.
187. Kondo MC, Jacoby SF, South EC. Does spending time outdoors reduce stress? A review of real-time stress response to outdoor environments. Health & Place. 2018;51:136-50.
188. Ohly H, White MP, Wheeler BW, Bethel A, Ukoumunne OC, Nikolaou V, et al. Attention Restoration Theory: A systematic review of the attention restoration potential of exposure to natural environments. Journal of Toxicology and Environmental Health, Part B. 2016;19(7):305-43.
189. de Keijzer C, Gascon M, Nieuwenhuijsen MJ, Dadvand P. Long-Term Green Space Exposure and Cognition Across the Life Course: a Systematic Review. Current Environmental Health Reports. 2016;3(4):468-77.
190. Whear R, Coon JT, Bethel A, Abbott R, Stein K, Garside R. What is the impact of using outdoor spaces such as gardens on the physical and mental well-being of those with dementia? A systematic review of quantitative and qualitative evidence. Journal of the American Medical Directors Association. 2014;15(10):697-705.
191. Lakhani A, Norwood M, Watling DP, Zeeman H, Kendall E. Using the natural environment to address the psychosocial impact of neurological disability: A systematic review. Health & Place. 2019;55:188-201.
192. Blaschke S. The role of nature in cancer patients' lives: a systematic review and qualitative meta-synthesis. BMC cancer. 2017;17(1):370.

193. Joseph RP, Maddock JE. Observational Park-based physical activity studies: A systematic review of the literature. Preventive medicine. 2016;89:257-77.
194. Hunter RF, Christian H, Veitch J, Astell-Burt T, Hipp JA, Schipperijn J. The impact of interventions to promote physical activity in urban green space: A systematic review and recommendations for future research. Social Science & Medicine. 2015;124(0):246-56.
195. Hanson S, Jones A. Is there evidence that walking groups have health benefits? A systematic review and meta-analysis. British Journal of Sports Medicine. 2015;49(11):710-5.
196. Bancroft C, Joshi S, Rundle A, Hutson M, Chong C, Weiss CC, et al. Association of proximity and density of parks and objectively measured physical activity in the United States: A systematic review. Social Science & Medicine. 2015;138:22-30.
197. Calogiuri G, Chroni S. The impact of the natural environment on the promotion of active living: An integrative systematic review. BMC Public Health. 2014;14(1):873.
198. Zhang G, Poulsen DV, Lygum VL, Corazon SS, Gramkow MC, Stigsdotter UK. Health-Promoting Nature Access for People with Mobility Impairments: A Systematic Review. International journal of environmental research and public health. 2017;14(7):703.
199. Kabisch N, van den Bosch M, Lafortezza R. The health benefits of nature-based solutions to urbanization challenges for children and the elderly – A systematic review. Environmental Research. 2017;159:362-73.
200. Orr N, Wagstaffe A, Briscoe S, Garside R. How do older people describe their sensory experiences of the natural world? A systematic review of the qualitative evidence. BMC Geriatrics. 2016;16(1):116.
201. MacBride-Stewart S, Gong Y, Antell J. Exploring the interconnections between gender, health and nature. Public Health. 2016;141:279-86.
202. Russo A, Escobedo FJ, Cirella GT, Zerbe S. Edible green infrastructure: An approach and review of provisioning ecosystem services and disservices in urban environments. Agriculture, Ecosystems & Environment. 2017;242:53-66.
203. O'Brien L, De Vreese R, Kern M, Sievänen T, Stojanova B, Atmiş E. Cultural ecosystem benefits of urban and peri-urban green infrastructure across different European countries. Urban Forestry & Urban Greening. 2017;24:236-48.
204. Ordóñez-Barona C. How different ethno-cultural groups value urban forests and its implications for managing urban nature in a multicultural landscape: A systematic review of the literature. Urban Forestry & Urban Greening. 2017;26:65-77.

205. Aerts R, Honnay O, Van Nieuwenhuyse A. Biodiversity and human health: mechanisms and evidence of the positive health effects of diversity in nature and green spaces. British Medical Bulletin. 2018;127(1):5-22.
206. Lovell R, Wheeler BW, Higgins SL, Irvine KN, Depledge MH. A systematic review of the health and well-being benefits of biodiverse environments. Journal of Toxicology and Environmental Health, Part B. 2014;17(1):1-20.
207. Browning M, Lee K. Within What Distance Does "Greenness" Best Predict Physical Health? A Systematic Review of Articles with GIS Buffer Analyses across the Lifespan. Int J Environ Res Public Health. 2017;14(7).
208. Sreetheran M, van den Bosch CCK. A socio-ecological exploration of fear of crime in urban green spaces – A systematic review. Urban Forestry & Urban Greening. 2014;13(1):1-18.
209. Roberts H, McEachan R, Margary T, Conner M, Kellar I. Identifying Effective Behavior Change Techniques in Built Environment Interventions to Increase Use of Green Space. Environment and Behavior. 2016;50(1):0013916516681391.
210. World Health Organization. Urban Green Space Interventions and Health: A review of impacts and effectiveness. Copenhagen; 2017.
211. Lee I, Choi H, Bang K-S, Kim S, Song M, Lee B. Effects of Forest Therapy on Depressive Symptoms among Adults: A Systematic Review. International Journal of Environmental Research and Public Health. 2017;14(3):321.
212. Benz A, Holmgren A, Kinter D, McGarry J, Rufino G. A Systematic Review of the Effects of Horticultural Therapy on Persons with Mental Health Conditions AU - Cipriani, Joseph. Occupational Therapy in Mental Health. 2017;33(1):47-69.
213. Ohly H, Gentry S, Wigglesworth R, Bethel A, Lovell R, Garside R. A systematic review of the health and well-being impacts of school gardening: synthesis of quantitative and qualitative evidence. BMC Public Health. 2016;16(1):1-36.
214. Lovell R, Husk K, Cooper C, Stahl-Timmins W, Garside R. Understanding how environmental enhancement and conservation activities may benefit health and wellbeing: a systematic review. BMC Public Health. 2015;15(1):864.
215. Genter C, Roberts A, Richardson J, Sheaff M. The contribution of allotment gardening to health and wellbeing: A systematic review of the literature. British Journal of Occupational Therapy. 2015;78(10):593-605.
216. Audrey S, Batista-Ferrer H. Healthy urban environments for children and young people: A systematic review of intervention studies. Health & Place. 2015;36:97-117.

217. Lovell R, Husk K, Cooper C, Stahl-Timmins W, Garside R. Environmental conservation activities for health: building on systematic review methods to consider a disparate, dispersed, and limited evidence base. The Lancet. 2014;384:s46.
218. South EC, Hohl BC, Kondo MC, MacDonald JM, Branas CC. Effect of greening vacant land on mental health of community-dwelling adults: A cluster randomized trial. JAMA Network Open. 2018;1(3):e180298.
219. Droomers M, Jongeneel-Grimen B, Kramer D, de Vries S, Kremers S, Bruggink J-W, et al. The impact of intervening in green space in Dutch deprived neighbourhoods on physical activity and general health: results from the quasi-experimental URBAN40 study. Journal of epidemiology and community health. 2015.
220. Ward Thompson C, Silveirinha de Oliveira E, Tilley S, Elizalde A, Botha W, Briggs A, et al. Health impacts of environmental and social interventions designed to increase deprived communities' access to urban woodlands: a mixed-methods study. 2019;7:2.
221. McEachan RRC, Yang TC, Roberts H, Pickett KE, Arseneau-Powell D, Gidlow CJ, et al. Availability, use of, and satisfaction with green space, and children's mental wellbeing at age 4 years in a multicultural, deprived, urban area: results from the Born in Bradford cohort study. The Lancet Planetary health. 2018;2(6):e244-e54.
222. Cherrie MPC, Shortt NK, Mitchell RJ, Taylor AM, Redmond P, Thompson CW, et al. Green space and cognitive ageing: A retrospective life course analysis in the Lothian Birth Cohort 1936. Social Science & Medicine. 2018;196:56-65.
223. Bloemsma LD, Gehring U, Klompmaker JO, Hoek G, Janssen NA, Smit HA, et al. Green Space Visits among Adolescents: Frequency and Predictors in the PIAMA Birth Cohort Study. Environmental Health Perspectives (Online). 2018;126(4).
224. Dadvand P, Tischer C, Estarlich M, Llop S, Dalmau-Bueno A, López-Vicente M, et al. Lifelong Residential Exposure to Green Space and Attention: A Population-based Prospective Study. Environmental health perspectives. 2017;125(9):097016-.
225. Picavet HSJ, Milder I, Kruize H, de Vries S, Hermans T, Wendel-Vos W. Greener living environment healthier people?: Exploring green space, physical activity and health in the Doetinchem Cohort Study. Preventive medicine. 2016.
226. Dalton AM, Wareham N, Griffin S, Jones AP. Neighbourhood greenspace is associated with a slower decline in physical activity in older adults: a prospective cohort study. SSM - Population Health. 2016.
227. McEachan RRC, Prady SL, Smith G, Fairley L, Cabieses B, Gidlow C, et al. The association between green space and depressive symptoms in pregnant women: moderating

roles of socioeconomic status and physical activity. Journal of epidemiology and community health. 2015.
228. Annerstedt M, Östergren P-O, Björk J, Grahn P, Skärbäck E, Währborg P. Green qualities in the neighbourhood and mental health - results from a longitudinal cohort study in Southern Sweden. BMC Public Health. 2012;12:337.
229. Wolch J, Jerrett M, Reynolds K, McConnell R, Chang R, Dahmann N, et al. Childhood obesity and proximity to urban parks and recreational resources: A longitudinal cohort study. Health & Place. 2011;17(1):207-14.
230. Alcock I, White MP, Lovell R, Higgins SL, Osborne NJ, Husk K, et al. What accounts for 'England's green and pleasant land'? A panel data analysis of mental health and land cover types in rural England. Landscape and Urban Planning. 2015;142:38-46.
231. Alcock I, White MP, Wheeler BW, Fleming LE, Depledge MH. Longitudinal effects on mental health of moving to greener and less green urban areas. Environmental Science & Technology. 2014;48(2):1247-55.
232. Cronin-de-Chavez A, Islam S, McEachan RRC. Not a level playing field: A qualitative study exploring structural, community and individual determinants of greenspace use amongst low-income multi-ethnic families. Health & Place. 2019;56:118-26.
233. Ferguson M, Roberts HE, McEachan RRC, Dallimer M. Contrasting distributions of urban green infrastructure across social and ethno-racial groups. Landscape and Urban Planning. 2018;175:136-48.
234. Mullin K, Mitchell G, Nawaz NR, Waters RD. Natural capital and the poor in England: Towards an environmental justice analysis of ecosystem services in a high income country. Landscape and Urban Planning. 2018;176:10-21.
235. Bell SL, Phoenix C, Lovell R, Wheeler BW. Seeking everyday wellbeing: The coast as a therapeutic landscape. Social Science & Medicine. 2015;142:56-67.
236. Flies EJ, Skelly C, Lovell R, Breed MF, Phillips D, Weinstein P. Cities, biodiversity and health: we need healthy urban microbiome initiatives. Cities & Health. 2018:1-8.
237. Flies EJ, Skelly C, Negi SS, Prabhakaran P, Liu Q, Liu K, et al. Biodiverse green spaces: a prescription for global urban health. Frontiers in Ecology and the Environment. 2017;15(9):510-6.
238. Pearson AL, Rzotkiewicz A, Pechal JL, Schmidt CJ, Jordan HR, Zwickle A, et al. Initial Evidence of the Relationships between the Human Postmortem Microbiome and Neighborhood Blight and Greening Efforts. Annals of the American Association of Geographers. 2019:1-21.

239. Mills JG, Brookes JD, Gellie NJC, Liddicoat C, Lowe AJ, Sydnor HR, et al. Relating Urban Biodiversity to Human Health With the 'Holobiont' Concept. Front Microbiol. 2019;10:550-.
240. Cox DTC, Gaston KJ. Urban Bird Feeding: Connecting People with Nature. PloS one. 2016;11(7):e0158717.
241. Alcock I, White M, Cherrie M, Wheeler B, Taylor J, McInnes R, et al. Land cover and air pollution are associated with asthma hospitalisations: A cross-sectional study. Environment International. 2017;109:29-41.
242. Salmond JA, Williams DE, Laing G, Kingham S, Dirks K, Longley I, et al. The influence of vegetation on the horizontal and vertical distribution of pollutants in a street canyon. Science of The Total Environment. 2013;443:287-98.
243. Hansford KM, Fonville M, Gillingham EL, Coipan EC, Pietzsch ME, Krawczyk AI, et al. Ticks and Borrelia in urban and peri-urban green space habitats in a city in southern England. Ticks and Tick-borne Diseases. 2017;8(3):353-61.
244. White MP, Elliott LR, Wheeler BW, Fleming LE. Neighbourhood greenspace is related to physical activity in England, but only for dog owners. Landscape and Urban Planning. 2018;174:18-23.
245. White MP, Pahl S, Wheeler BW, Depledge MH, Fleming LE. Natural environments and subjective wellbeing: Different types of exposure are associated with different aspects of wellbeing. Health & Place. 2017;45:77-84.
246. White MP, Wheeler BW, Herbert S, Alcock I, Depledge MH. Coastal proximity and physical activity: Is the coast an under-appreciated public health resource? Preventive medicine. 2014;69:135-40.
247. White MP, Pahl S, Ashbullby K, Herbert S, Depledge MH. Feelings of restoration from recent nature visits. Journal of Environmental Psychology. 2013;35(0):40-51.
248. Taylor L, Hochuli DF. Defining greenspace: Multiple uses across multiple disciplines. Landscape and Urban Planning. 2017;158:25-38.
249. Klompmaker JO, Hoek G, Bloemsma LD, Gehring U, Strak M, Wijga AH, et al. Green space definition affects associations of green space with overweight and physical activity. Environmental Research. 2018;160:531-40.
250. Engemann K, Pedersen CB, Arge L, Tsirogiannis C, Mortensen PB, Svenning J-C. Residential green space in childhood is associated with lower risk of psychiatric disorders from adolescence into adulthood. Proceedings of the National Academy of Sciences. 2019;116(11):5188-93.

251. James P, Hart JE, Banay RF, Laden F. Exposure to Greenness and Mortality in a Nationwide Prospective Cohort Study of Women. Environmental health perspectives. 2016;124(9):1344-52.
252. Kihal-Talantikite W, Padilla CM, Lalloue B, Gelormini M, Zmirou-Navier D, Deguen S. Green space, social inequalities and neonatal mortality in France. BMC Pregnancy & Childbirth. 2013;13:191.
253. Lara-Valencia F, Álvarez-Hernández G, Harlow SD, Denman C, García-Pérez H. Neighborhood socio-environmental vulnerability and infant mortality in Hermosillo, Sonora. salud pública de méxico. 2012;54(4):367-74.
254. Donovan GH, Michael YL, Gatziolis D, Prestemon JP, Whitsel EA. Is tree loss associated with cardiovascular-disease risk in the Women's Health Initiative? A natural experiment. Health & Place. 2015;36:1-7.
255. Hanski I, von Hertzen L, Fyhrquist N, Koskinen K, Torppa K, Laatikainen T, et al. Environmental biodiversity, human microbiota, and allergy are interrelated. Proceedings Of The National Academy Of Sciences Of The United States Of America. 2012;109(21):8334-9.
256. Kabisch N, Haase D, Annerstedt van den Bosch M. Adding Natural Areas to Social Indicators of Intra-Urban Health Inequalities among Children: A Case Study from Berlin, Germany. International Journal of Environmental Research and Public Health. 2016;13(8):783.
257. Ghiani A, Aina R, Asero R, Bellotto E, Citterio S. Ragweed pollen collected along high-traffic roads shows a higher allergenicity than pollen sampled in vegetated areas. Allergy. 2012;67(7):887-94.
258. Astell-Burt T, Feng X, Kolt GS. Neighbourhood green space and the odds of having skin cancer: multilevel evidence of survey data from 267072 Australians. Journal of epidemiology and community health. 2014;68(4):370-4.
259. von Döhren P, Haase D. Ecosystem disservices research: A review of the state of the art with a focus on cities. Ecological Indicators. 2015;52:490-7.
260. Lõhmus M, Balbus J. Making green infrastructure healthier infrastructure. Infection ecology & epidemiology. 2015;5:30082-.
261. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097-e.
262. Commission on Social Determinants of Health. Closing the gap in a generation: health equity through action on the social determinants of health. Final Report of the Commission on Social Determinants of Health. Geneva, World Health Organization. 2008.

263. Dennis M, James P. Evaluating the relative influence on population health of domestic gardens and green space along a rural-urban gradient. Landscape and Urban Planning. 2017;157:343-51.
264. de Keijzer C, Tonne C, Basagaña X, Valentín A, Singh-Manoux A, Alonso J, et al. Residential surrounding greenness and cognitive decline: A 10-year follow-up of the whitehall II cohort. Environmental Health Perspectives. 2018;126(7).
265. Goyder EC, Maheswaran R, Read S. Associations between neighbourhood environmental factors and the uptake and effectiveness of a brief intervention to increase physical activity: Findings from deprived urban communities in an English city. Journal of Public Health (United Kingdom). 2017;39(1):132-8.
266. Houlden V, Weich S, Jarvis S. A cross-sectional analysis of green space prevalence and mental wellbeing in England. BMC Public Health. 2017;17.
267. Mitchell R, Popham F. Effect of exposure to natural environment on health inequalities: an observational population study. The Lancet. 2008;372(9650):1655-60.
268. Mueller N, Rojas-Rueda D, Khreis H, Cirach M, Milà C, Espinosa A, et al. Socioeconomic inequalities in urban and transport planning related exposures and mortality: A health impact assessment study for Bradford, UK. Environment International. 2018;121:931-41.
269. Roe J, Aspinall PA, Thompson CW. Understanding relationships between health, ethnicity, place and the role of urban green space in deprived urban communities. International Journal of Environmental Research and Public Health. 2016;13(7).
270. Ruijsbroek A, Droomers M, Kruize H, Van Kempen E, Gidlow CJ, Hurst G, et al. Does the health impact of exposure to neighbourhood green space differ between population groups? An explorative study in four European cities. International Journal of Environmental Research and Public Health. 2017;14(6).
271. Roe JJ, Aspinall PA, Ward Thompson C. Coping with stress in deprived urban neighborhoods: What is the role of green space according to life stage? Frontiers in Psychology. 2017;8.
272. Roe JJ, Ward Thompson C, Aspinall PA, Brewer MJ, Duff EI, Miller D, et al. Green space and stress: Evidence from cortisol measures in deprived urban communities. International Journal of Environmental Research and Public Health. 2013;10(9):4086-103.
273. Ward Thompson C, Roe J, Aspinall P, Mitchell R, Clow A, Miller D. More green space is linked to less stress in deprived communities: Evidence from salivary cortisol patterns. Landscape and Urban Planning. 2012;105(3):221-9.

274. Cairns-Nagi JM, Bambra C. Defying the odds: A mixed-methods study of health resilience in deprived areas of England. Social Science and Medicine. 2013;91:229-37.
275. Sarkar C, Webster C, Gallacher J. Residential greenness and prevalence of major depressive disorders: a cross-sectional, observational, associational study of 94 879 adult UK Biobank participants. The Lancet Planetary Health. 2018;2(4):e162-e73.
276. Smith L, Panter J, Ogilvie D. Characteristics of the environment and physical activity in midlife: Findings from UK Biobank. Preventive medicine. 2019;118:150-8.
277. Cochrane T, Davey RC, Gidlow C, Smith GR, Fairburn J, Armitage CJ, et al. Small area and individual level predictors of physical activity in urban communities: A multi-level study in stoke on trent, England. International Journal of Environmental Research and Public Health. 2009;6(2):654-77.
278. Dalton AM, Jones A, Ogilvie D, Petticrew M, White M, Cummins S. Using spatial equity analysis in the process evaluation of environmental interventions to tackle obesity: The healthy towns programme in England. International Journal for Equity in Health. 2013;12(1).
279. Dunstan F, Fone DL, Glickman M, Palmer S. Objectively Measured Residential Environment and Self-Reported Health: A Multilevel Analysis of UK Census Data. PloS one. 2013;8(7).
280. Ord K, Mitchell R, Pearce J. Is level of neighbourhood green space associated with physical activity in green space? International Journal of Behavioral Nutrition and Physical Activity. 2013;10.
281. Wheeler BW, White M, Stahl-Timmins W, Depledge MH. Does living by the coast improve health and wellbeing. Health and Place. 2012;18(5):1198-201.
282. Elliott LR, White MP, Grellier J, Rees SE, Waters RD, Fleming LE. Recreational visits to marine and coastal environments in England: Where, what, who, why, and when? Marine Policy. 2018;97:305-14.