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Cities, health and well-being

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Foreword

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One of the most difficult challenges facing the world today is how to accommodate the huge numbers of people crowding into our cities in a way that ensures inhabitants' long-term health and well-being, and the opportunity to live fulfilling lives.

Many of the world's fastest growing cities are struggling to deal with the kind of health problems encountered in the 19th Century in developed countries. At the same time, cities in developed countries are being confronted with new challenges – ailments partly attributable to the way in which we have arranged our cities, the means of transport that service them and the lifestyles we have adopted.

For over a century and a half property professionals have been centrally involved in decision-making about the built environment, whether at the scale of land allocation, choices about the types of property to be constructed or the cost at which development is to be delivered.

It is fitting that we should publish this insight paper in our 150th anniversary year, given the continued pressure on land to be used more intensively, property to be employed more efficiently and construction carried out more affordably. Yet all of this will be futile if, ultimately, it does not create places where people can live healthy lives.

In the UK, the Marmot Review (2010) provided some startling conclusions on the link between urban conditions and the health and well-being of citizens. The report provided a jolting reminder of how much of the impetus for urban improvement originated with public health legislation in the 19th Century. It also reminded us about how important it is for urban development and planning to recover this perspective.

The benefits of improved standards of development can be immediately experienced when implemented on the outskirts of emerging cities, through the elimination of diseases such as cholera and typhoid. In developed economies, the benefits tend to be more long term through extended, healthier lives. At a time of strained financial resources it is easy to understand how arguments are made to explain why costs cannot be incurred that have no obvious immediate return.

Yet health and well-being in our cities should not be a private finance issue or even a public finance issue, important as these may be. It is a far more critical matter: it is a public health issue that will result in widespread human distress and enormous financial costs in the long-run if we do not take the appropriate measures in the short term.

John Hughes
RICS President

Executive summary

The urban environment has long been recognised as an important determinant of health and well-being. Historically this focused on pollution, disease and overcrowding but there is now growing evidence of the health and well-being impacts, both positive and negative, of the physical urban environment. Built environment professionals working across the public and private sector can make use of this knowledge to integrate health-promoting policies and design into new developments and regeneration projects of all scales.

Chronic health conditions are rising globally and impose heavy costs. And yet many of these conditions are preventable and strongly influenced by the built environment. In the UK, they account for 70% of spending on health and social care. At all scales of development, promoting physical activity is one of the most impactful measures planners and designers can take to reduce chronic disease and obesity. Given the extent of ill health caused or worsened by air pollution, strategies to reduce exposure within buildings and improve urban air quality are also highly impactful. Providing access to greenspace, affordable healthy food, and leisure facilities can be integrated at multiple scales of development to support health and well-being.

This paper also recognises there is an 'urban health advantage' in that the economic, social and governance opportunities of cities can promote healthier living. However, this has to be actively created and maintained; with recognition that this advantage is not evenly distributed across a city. Attention must be given to health inequalities within cities and the ways in which environmental deprivation and poor quality housing contribute to higher levels of ill health among the urban poor.

A wide range of physical features of the urban environment affect health and well-being, including:

- water, waste and sanitation infrastructure
- pollutants including those affecting air quality and noise
- land use mix and density
- street design and connectivity
- public transport
- building materials and design
- green spaces and parks
- access to food, and
- the urban heat island effect (see Glossary).

Influencing these features to promote health can take place through built environment design, planning and management activities at the level of the city, the neighbourhood, the street and the building, including:

- urban planning approaches to integrate health and well-being and align them with other policy objectives such as economic development and environmental protection
- design at the street-scale supporting 'active transport' such as cycling and walking
- buildings designed for health and well-being as promoted by a number of building standards (see Building standards and health).

As a built environment professional you can make a significant contribution to designing and planning healthy places by:

- understanding your client and their requirements
- considering potential health and well-being impacts for all occupants and residents, including those who are more vulnerable and require special consideration
- determining appropriate policies, design strategies, materials and technologies
- arming yourself with data about the costs and benefits
- considering using a building standard
- identifying metrics to measure your success.

The last few years have seen a marked growth of the health and well-being agenda in the property sector. If this area is new to you, there are plenty of opportunities to increase your knowledge through publications such as this, events or training courses. This is a quickly developing specialism within sustainable planning and property development, but it is not too late to get involved and integrate this new knowledge into your work.

Glossary

Active design: a design approach that seeks to increase physical activity in all aspects of daily life and can be applied at multiple built environment scales.

Biophilic design: a human centred approach to design that incorporates and mimics forms found in the natural world with the aim of improving health and well-being.

Standards and assessment tools: systems for evaluating the quality of new or refurbished buildings and communities beyond the minimum level set by building regulations.

Noncommunicable diseases or chronic diseases: 'tend to be of long duration and are the result of a combination of genetic, physiological, environmental and behaviours factors. The main types of NCDs are cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma) and diabetes.'[1]

Climate change: 'a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use.'[2]

Green infrastructure: 'the network of natural and semi-natural areas, features and green spaces in rural and urban, and terrestrial, freshwater, coastal and marine areas, which together enhance ecosystem health and resilience, contribute to biodiversity conservation and benefit human populations through the maintenance and enhancement of ecosystem services'.[3]

Health: 'a complete state of physical, mental and social well-being, and not merely the absence of disease or infirmity.'[4]

Healthy city: 'one that is continually creating and improving those physical and social environments and strengthening those community resources which enable people to mutually support each other in performing all the functions of life and achieving their maximum potential.'[5]

Health Impact Assessment (HIA): 'a combination of procedures, methods and tools by which a policy, program or project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population.'[6]

Mental health: 'a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community.'[7]

Pocket parks: small parks consisting of plants and possibly furniture (e.g. chairs or tables) sometimes created on vacant land or portions of streets.

Social value: 'wider financial and non-financial impacts of programmes, organisations and interventions, including the wellbeing of individuals and communities, social capital and the environment.'[8]

Street connectivity: 'characterizes the ease of moving between origins (e.g., households) and destinations (e.g., stores and employment) within the existing street and sidewalk–pathway structure. Connectivity is high when streets are laid out in a grid pattern and there are few barriers (e.g., walls, freeways) to direct travel between origins and destinations.'[9]

Sustainable buildings: buildings which have been designed to reduce their impact on the environment (e.g. through materials and energy use) while also contributing positive social and economic impacts throughout construction, use and demolition phases.

Urban health advantage: a phenomenon in which urban populations have experienced better health outcomes than their rural counterparts.

Urban heat island effect: a phenomenon where urban areas are several degrees warmer than neighbouring rural areas due to the heat retention of buildings and paved surfaces compared with vegetated areas.

Well-being: 'includes the presence of positive emotions and moods (e.g., contentment, happiness), the absence of negative emotions (e.g., depression, anxiety), satisfaction with life, fulfilment and positive functioning.'[10]

1. World Health Organization. Noncommunicable diseases: Fact Sheet. 2015. http://www.who.int/mediacentre/factsheets/fs355/en/ (accessed March 2, 2016).
2. Intergovernmental Panel on Climate Change, Working Group I: The Scientific Basis, Edited by A.P.M. Baede. Appendix I - Glossary. https://www.ipcc.ch/ipccreports/tar/wg1/518.htm.   3. Naumann S, Davis M, Kaphengst T, Pieterse M, Rayment M. Design, implementation and cost elements of Green Infrastructure projects. Final report to the European Commission, DG Environment, Contract no. 070307/2010/577182/ETU/F.1. 2011.   4. World Health Organization. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, 19-22 June, 1946; and entered into force on 7 April 1948. New York: World Health Organization, 1948.   5. Hancock T, Duhl LJ. Healthy Cities: Promoting Health in the Urban Context. World Health Organization Regional Office for Europe, 1986.

1.0 Introduction

Cities are home to leading business, cultural and civic institutions that support residents in employment, education and access to entertainment and other amenities. For many, living in a city means being at the heart of activity and production in their region with the option of travelling elsewhere with relative ease. This concentration of opportunity and services in urban areas can be very beneficial for residents' health and well-being. Yet for centuries, the dense living and working conditions of cities have also created the conditions for the spread of pollution and disease.

Building on the joint origins of public health, urban planning and the surveying profession, there are now many mechanisms to ensure urban environments can support healthy living. National regulations and urban policies seek to ensure we live in safe, pollution-free environments with the necessary supporting infrastructure. Through good planning and design, city residents are not only less exposed to pollution, but will also have access to parks, public transport, healthy food and other amenities that support health and well-being.

The economic and social opportunities, including high quality healthcare, available in cities have led some researchers to conclude that residents may benefit from an 'urban health advantage' compared to rural areas. However, the unequal distribution of resources within cities means that different neighbourhoods may have very different access to such opportunities and this can negatively affect health. Poorer neighbourhoods are more likely to have poor quality housing, greater exposure to pollution and reduced access to key services. The so-called 'urban health advantage' does not apply to everybody in a city and it requires ongoing management.

This paper provides information about cities, health and well-being that will be relevant globally. However, this does not mean that all cities would prioritise the same action to produce healthy built environments. Cities in low and middle income countries tend to have greater challenges related to water, waste and sanitation infrastructure and building quality than high income countries. The policy focus for high income countries is more related to supporting healthy lifestyles, including physical activity and healthy eating. Noise and air pollution are significant challenges globally and require attention by policy makers across multiple sectors, including the built environment.

1.1 Purpose

Property professionals play an important role in improving the health and well-being of the people living and working in buildings and places which they developed or manage. This paper outlines the key concepts that will help property professionals integrate health and well-being objectives into their work.

As cities plan for significant projected growth they are also faced with managing a number of global challenges, such as climate change, resource depletion, an ageing population and the rising burdens of obesity and chronic disease. This paper will help property professionals play their part in addressing some of these issues by outlining the latest thinking regarding healthy and sustainable building and urban design measures, and how these relate to value.

This paper is organised into seven sections. The first three sections introduce the key issues in urban health, with the latter focused specifically on the health impact of the built environment. Section 4 describes current practices to incorporate health and well-being principles into new development. Section 5 looks specifically at the role of building standards and section 6 reviews the business case for promoting health and well-being through the physical environment. The final section sets out possible next steps for integrating health and well-being principles into your next project, as well as future challenges. There are case studies throughout the paper to showcase leading examples and provide more detail.

1.2 Health and the urban environment

It is difficult to pinpoint the potential impact of the physical urban environment on health because so many factors affect personal health and well-being. Although many people think of healthcare and genetics as the primary drivers of health, we now know that social and environmental factors play a large role. Globally, around 23% of deaths in 2012 were attributed to the physical environment including air and noise pollution, housing, transport and other factors.[11] Built environment professionals can contribute to the reduction of negative impacts and maximisation of positive health effects through the design and development of buildings and communities.

6. International Association for Impact Assessment. Health Impact Assessment. http://www.iaia.org/wiki-details.php?ID=14 (accessed April 24, 2018).   7. Mental health: a state of well-being. World Health Organization. 2014; published online Aug. http://www.who.int/features/factfiles/mental_health/en/ (accessed Aug 23, 2017).   8. What is Social Value. The Social Value Portal. 2017; published online Aug 1. https://socialvalueportal.com/what-is-social-value/ (accessed April 24, 2018).   9. Saelens BE, Sallis JF, Frank LD. Environmental correlates of walking and cycling: Findings from the transportation, urban design, and planning literatures. ann behavmed 2016; 25: 80–91.   10. U.S. Centers for Disease Control and Prevention. Well-Being Concepts. https://www.cdc.gov/hrqol/wellbeing.htm (accessed April 24, 2018)

The work of built environment professionals also affects the wide-ranging social and economic infrastructure such as education and jobs which also affect health. This wider impact of urban planning policies and programmes led New York's Regional Plan Association to conclude that up to 80% of a community's health could be shaped by the activities of urban planning.[12]

Generally, the range of factors that influence health outside our genes are known as the 'social determinants of health'. The World Health Organization (WHO) describes these as 'the circumstances in which people are born, grow up, live, work and age, and the systems put in place to deal with illness.'[13] The built environment and physical structures where we spend the majority of our time can have a significant impact on our health and well-being (see The urban environment).

City leaders are increasingly influencing health and well-being through policies across multiple departments. Los Angeles' planning department produced a Plan for a Healthy Los Angeles. It outlines both planning policies and related activities across city departments aiming to help improve the health and well-being of residents as the city grows. A key element of the plan is the intention to address health inequities. The city recognises that poor neighbourhoods in LA are characterised by concentrations of people with chronic health conditions (such as asthma, diabetes, and heart disease) and environmental deprivation, unemployment and lower educational attainment.

Health inequities (or inequalities) are a significant problem for cities globally. The work of University College London's Institute of Health Equity has shown that there is a social gradient in health – meaning that people living in the most deprived neighbourhoods die younger and suffer longer from ill health than those who live in the least deprived neighbourhoods.[14]

Urban environments can exacerbate health inequities, as shown in Los Angeles, where residents may have little opportunity to escape unhealthy living and working conditions. These challenges are particularly high in low income countries where the poorest inhabitants lack access to basic water and sanitation infrastructure and buildings are seldom constructed to safety codes, creating significant risks especially during natural disasters.

Image source: Stuart Monk / Shutterstock.com

11. Prüss-Üstün A, Wolf J, Corvalan C, Bos R, Neira M. Preventing disease through healthy environments: a global assessment of the burden of disease from environmental risks. World Health Organization, 2016 http://apps.who.int/iris/bitstream/10665/204585/1/9789241565196_eng.pdf?ua=1 (accessed April 18, 2016).   12. Regional Plan Association. State of the Region's Health: How the New York Metropolitan Region's Urban Systems Influence Health. Regional Plan Association, Robert Wood Johnson Foundation, 2016.   13. World Health Organization. Social determinants of health: Key concepts. 2012. http://www.who.int/social_determinants/final_report/key_concepts_en.pdf?ua=1.   14. Marmot M, Allen J, Goldblat P, et al. Fair society, healthy lives: the Marmot review; strategic review of health inequalities in England post-2010. London: Marmot Review, 2010.

2.0 Global health trends

As outlined in the 2012 UCL-Lancet Healthy Cities Commission report, the quality of urban environments varies significantly at the global scale.[15] Table 1 outlines some of the priority challenges for the urban built environment and health across low, middle and high income countries (many of which are shared across countries).[16]

Table 1: Priority challenges related to health and the urban built environment in low, middle and high income countries.

Low and middle income countries

- Access to and quality of water, waste and sanitation infrastructure
- Building quality (structural safety and materials)
- Informal settlements
- Preparedness and ability to cope with natural disasters

High income countries

- 'Food deserts' – communities where it is only possible to access healthy foods with a private vehicle
- Concentration of shops and services which may be detrimental to health in poor neighbourhoods (e.g. fast food outlets, betting shops and alcohol outlets)
- Proximity of fast food outlets to schools

Shared priorities

- Lack of opportunities for physical activity in daily life (e.g. commute to work/school)
- Noise and air pollution
- Access to affordable housing
- Preparedness for the impacts of climate change
- Building quality (thermal comfort and air quality)
- Access to greenspace
- Designing for children, an ageing population and disabled people
- Learning from communities about their perceptions of health and place

Note: cities from any country may have challenges with any of the issues in this table regardless of their development status.

15. Rydin Y, Bleahu A, Davies M, et al. Shaping cities for health: complexity and the planning of urban environments in the 21st century. The Lancet 2012; 379: 2079–2108.   16. World Health Organization. Global report on urban health: equitable, healthier cities for sustainable development. World Health Organization, 2016.

2.1 Chronic diseases

There is variation in the types of health conditions that affect urban dwellers globally, however, chronic conditions and obesity are on the rise around the world. Chronic diseases are often described as 'lifestyle' diseases because the main risk factors are smoking, physical inactivity, unhealthy diet and alcohol misuse. These conditions are increasingly common and very expensive because people can live for many years with such illnesses. The four main types of non-communicable chronic diseases are cardiovascular diseases (e.g. heart attacks and stroke), cancers, chronic respiratory diseases (e.g. chronic obstructed pulmonary disease and asthma) and diabetes.

Non-communicable diseases (NCDs) were responsible for around 70% of the world's deaths in 2015.[17] The World Economic Forum estimates the global costs of these diseases to reach USD47 trillion by 2030.[18] The WHO describes non-communicable diseases as being driven by 'ageing, rapid unplanned urbanization, and the globalization of unhealthy lifestyles.'[19] In rapidly urbanising countries, including China and India, chronic diseases coexist with communicable diseases creating significant challenges for disease control and prevention efforts. Designing urban environments where people can easily be physically active as part of their daily lives, and have access to affordable healthy foods, can be a significant part of the solution to decreasing the burden of chronic diseases.

According to the WHO, global obesity levels have more than doubled since 1980 and this is not only a challenge in high income countries. Increasing obesity levels are also a problem in low and middle income countries, particularly in urban areas. Both obesity and chronic diseases are preventable through lifestyle modifications, such as physical activity and healthy eating.

Health challenges in rapidly urbanising low and middle income countries

At the start of the 20th century only one in ten people lived in cities. By 2030 this is projected to increase to six in ten, with more than 90 percent of urban populations living in low and middle income countries (LMICs).[20] There are a wide range of health challenges and some benefits associated with urbanisation in LMICs. Cities in these countries suffer from a 'triple threat of disease' including: chronic diseases, communicable diseases and increased risk of violence and injury.[21] As urban infrastructure struggles to cope with rapid growth, many people live in informal settlements with dramatic effects on the environment and human health. However, as rural populations move to urban areas they tend to have greater access to health services, education and higher incomes, providing positive health impacts.

Several decades of economic growth and urbanisation in China have pulled hundreds of millions of Chinese people out of poverty but have come at a cost for the environment and health including increased exposure to air and water pollution and physical inactivity.[22] Poor air quality is one of China's biggest environmental health challenges and is associated with an estimated 4,000 deaths per day (or 17 percent of all deaths annually). [23] To address air pollution and other environmental health risks, China has been seeking to move beyond an economic growth model to include environmental protection and energy reduction.[24] The Chinese government will need to overcome policy and institutional barriers such as a lack of effective legislation, mechanisms for inter-departmental coordination, involvement of health authorities in environmental management, and adequate staffing at local level.[25]

Indian architecture and urban design academics, Rajan and Majoj Kumar, have proposed a framework for health and wellness to address India's health-related urbanisation challenges.[26] The framework includes design efforts to increase physical activity, support a healthy diet, reduce tobacco and alcohol use, increase social integration and safety, reduce pollution and increase road safety, among other measures.[27]

Built environment professionals have a key role to play in ensuring that urban growth has a reduced environmental impact and increases opportunities for healthy lifestyles. Priorities will vary by country and city but there are many built environment solutions discussed in this publication that can be applied across low, middle and high income countries to improve urban health.

17. Wang H, Naghavi M, Allen C, et al. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. The Lancet 2016; 388: 1459–544.   18. Bloom D., Cafiero E., Jané-Llopis E, et al. The Global Economic Burden of Noncommunicable Diseases. Geneva: World Economic Forum, 2011.
19. World Health Organization. Noncommunicable diseases: Fact Sheet. 2015. http://www.who.int/mediacentre/factsheets/fs355/en/ (accessed March 2, 2016).   20. United Nations, Department of Economic and Social Affairs, Population Division. World urbanization prospects: the 2014 revision: highlights. 2014.   21. World Health Organization, United Nations Human Settlements Programme, editors. Hidden cities: unmasking and overcoming health inequities in urban settings. Kobe, Japan: World Health Organization ; UN-HABITAT, 2010.   22. Gong P, Liang S, Carlton EJ, et al. Urbanisation and health in China. Lancet 2012; 379: 843–52.   23. Rohde RA, Muller RA. Air Pollution in China: Mapping of Concentrations and Sources. PLOS ONE 2015; 10: e0135749.   24. Kan H. Environment and Health in China: Challenges and Opportunities. Environ Health Perspect 2009; 117: A530–1.   25. Ibid.   26. Rajan A, Manoj Kumar K. Urban Health and Wellness in Indian Context - A Strategic Approach in Urban Design. Procedia Technology 2016; 24: 1750–7.   27. Ibid.

2.2 Physical activity and active design

As a result of global epidemics of obesity and chronic diseases, encouraging physical activity is of growing importance. Although physical inactivity is only one of several risk factors for these diseases, it is one which is greatly influenced by the urban environment. It is easiest for people to obtain the recommended 150 minutes of physical activity per week if they can integrate it into their daily lives; for example, through walking or cycling to school or work.

Active design refers to measures to increase physical activity through the design of buildings, streetscapes and cities. Within buildings, the location of stairs and layout of internal spaces can encourage people to be more active. At the street scale, pedestrians are influenced by safety (in relation to traffic and perceived crime) and 'walkability'. At the urban scale, land use policies and transport networks can influence the convenience of walking or cycling for all or part of a journey (with public transport forming part of an active transport network).

Walkability

The term 'walkability' refers to a combination of factors which make a neighbourhood easier and more convenient for pedestrians: street connectivity, land use mix and residential density. Multiple studies have shown that people living in more walkable neighbourhoods actually walk more than people who live in neighbourhoods which are rated as less walkable.

There are a number of tools designed to assess the objectively measurable walkability of a neighbourhood. These tools can be used by urban planners but they are also being used by the property sector as a mark of a neighbourhood's desirability. Walk Score rates the walkability of individual properties, neighbourhoods and cities and also has a widget for real estate agents to add a Walk Score to their properties (https://www.walkscore.com/). Bike Scores and Transit Scores are also produced by the website.

Other examples include Walkonomics (http://www.walkonomics.com/) and the Walkability app (http://walkabilityasia.org/2012/10/03/walkability-mobile-app/#).

A number of design guides have emerged to increase physical activity in cities, such as New York City's Active Design Guidelines and a guide for city leaders Designed to Move: Active Cities. The latter describes the full business case for increasing physical activity in cities, including: increased productivity and jobs, reduced crime and transport-related injuries, and environmental benefits.

The benefits of active design in cities

Design strategies to encourage physical activity in a city may be introduced by a range of public and private stakeholders including building owners, transport service providers and urban planners. The benefits of such measures will also be spread across different organisations and sectors. A guide for city leaders to increase physical activity called Designed to Move: Active Cities[29] outlines many benefits from getting people moving, including:

- cost savings
- job growth
- increased productivity
- less crime
- fewer pedestrian and cyclist injuries
- better social cohesion
- increased civic engagement
- reduced pollution
- improved climate
- less depression, anxiety and stress
- less obesity and chronic disease.

2.3 Urban health stakeholders

Government, the private sector and healthcare providers have varying drivers to improve health through the built environment, partly influenced by a country's healthcare model. In the built environment sector, many organisations are promoting guidance and offering a business case to incorporate health and well-being principles into design at multiple scales. The emergence of new building design standards specifically targeted towards health objectives, such as the WELL Building Standard and Fitwel, demonstrate the property sector's engagement with this topic.

At a national level, governments provide support for healthy urban environments through legislation and guidance. The US's landmark Clean Air Act 1963 and Clean Water Act 1972 created global examples for pollution prevention at the national level. These fundamental layers of environmental and health protection form the basis for improvements across multiple sectors.

28. Hajna S, Ross NA, Brazeau A-S, Bélisle P, Joseph L, Dasgupta K. Associations between neighbourhood walkability and daily steps in adults: a systematic review and meta-analysis. BMC Public Health 2015; 15: 768.   29. Designed to Move, Active Cities: A Guide for City Leaders. 2015; published online June. http://www.designedtomove.org/resources/active-cities

Figure 1: Health Loop Trail in the Baton Rouge Health District

Image source: Perkins+Will

National requirements to assess and improve the environmental impact of new development and policies (such as through Strategic Environmental Assessments and Environmental Impact Assessments) also reduce negative health impacts. Increasingly, policy-makers are looking for Health Impact Assessments for large developments and infrastructure proposals to reduce negative health effects and maximise potential benefits (see Section 3).

Where the state is heavily involved in providing health-related services, such as the UK's National Health Service, there is a strong financial incentive for government to promote healthy design of buildings and cities. For example, bodies such as the National Institute for Health and Care Excellence (NICE) and Public Health England have produced multiple guidance publications on increasing physical activity for built environment professionals. The UK's National Planning Policy Framework, to which all local planning documents must demonstrate conformity, includes a section on promoting healthy communities. This illustrates the central role of planning in creating places that encourage social interaction and physical activity.

In countries which operate predominately through a private healthcare model, hospitals and health insurance providers also have an important role. Many hospitals and healthcare buildings are seeking to maximise positive health benefits through the design of their facilities. Some have even sought to influence health beyond the boundaries of hospital grounds. The US Centers for Disease Control and Prevention (CDC) have produced a number of healthy design resources, including a built environment assessment tool.

A wide range of private sector stakeholders are involved in producing or maintaining healthy urban environments.

Healthcare beyond hospitals

The Baton Rouge Health District involves the collaboration of multiple hospitals and healthcare providers in Baton Rouge, Louisiana, to influence the health and well-being of visitors and residents in their community. The group developed the Baton Rouge Health District Treatment Plan as a mechanism to coordinate land use and infrastructure investment in ways that will promote health, such as by better supporting walking and cycling in the area. The Plan involves developing a District Street Network and Health Loop Trail, facilitating access to greenspace, among other initiatives. The collaboration is also a platform for community health initiatives and sustainable economic development. http://brhealthdistrict.com/

Employers often recognise their impact on the health, safety and well-being of their workforce and many are beginning to explore the effect of offices on these factors. Increasingly there is a drive to optimise indoor environments to boost productivity and well-being. Developers see the potential for increased value of properties which are seen as healthier, whether these are homes, shops or work places. Built environment professionals, including architects, engineers and surveyors, are incorporating health and well-being into their work in new ways, whether this relates to improving well-being through design, optimising indoor air quality or valuing the health benefits of a new office.

3.0 The urban environment

3.1 Urban environment factors

The urban environment is comprised of many interacting factors that affect health and well-being, directly and indirectly. The city can impact health at multiple scales from macrosystems related to air pollution to microsystems, such as the provision of benches and street lighting encouraging people to walk around their neighbourhood. Figure 2 shows a considerable range of physical urban environment factors affecting health and well-being.

Multiple departments within city government have responsibility for managing features of the urban environment which impact health. Services, buildings and infrastructure will also be managed by the private sector or public organisations outside of city hall. This requires stakeholders to work together and independently to improve the health impact of the city.

For instance, transport networks including subway systems, buses, and roads may be managed by several organisations within a city. Each organisation can improve their service to support health. However, there may be a lack of knowledge of the required changes or competing interests which act as a barrier to creating a health-promoting transport network. Transport nodes may involve the intersection of several providers, requiring them to consider how passengers will transfer between services supporting a convenient and accessible active transport network.

Figure 2: Physical urban environment factors impacting health and well-being
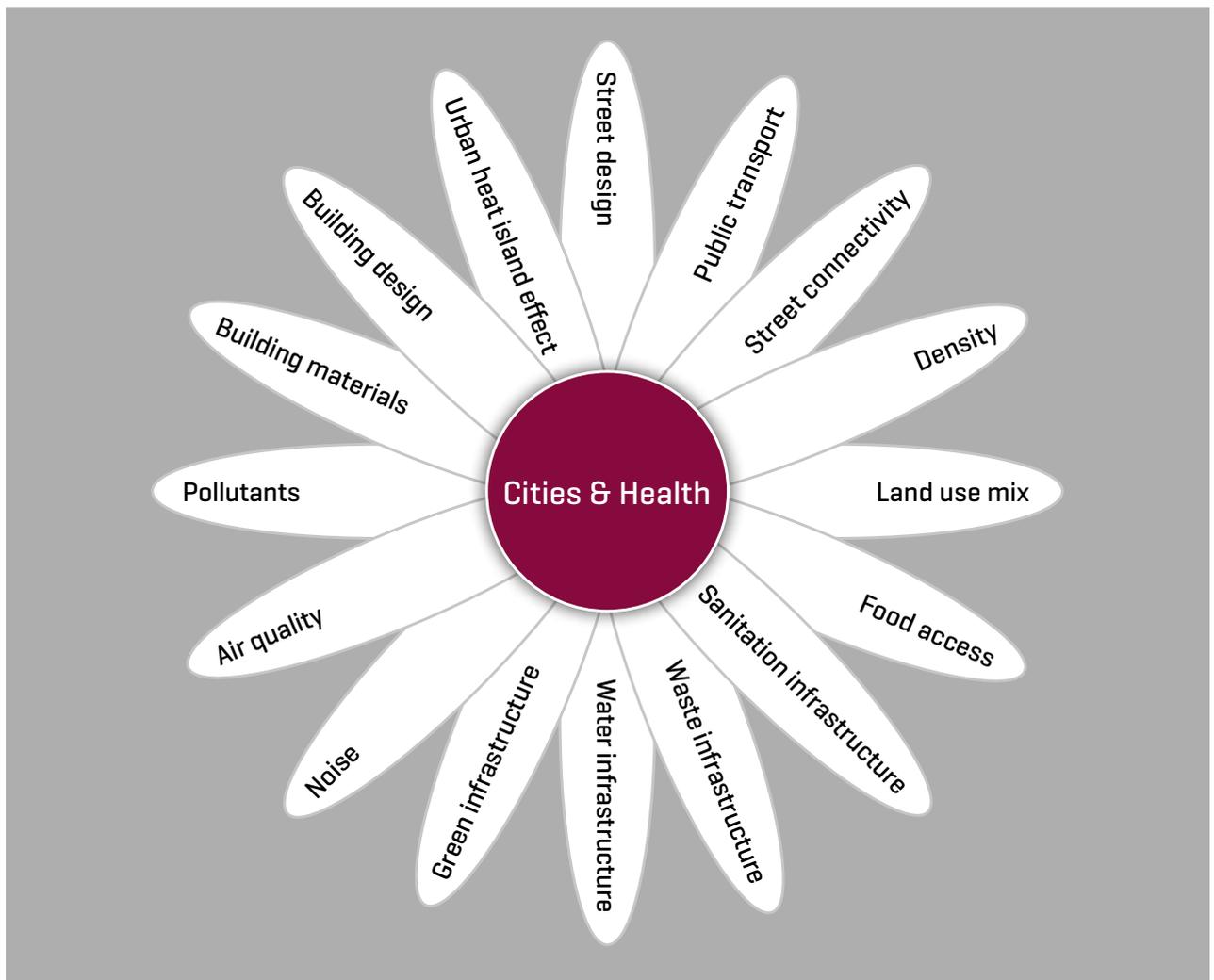
3.2 Exposures and health impacts

One way of considering the health impact of cities is through environmental 'exposures' such as air and noise pollution. Although the term 'exposure' may sound negative, it can also be used in reference to urban features that promote health, as in the case of green infrastructure.

There are well-understood links between the urban environment and health that practitioners can integrate into the design of healthy buildings and places. Understanding the health impact of the physical urban environment helps to underscore the importance of health-promoting design and policy measures. Figure 3 outlines examples of the health impacts of the urban environment at three scales: city/neighbourhood, street and building.

Figure 3: Examples of urban environment exposures and associated health outcomes at three scales (city/neighbourhood, street and building)

City and Neighbourhood
Air and noise pollution, traffic, waste/water/sanitation infrastructure, urban heat island effect, service provision, land use

- cardiovascular disease
- respiratory disease
- neurodevelopment & cognitive function problems
- diabetes
- hearing loss and impairments
- anxiety, annoyance, sleep disturbance, psychological distress
- exposure to toxins and infectious diseases
- heat exhaustion

Street
Microclimate, traffic, open/green spaces

- death or injury from traffic collisions
- unpleasant street environment (wind, noise, traffic) reduces physical activity
- lack of place to gather reduces social interaction (mental health and wellbeing)

Building
Indoor air quality, lighting, structural safety, toxins, pests, thermal comfort, overcrowding, tenure

- exposure to toxins and infectious diseases
- heat exhaustion
- damp/mould can cause/ exacerbate asthma, allergies or respiratory diseases
- death or injury from excess cold, falls or building damage
- mental health and wellbeing

3.3 Challenges

Urban air pollution is a significant challenge for city leaders and health professionals, causing or exacerbating cardiovascular and respiratory diseases among other conditions. The WHO reports that indoor and outdoor air pollution together are one of the largest risks to health worldwide with 3.7 million deaths (of people under the age of 60) caused by outdoor air pollution in 2012.[30] About half of the urban population being monitored by the WHO is exposed to air pollution that is at least 2.5 times higher than recommended, although there is no absolutely safe level of exposure.[31]

The causes of air pollution include transport (particularly motor vehicles), buildings, energy production and industry. To improve air quality city leaders rely on national and international policies and regulators across multiple industries. Pollutants can travel very large distances and local mitigation measures will not always have a significant impact. Reducing exposure to external and internal air pollutants is a key objective for built environment professionals who seek to improve health and well-being.

Traffic is a major contributor to air and noise pollution, but it also creates a serious risk of death and injury. Road injuries are the eighth leading cause of death globally and they are the biggest cause of death for people aged 15 to 25.[32] The perception of danger from traffic also deters people from walking and cycling, particularly vulnerable road users such as children and older people. One highly effective measure to reduce road injuries is to limit traffic speeds to 20mph, particularly in residential areas. A range of policies and urban design principles can be used to create safe streets for all road users.

A 2015 Lancet Commission on health and climate change policy warned that the impacts of climate change could undermine decades of health improvements globally.[33] The effects of climate change include extreme heat, cold, droughts, storms and changes in air and water quality. These weather events can influence health directly (such as through heat exhaustion) or indirectly by increasing conditions that facilitate the spread of infectious diseases and/or pests.

The urban heat island effect is also exacerbated by the effects of climate change. On hot days, urban temperatures can be more than 5°F warmer than surrounding areas.[34] Building occupants and managers are likely to use air conditioning in buildings which exacerbates air pollution.

3.4 Opportunities

One feature of cities with almost exclusively positive effects on health and well-being is green infrastructure. The only exception appears to be where green spaces are not well maintained, creating a perception of neglect and reduced safety. Green infrastructure, in its many forms, contributes to better air quality in cities and helps to reduce temperatures and provide shade during heat waves. Different scales of green infrastructure, from street planting to parks, can also help reduce flooding by storing rainwater, create spaces for play and exercise and contribute to well-being.

The design and construction of buildings including homes, schools and offices has the opportunity to create spaces that support or detract from health and well-being. There are many factors to consider from structural safety, to daylighting and thermal comfort. Many studies have shown that internal environments can affect our ability to learn or work productively, but they can also have long-term health impacts where conditions are particularly poor. Given that buildings form the main environmental exposure for urban dwellers, they are a particularly important environment to optimise.

3.5 Understanding local conditions

Although there are some universal truths about urban environment exposures and health, local community knowledge can complement the general evidence base. When designing or retrofitting buildings or urban areas, it is helpful to find out how residents currently use and intend to use these spaces. In addition, it is important to ask whether there may be particular challenges or opportunities that design teams have not considered.

There are many approaches to engaging with local communities about proposed changes to the built environment. Health Impact Assessment includes many participatory methods that can be used for this purpose. Southwark and Lambeth in London conducted detailed research of residents' perceptions of health and place in relation to two major regeneration areas. They surveyed a range of approaches from existing research and best practice examples of how to gather knowledge from local communities, specifically about health and the urban environment.

30. World Health Organization. Air quality deteriorating in many of the world's cities. WHO. http://www.who.int/mediacentre/news/releases/2014/air-quality/en/ (accessed Aug 21, 2015). 31. ibid   32. Transport for Health: The Global Burden of Disease from Motorized Road Transport. Seattle, WA: IHME; Washington, DC: The World Bank: Global Road Safety Facility, The World Bank; Institute for Health Metrics and Evaluation, 2014 http://www.healthdata.org/sites/default/files/files/policy_report/2014/Transport4Health/IHME_Transport4Health_Full_Report.pdf.   33. Watts N, Adger WN, Agnolucci P, et al. Health and climate change: policy responses to protect public health. The Lancet 2015; 386: 1861–914.   34. Galea S, Vlahov D. Urban Health: Evidence, Challenges, and Directions. Annual Review of Public Health 2005; 26: 341–65.

Learning from the community about health and place

Southwark and Lambeth are two densely populated London boroughs characterised by diverse and young residents. Health outcomes in these boroughs are similar to other parts of London, however they are challenged by childhood obesity. Given their central location, these boroughs are prime locations to accommodate growth within London, providing residents with excellent access to the city's jobs, entertainment and services.

In preparing planning strategies for major regeneration in these respective boroughs, local government staff sought to gather detailed information about residents' perceptions of health and place through a large survey and a number of focus groups.

An initial literature review summarised best practice examples from similar research and engagement projects.[35] The review showed that knowledge from local communities about health and place may not be what built environment professionals had expected. For example, some researchers in the USA encountered neighbourhoods which were objectively perceived as 'walkable' with many healthy eating options. However, local residents had their own reasons for not using these spaces as intended, such as associations with criminal activity in public spaces or the perception of discrimination in certain eating establishments.

In Southwark and Lambeth the findings from the social research helped to establish specific issues that local children had with traffic safety and healthy eating, both related to their key health challenge of childhood obesity. The full results are now being used to inform planning and regeneration policies.

4.0 Integrating health and well-being

Health-promoting design and policy measures can be introduced at different urban scales and at multiple stages in the life cycle of places. National, regional and local government bodies use regulations to ensure new or refurbished development meet minimum standards for health protection and safety. Local planning authorities apply health-promoting policies based on local needs and priorities, sometimes requiring a higher level of building design quality than would be provided through building regulations. Built environment professionals specify materials and introduce design measures to meet the requirements of end users, sometimes through the application of sustainable or healthy building standards.

This section reviews current practice in incorporating health and well-being into development at multiple scales. A number of examples from specific developments help illustrate how developers and design teams are approaching such objectives.

4.1 Urban planning approaches

For city planning departments, integrating objectives to improve health and well-being is a natural step because it aligns with many other policy objectives, such as economic development and environmental protection. Land use policies that create mixed-use communities and high enough residential densities to support active transport are the starting point for sustainable development and health. Some policies and design measures can be integrated regardless of whether significant growth is planned (e.g. reducing speed limits in residential areas) while others are easier to integrate during periods of growth or regeneration (e.g. increasing densities and mixed-use communities).

Many city planning departments are producing land use and development policies and guidelines that include health and well-being considerations. For example, the Plan for a Healthy Los Angeles forms part of the city's general plan and sets out a range of built environment policy areas that link to health objectives. It encourages healthy building design and outlines the city's intention to produce healthy building design guidelines.

Similarly, Seattle's Department of Planning and Development supported the creation of a healthy living assessment tool that gathers information about health-related assets and gaps in areas undergoing growth. This data can then be used in the planning process for new development to ensure it considers and supports health.

Health Impact Assessment (HIA) is another source of information stakeholders can use to understand and reduce negative health effects of a proposed plan, policy or development. The London Plan encourages HIA on all major development (policy 3.2). The WHO meanwhile

provides guidance on conducting HIA, including quantitative, qualitative and participatory approaches. Planners may also make use of building standards to determine the extent to which a building has been appropriately designed for health and well-being objectives.

Health Impact Assessment

The use of HIA to evaluate new programmes, plans, policies or projects has been practiced since at least the 1980s and is required in some countries and voluntary in others. The World Bank and International Finance Corporation have required HIA to be used on projects receiving loans. Health considerations can be incorporated into Strategic Environmental Assessments (SEA) and Environmental Impact Assessments (EIA), although these may not be as comprehensive with regard to health and well-being impacts.

Similar to EIA, the use of HIA can inform decision-makers and can increase transparency about potential health impacts and any mitigating measures. The quantitative component of HIA may focus on health protection from noise or pollution, for example. Participatory approaches can be used to gather feedback from the affected community, perhaps exposing more detail about health impacts from social and economic factors. The health impacts being assessed should be broader than environmental exposures (such as noise) and may include many aspects of the social determinants of health, such as access to greenspace or employment.

Further guidance is available via the WHO http://who.int/hia/en/

There are many policy measures that can be used to create health-promoting environments at the city/neighbourhood scale. These measures are likely to benefit other sustainable development objectives, such as reducing carbon emissions and supporting community cohesion. Practitioners should seek to maximise these co-benefits when introducing and applying urban policies. Potential health-promoting policies include:

- mixed-use communities with high enough residential densities to support active transport
- public transport infrastructure which is frequent, affordable and integrated with multiple modes
- supportive infrastructure for electric vehicles and car-share schemes

35. Pineo H. Healthy Planning and Regeneration: innovations in community engagement, policy and monitoring. 2017; published online Aug.

- reduced speed limits of 20mph or lower, particularly in residential areas

- decentralised low or zero carbon energy systems

- provision of green infrastructure, particularly as a network of connected spaces

- provision of sports and leisure facilities for different ages and abilities

- encouraging or creating affordable places to socialise in different seasons (formal and informal)

- a mix of housing types and tenures

- integration of health and social care facilities in close proximity to residents

- retail provision selling affordable fresh food accessible to residents, and

- access to public toilets.

4.2 Improving health through street-scale design

Given the importance of increasing physical activity through daily commuting, a significant amount of research has been dedicated to understanding the characteristics of urban street environments that support active transport. Designing streets conducive to people of all ages and abilities walking and cycling more creates a vibrant environment supporting social interaction, local retailers and environmental objectives.

Existing streets can be retrofitted to varying extents to support active transport. For example, pocket parks can be installed along streets to slow traffic and provide spaces for people to informally gather. Street infrastructure such as benches, bicycle parking, and plant pots can also be installed with the same effect. Widening pavements (sidewalks) or installing cycle lanes may require reducing space for cars.

The following evidence-based street-scale design measures will support physical activity and have multiple co-benefits for the local community:

- increasing passive surveillance of public spaces and reduction of environmental cues of crime (such graffiti and litter) through maintenance of public spaces and buildings

- provision of places to rest which are comfortable in different seasons (e.g. shade/shelter)

- integration of green infrastructure into streetscape (requires maintenance)

- provision of an adequate number of safe crossing points which prioritise pedestrians/cyclists

- reduction of traffic speeds through narrow road widths, chicanes, speed humps, shared streets or speed limits

- designing in legibility and wayfinding through urban form and signage

- provision and maintenance of street lighting

- designing for all ages through lowered curbs at intersections/crossings and wider pavements with no obstacles restricting passage for pedestrians with reduced mobility

- ensuring pavements are maintained to reduce the risk of falls

- balancing building height and setback distances to create a human-scale street environment

- creation of safe spaces for pedestrians and cyclists near vehicle service and delivery points.

San Francisco's Transportation Demand Management Program

San Francisco has introduced a new programme to help accommodate the transport needs of the 100,000 new households and 190,000 new jobs projected for the city up to 2040. The city's Planning Code now includes a Transportation Demand Management Program (TDM) which aims to increase amenities which support sustainable transport and to reduce single-occupancy vehicle trips.

The TDM program applies to large developments (10 units or more of new residential development, 10,000 square feet or more of commercial development, and large [25,000 square feet] changes of use) except for 100 percent affordable housing developments. Developers are required to select from a menu of options, each associated with points, to be implemented alongside new development. These measures are aligned with health and well-being objectives because they will improve active transport options in the city and reduce traffic-related pollution.

There are 66 sustainable TDM measures, developed from best practice across the country, research and professional expertise. Each measure has a different point value corresponding to its relative ability to reduce the number of driving trips. New developments will be required to meet a specific point target based on the type of land use and proposed parking spaces. The measures include: on-site showers and lockers for active commuters, education and outreach efforts, and car-share parking/memberships.

More information: http://sf-planning.org/article/san-francisco-moves-forward-groundbreaking-transportation-demand-management-legislation

4.3 Building design

In most countries, building codes provide the basic structure for ensuring the design and construction of buildings do not harm human health. As more knowledge is gained about the impact of indoor environments on health and well-being, built environment professionals are integrating design measures that go further than building regulations with the aim of improving comfort, productivity and other measures.

The detail of building codes varies internationally, but usually covers basic issues related to the health and safety of occupants including: structural safety, fire, electricity, water, hygiene, noise, ventilation, heating/cooling, daylight, internal room dimensions, and exposure to toxic materials. There should be a distinction between topics covered under building regulations and those addressed through the planning system. However, planning policies may include building design requirements/guidelines related to health and well-being, such as active design principles, increased energy efficiency and third-party building standards.

Sustainable building standards are one route to improve the health and well-being impact of buildings. New building standards have recently been launched which are explicitly aimed at addressing these issues, including the WELL Building Standard and Fitwel. The most widely used international sustainable building standards are BREEAM (Building Research Establishment Environmental Assessment Method) and LEED (Leadership in Energy and Environmental Design). Both of these address issues related to health and well-being and are compatible with the WELL Building Standard (see Section 5).

The following building design considerations are linked to health and well-being and may be required or encouraged through local permitting processes or by building owners/occupants:

- reduction of indoor air pollutants from materials and furnishings

- provision of adequate ventilation (avoiding moisture retention) and filtration of external air pollutants

- reduction of noise pollution from internal and external sources

- ensuring building construction and materials do not expose occupants to toxins (e.g. lead, radon, asbestos)

- provision of access to clean drinking water

- designing in adequate daylighting, lighting and reduce glare

- supporting physical activity through building design (e.g. prominent stair location) and facilities (e.g. cycle storage)

- optimising thermal comfort

- provision of mechanisms for occupants to control indoor environment where possible (lighting, temperature, ventilation, etc.)

- ensuring maintenance contracts are in place for required systems and providing adequate information to occupants

- consideration of the edges between public and private space in residential developments

- integrating views of nature (outside) and plants inside for well-being and air quality benefits, and

- designing internal spaces for all users including those with disabilities.

Active design in buildings

Offices, schools, shops and other non-residential buildings can be designed to encourage physical activity and reduce sedentary behaviour. Many office workers spend the majority of their day sitting and this has been associated with adverse health outcomes. At the building-scale, active design often refers to prominent location of stairs and ensuring that corridors/stairwells are well-lit and inviting. It can also include the following measures:

- communal areas (e.g. kitchens and meeting rooms) and toilets located near central areas

- sit-stand and treadmill desks

- promoting stair use through communications

- pathways or tracks for walking, including 'walking meetings' (inside and/or outside)

- on-site exercise facilities.

The latter four measures can be implemented in new and existing buildings to encourage standing and walking with little disruption. For example, Southwark Council's Tooley Street office in London has signs near lifts and in stairways displaying the number of calories burned per floor when using the stairs. The NHS Health Education England office at Stewart House has playful designs encouraging stair use.

Figure 4: Signs that encourage stair use in buildings
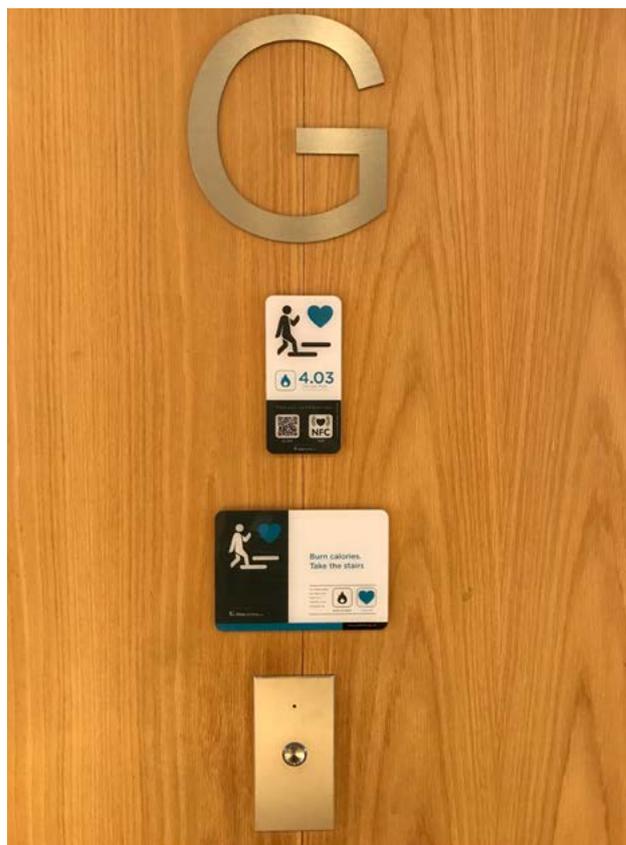
Image source: Helen Pineo

4.4 Developers' initiatives

Improving the design quality of new developments can positively affect social issues related to sense of community, well-being and health. Private developers are increasingly aware that designing for social value can help differentiate their product, creating an impact on the permitting process and rental/sales values (see Section 6). Developers' initiatives to improve the social impact of properties and places may include health and well-being as part of a range of sustainability benefits.

In 2012, British residential property developers the Berkeley Group developed a framework to assess the social sustainability of its developments, including residents' quality of life and well-being. This was followed by Berkeley's Creating successful places toolkit in 2014, which includes criteria to help developers and planners apply social sustainability principles in practice. The criteria include a range of measures that can be introduced in

developments to create a sense of community and improve well-being, such as providing community gardens and ensuring public spaces are overlooked (e.g. by residential properties). The toolkit also refers to the provision of facilities for health, education and socialising.

British Land, the developers of office, retail and residential properties, recently created a set of performance indicators related to occupant well-being. Established in 2016, the indicators include a commitment to obtaining WELL certification for commercial offices to shell and core, and developing and piloting a retail well-being specification. They will also be researching how their developments impact public health outcomes and productivity in offices.

International property and infrastructure group Lendlease, incorporates health and well-being as one of twelve principles in its sustainability framework. Lendlease's approach to sustainability gives equal emphasis to social, economic and environmental objectives, with a focus on people.

Paya Lebar Quarter in Singapore

The Paya Lebar Quarter is a Lendlease development forming part of the Singapore Urban Redevelopment Authority's regeneration masterplan for Paya Lebar. The project includes three office towers, a retail mall and three residential towers with 429 apartments, surrounded by public space.

The sustainability plan for Paya Lebar Quarter states that the project will enable healthy lifestyles and promote diversity and inclusion among residents. The green infrastructure plan includes the provision of 300% more trees than currently exist on-site, reducing the urban heat island effect by 20%, supporting biodiversity and helping to manage rainwater. The plan also includes green walls, roofs and urban farming through community gardens.

The well-being portion of the sustainability plan includes measures to support active transport, social interaction, air quality and biophilia. The site will provide connections for pedestrians, joggers and cyclists to five different parks along the eastern coastal loop of Singapore. All of the buildings will be connected through sheltered elevated pedestrian walkways. Office spaces will have enhanced air filtration and optimisation systems. The public spaces in the Quarter will be designed with ample green and blue infrastructure and meeting spaces for residents and visitors.

The three office towers (covering nearly one million square feet) are registered for the International WELL Building Institute's (IWBI) WELL Core and Shell Certification. This is the first project in Singapore to register for WELL Certification. The provision of showers, lockers and bicycle storage facilities for the office tenants are an example of how the project will meet the standard's requirements.

Figure 5: Paya Lebar Quarter in Singapore

Image source: Lendlease

5.0 Building standards and health

There are a number of standards in use internationally aiming to improve the health and well-being impact of new and refurbished buildings including: 3 Star, BREEAM, LEED, Green Star and Living Building Challenge. New building standards focused specifically on health include the WELL Building Standard (for new and refurbished buildings) and Fitwel (for existing and new buildings). These standards include some topics covered by green building standards, such as indoor environmental quality, and introduce a number of additional topics related to the health impacts of building location, design, and operation and human resources policies.

Sustainable building design standards seek to improve building performance across a range of metrics, including environmental and social issues. By reducing a building's environmental impact these standards are supporting health and well-being through a range of mechanisms such as:

- reducing air pollution
- adapting and mitigating against the effects of climate change
- ensuring local water sources are not contaminated, and
- reducing the impact of flooding.

Although the origins of BREEAM and LEED relate to environmental issues, this has always included consideration of the health impact of building design. The original BREEAM standard from 1990 included a section on 'indoor effects' which focused specifically on the building's impact on health, safety and well-being and credits have been developed over iterations of the standard for a number of health and well-being issues. As the BREEAM standards have grown to include multiple building types, life-cycle stages and scales of development (e.g. new communities), additional topics have been added such as active transport, food growing space and security.

5.1 The impact of sustainable buildings

Researchers have investigated the health benefits of sustainable buildings. Allen and colleagues reviewed 17 studies of the health impact of 'green buildings' (mainly certified with LEED).[37] The studies included a range of subjective and objective measures of health across different building types including housing, hospitals, offices, universities and factories. Overall, the authors concluded that the evaluated green buildings were better for health than conventional buildings. This was due to the buildings' superior indoor environmental quality (in terms of environmental contaminants and air quality).

Productivity is becoming a key measure of building performance which relates to health and well-being. Productivity can be measured in many ways; for example, through levels of concentration and cognition or factors related to productivity such as absenteeism and workplace satisfaction.

The World Green Building Council (WGBC) has reported on the business case linking green buildings and productivity, claiming that office space design impacts productivity with direct cost implications for employers. With up to 90% of business operating costs going toward salaries and benefits, even a 1% improvement in staff productivity could result in significant savings for employers.[38]

The building design and operation factors described by the WGBC as being associated with productivity, health and well-being include:

- indoor air quality
- thermal comfort
- daylighting and lighting
- biophilia
- noise
- interior layout
- look and feel
- active design and exercise
- amenities and location.

Many of these features are related to design principles for environmental sustainability and can be integrated to create a 'virtuous circle', improving occupant well-being while reducing carbon emissions and energy costs.

37. Allen JG, MacNaughton P, Laurent JGC, Flanigan SS, Eitland ES, Spengler JD. Green Buildings and Health. Curr Envir Health Rpt 2015; 2: 250–8.   38. World Green Building Council. Building the Business Case: Health, Wellbeing and Productivity in Green Offices. 2016; published online Oct. http://www.worldgbc.org/files/1114/7735/3801/WGBC_BtBC_Oct2016_Digital_Low.pdf (accessed Nov 1, 2016).

Landsec HQ certified to BREEAM and WELL Building Standard

The UK's largest commercial property development and investment company, Landsec, moved its headquarters to a newly refurbished building where all staff are now located on a single floor. The new office is the first workplace in the world to achieve both WELL Certified™ Silver and BREEAM Outstanding in recognition of its health, well-being and sustainability credentials.

Employees now benefit from improved air quality, optimised lighting, and ample communal spaces. The company's previous offices saw staff spread across eight floors making collaboration difficult. The new office space includes supportive equipment for 'activity-based working', including sit-stand and treadmill desks. Staff also have access to a free juice and healthy snack bar and a shower room for active commuters.

The project has won a number of awards and a recent Leesman Index Survey showed that 88% of staff believe the new office design enables them to work productively, against the global average of 67% (a 20% improvement from the previous office). The office scored in the top 5% of the Leesman Index for workplace well-being and productivity.

Figure 6: Interior of new Landsec HQ in London

Image source: Landsec

5.2 Comparing building standards

Sustainable building design standards require design teams to consider a range of performance objectives simultaneously, including energy efficiency and health. There can be some tensions between these goals. Greater levels of energy efficiency, for example, may result in reduced ventilation and indoor air quality. However, the WGBC would emphasise the potential for a 'virtuous circle' if these issues are addressed in the design process, creating healthy and sustainable buildings with multiple cost savings.

A comparison of BREEAM and LEED with the WELL Building Standard shows that the sustainable building standards cover a third of the topics addressed by WELL, with significant overlap in the areas of air quality, lighting, noise, thermal comfort and active design. There are gaps in both BREEAM and LEED in relation to the 'nourishment' and 'mind' categories of the WELL Building Standard. These categories cover topics such as healthy food access within the property and human resources policies related to health and well-being more broadly.

Table 2: Comparison of WELL Building Standard with BREEAM and LEED (see Appendix 1 for detailed comparison and methodology)

Categories in the WELL Building Standard	Number of overlapping issues	
	BREEAM	LEED
Air	15/29	15/29
Water	1/8	0/8
Nourishment	0/15	1/15
Light	10/11	7/11
Fitness	4/8	4/8
Comfort	6/12	8/12
Mind	2/17	1/17
Total overlap	38/100	36/100

5.3 Healthy building standards

The recent emergence of building standards focusing exclusively on health and well-being issues responds to growing recognition by built environment professionals of the importance of the health impact of buildings. The WELL Building Standard and Fitwel were both created following an extensive review of the evidence base linking building design and health. Both standards are backed by health professionals and intend to make a mark on health by improving properties globally.

5.3.1 WELL Building Standard

The WELL Building Standard was launched in October 2014 following six years of research, development and peer review. The international standard measures design features, materials and employee policies (among other topics) within buildings, interior spaces and communities with the intention of improving human health and wellness. The International WELL Building Institute (IWBI) has worked

with the US Green Building Council and BRE to ensure that the standard can be used jointly with LEED and BREEAM. It also aligns with the Living Building Challenge.

New and existing buildings, interiors and core and shell typologies can be certified with WELL and there are specific standards for retail, education, residential, commercial kitchen and multi-family residential facilities (with others under development). Performance measurement is carried out in the completed space by an authorised WELL assessor involving a number of tests, including air and water quality, noise and light levels. After three years (maximum) buildings are required to undergo another stage of performance verification and recertification to ensure that they continue to perform according to the standard.

There are 7 categories called 'concepts' in the WELL standard: air, water, nourishment, light, fitness, comfort, and mind. Buildings are rated as Silver, Gold or Platinum (highest) and must meet certain precondition requirements.

Continental Europe's first WELLBuilding Standard certification

France is home to mainland Europe's first WELL Certification. The 130,000 square-foot office building, SCENEO, has been awarded the certification's Gold level. In addition to WELL certification, the building has also achieved BBC (Low Consumption Building), HQE (High Environmental Quality) Exceptional and BREEAM Excellent ratings.

International property developer, HRO, manages SCENEO. The project lead, Virginie Scaglia, says that their reason for obtaining certification was, first and foremost, to improve the health and well-being of tenants and employees. They also wanted to gain a competitive edge in Paris's real estate market and show their sustainability leadership.

Some of the building design features which contributed to the WELL certification include: optimised lighting, acoustic attenuations, enhanced air quality, and active design layouts. The building also seeks to incorporate nature into indoor spaces and provides outdoor garden and eating spaces.

More information: https://www.wellcertified.com/en/articles/sceneo-first-well-certification-france

Figure 7: SCENEO building interior
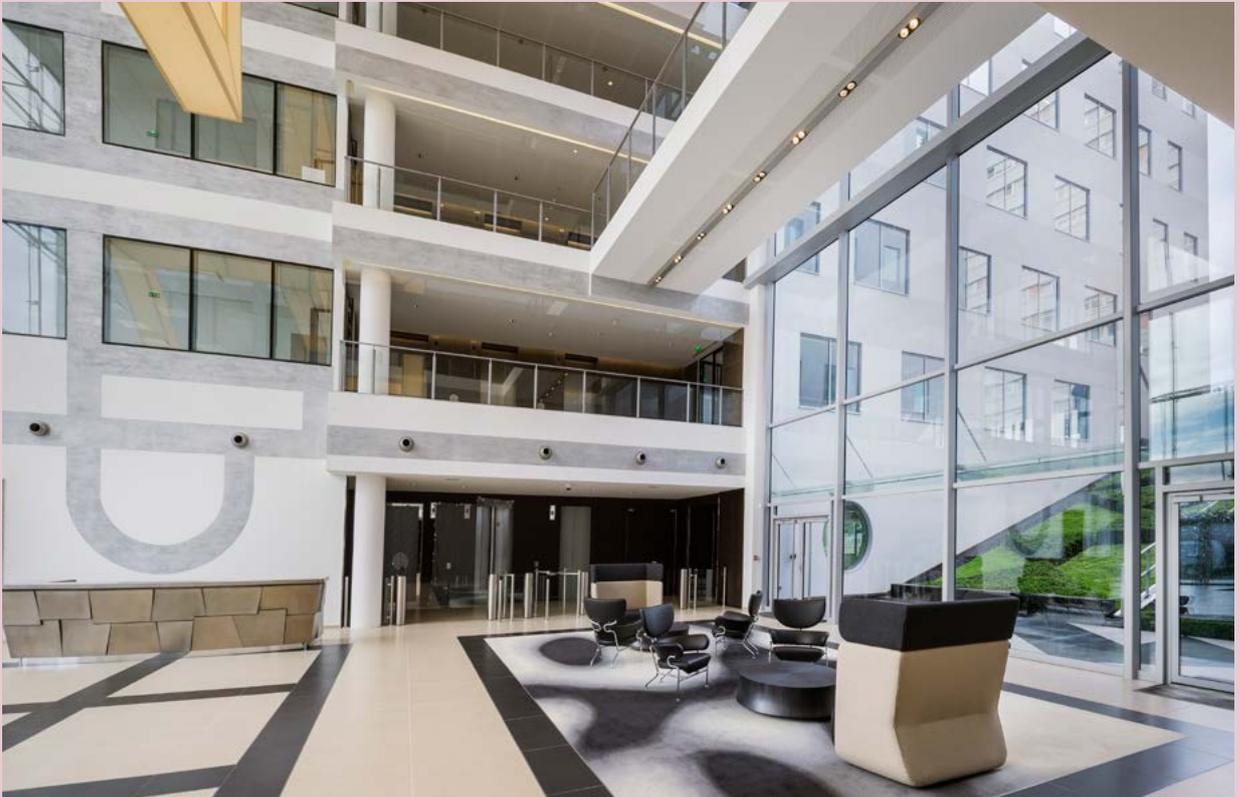
Image source: HRO FRANCE

5.3.2 Fitwel

The Fitwel standard was piloted in 2015 and launched in 2017. The standard was created by the US Centers for Disease Control and Prevention (CDC) and the General Services Administration (GSA), originally for use on workplaces but now expanded to include multi-family residential buildings. The international non-profit organisation, the Center for Active Design (CfAD), independently operates the standard and certifies buildings. It will also be expanding the standard globally (and to include other building types) while the CDC and GSA will continue to support the standard and integrate new scientific evidence.

Fitwel's website states that '49% of building owners are willing to pay more for buildings demonstrated to have a positive impact on health'.[39] With an initial focus on certifying workplaces, Fitwel note that in the US alone there are 5.6 million commercial buildings with 120 million employees. This creates a substantial market to introduce health promoting design strategies, technologies and policies. The Fitwel system uses evidence-based strategies informed by research studies and created by experts in public health, facility management and design.

Organisations can become 'Fitwel Champions' if they commit to applying the Fitwel approach to their properties. Current Fitwel Champions include architecture and design firm Perkins+Will, global engineering firm Integral Group, and real estate investment trust Kilroy Realty Corporation.

The system is promoted by 'Fitwel Ambassadors', individuals who have received online training about the scientific evidence linking buildings and health. Ambassadors are also trained in using the online portal where buildings can be registered, scored and submitted for certification.

The Fitwel approach includes design and policy strategies that are linked to seven 'healthy impact categories':

1. Impacts Community Health
2. Reduces Morbidity + Absenteeism
3. Supports Social Equity for Vulnerable Populations
4. Instills Feelings of Well-Being
5. Provides Healthy Food Options
6. Promotes Occupant Safety
7. Increases Physical Activity.

The certification includes a star rating between one and three (highest). Fitwel is currently applied to the following building user groups: single-tenant, multi-tenant buildings, commercial interior space and multi-family residential. Certification is valid for three years and projects can be recertified to maintain Fitwel status.

39. Fitwel. https://fitwel.org/ (accessed Sept 2, 2017).

Perkins+Will Minneapolis office achieves Fitwel 2-star certification

Global architecture and design firm Perkins+Will has committed to pursue Fitwel certification for all twelve of its North American offices as part of its role as a Fitwel Champion. The Minneapolis office was the first to achieve certification and was awarded a two-star rating in early 2017.

Perkins+Will were the designers of two of the 89 public buildings that piloted Fitwel over its five-year development period. The CDC's Building 106 and the CDC's National Center for Environmental Health both achieved a three-star rating (the highest level in the certification).

The Minneapolis office, called studioIDS, scored 117 points and it was the first Fitwel certified Commercial Interior Space in Minnesota. The highest scoring Fitwel sections were Location, Entrances and ground floor, and Workspaces. In these sections, the following strategies were used:

- **Location** – walk score and public transportation

- **Entrances and ground floor** – signage, oriented to pedestrian traffic and transit, context appropriate lighting, permanent entryway system, and advertisement for amenities within walking distance

- **Workspace** – daylighting, views, operable shading, and active workstations.

The firm's London office has also committed to achieved two-star certification as the Fitwel standard has expanded globally.

Figure 8: Perkins+Will Minneapolis office interior

Image source: Perkins + Will

6.0 The value of healthy places

Building healthy places with walkable streets, safe homes, access to healthy food, and publicly accessible amenities need not be an additional line on a development's cost sheet. Many cost-effective healthy design measures are features of good design that not only benefit health and well-being, but also create better places with higher commercial value and lower environmental impact.

Multiple urban built environment stakeholders may pay the cost of creating healthier places with the beneficiaries spreading across many sectors. Table 2 shows the stakeholders involved in promoting healthy places and those who benefit from managing, living or working in better buildings, neighbourhoods and cities.

At the urban scale, planners have been blamed for facilitating sedentary lifestyles and environmental problems by segregating land uses and allowing sprawling growth. In practice, growth patterns are not the simple result of land use policy. A complex set of economic, environmental and social factors determine how and where new development occurs, within the constraints of a political system.

The perceived value of different forms of development plays a part in determining how buildings and communities are designed. As a result, the responsibility to create healthy places does not only sit with planners. All built environment professionals can play a role in integrating health into policy and design at all scales. In doing so, they will ensure that health and well-being are not seen as bonus design features of high end developments, but rather a normal part of good design and sustainable development.

Table 3: Who pays and who benefits from investment in health-promoting design?

Built environment stakeholders	Potential benefits of investing in health-promoting design	Who pays?	Who else benefits?
Local government	Increased investment from private sector, reduced crime, improved social cohesion, reduced social services costs, improved health of residents, reduced injuries, reduced pollution, improved environment and resilience	• Regeneration departments • Infrastructure providers • Transport services • Private and public developers	• National departments (e.g. welfare & health) • Police and emergency services • Health and social care providers • Private and public sector • Insurance companies • Employers • Social housing providers and managers • Residents
Developers and property owners	Increased value of properties, easier to lease properties, increased property rents, improved client satisfaction	• Private and public developers and property owners • Building owners and tenants	
Building managers and occupants (including employers)	Reduced energy costs, reduced absenteeism, increased productivity, increased employee engagement and satisfaction, greater resilience to changing climate and extreme weather		
Home builders and occupants	Improved health and wellbeing, increased value of property, reduced energy costs, greater resilience to changing climate and extreme weather	• Private and public developers and property owners • Home owners • Social housing providers and managers	

Value filters down → *Value filters up*

40. Long Term Conditions Compendium of Information, Third Edition. 2012. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216528/dh_134486.pdf (accessed Aug 23, 2016). 41. The Causes And Costs Of Absenteeism In The Workplace. Forbes. http://www.forbes.com/sites/investopedia/2013/07/10/the-causes-and-costs-of-absenteeism-in-the-workplace/ (accessed July 9, 2015).

6.1 The cost of unhealthy buildings and neighbourhoods

The cost of unhealthy places is paid by many sectors in society including employers, health and social care services and insurance providers. Globally, chronic diseases are the largest burden of ill-health. Many of these expensive 'lifestyle diseases' are preventable, and are strongly influenced by the built environment. In the UK they account for £7 out of every £10 spent on health and social care,[40] and they result in losses to productivity estimated to cost $84 billion annually in the US alone.[41]

6.1.1 Office spaces

It can be difficult to measure productivity, yet employers are very aware of the cost of absenteeism. In the UK, the Office of National Statistics (ONS) reported that there were 137.3 million working days lost due to sickness or injury in 2016 (equivalent to 4.3 days per worker).[42] Sickness related absenteeism has been declining in the UK. The illnesses that keep people home from work are often preventable and may be related to working conditions. The main causes of sickness absence reported by the ONS include:

- minor illnesses including coughs and colds (24.8% of the total days lost)
- musculoskeletal problems such as back pain, neck and upper limb problems (22.4%)
- mental health issues including stress, depression, anxiety and other conditions (11.5%).

The design and management of offices and workspaces could help reduce these illnesses, particularly when coupled with supportive HR policies related to work-life balance, mental health and well-being. Employers can support staff to decrease the number of hours spent sitting during the day (and increase physical activity) by providing space for 'walking meetings' (small meetings held while walking, rather than sitting) and other active design features.

6.1.2 Poor quality housing

The impact of housing on health is not usually described or valued in terms of productivity but rather the cost to individuals and healthcare providers. Poor-quality housing can expose people to noise, indoor air pollution and extreme temperatures, causing a range of adverse health outcomes, including respiratory disease, heart disease and even death.

Low-quality housing in the UK has been estimated to cost the National Health Service £1.4 billion in first-year treatments.[43] Across Europe, the health costs of inadequate housing are substantial. For every €3 invested in the reduction of housing hazards (such as poor ventilation or significant disrepair), governments and healthcare providers/insurers would save €2 on medical costs. This equates to a potential savings of €9 billion in the first year, with additional savings over time.[44]

The cost of improving housing and the benefits associated with such improvements are rarely accrued in the same government department (even in the case of social housing) and may be spread across many public and private stakeholders and individuals. The impact of unhealthy environments is also not spread evenly across society. Poorer people are more likely to live in neighbourhoods and homes worse for their health, and suffer a greater burden of disease as a result.

6.2 The financial value of healthy buildings and communities

A number of studies have quantified the higher value of healthy properties and communities. These studies have looked at increased commercial value for developers, health or risk factor improvements (creating savings for healthcare providers) and reduced absenteeism costs for employers.

6.2.1 Large-scale development and communities

A 2016 RICS report found that new large-scale developments with high-quality urban design have a higher commercial value (between 5% and 56%) than comparable new properties in the local area.[45] The features that were deemed to contribute to this increased value included design, layout, density, housing mix, transport services, community facilities, shops, green/open space, environmental sustainability, and community engagement. All of these features are important for health and well-being. Young families were willing to pay more for terraced properties in some of these developments than they were for cheaper semi-detached properties in the area because the new developments provide access to denser, walkable communities with multiple amenities.

The Urban Land Institute's (ULI's) Building Healthy Places Initiative has produced a number of publications and a healthy design toolkit. A 2014 ULI report looked at 13

42. ONS. Sickness absence in the labour market. Office for National Statistics. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/articles/sicknessabsenceinthelabourmarket/2016 (accessed Sept 6, 2017). 43. Nicol S, Roys M, Garrett H. The Cost of Poor Housing to the NHS. 2015. http://www.bre.co.uk/page.jsp?id=3611 (accessed Oct 6, 2015). 44. Eurofound. Inadequate housing in Europe: costs and consequences. Luxembourg: Publications Office of the European Union, 2016. 45. Royal Institution of Chartered Surveyors. Placemaking and value. 2016; published online Feb.

developments with healthy design features including indoor air quality, active design, fitness amenities and programmes, lighting, and social interaction. Developers reported that the development costs of these features were a 'minimal percentage of the overall development budget' and 'were well worth the cost and contributed to the projects' overall success'.[46] One of the case study projects was the masterplanned community of Mueller, near Austin, Texas, with 5,700 homes (being developed in phases up to 2020). The two universities studying the new community found that residents in the early phases increased their physical activity levels by 40–50 minutes per week.

The commercial tool, Walk Score, which rates the walkability of addresses in a number of countries (see Walkability), has been used to compare the value of homes in neighbourhoods with varying walkability scores. One study of US cities found that houses with high walkability scores, as measured by Walk Score, sold at values of $4,000–$34,000 higher than homes with average walkability scores.[47] This demonstrates the value that homeowners place on living in accessible communities.

6.2.2 Healthy offices

Measures of increased productivity including employee absenteeism, task completion, student performance and even retail sales, are used to quantify the financial benefits of healthy buildings for owners and occupants.

The World Green Building Council has produced a number of reports on the business case for healthy and sustainable buildings.[48],[49],[50] In 2013, they reported inconsistency in research on financial metrics related to buildings and productivity creating a certain level of scepticism within industry about the potential return on investment from attention to the occupant experience. However, the report cited multiple studies associating healthy design with productivity-related measures. For example, studies associated better lighting, daylighting, ventilation and views outside with: increased productivity (11–23%), higher retail sales (15–40%) and higher test scores (5–14%), among other measures.[51]

A 2016 update to the WGBC report provides evidence that the business case may now be more widely recognised by the property sector. They cited a Canadian survey of 200 building owners which found the following benefits of healthy buildings:

- 38% of respondents said they had an increased value of at least 7%
- 46% said that they were easier to lease
- 28% responded that they commanded premium rents.

The WGBC also explicitly links productivity and green buildings with multiple examples. For example, Skanska UK was able to save £28,000 ($36,000) in 2015 in absenteeism costs as a result of moving to a new BREEAM UK 'Outstanding' office building. They also reduced the payback period of achieving the sustainable office certification from 11 to 8 years by reducing building-related sick days (by 3.5 times) while improving employee comfort and satisfaction.[52] While Saint-Gobain call centre staff doubled productivity in their LEED Platinum Core & Shell and Interior certified office in Malvern, Pennsylvania, USA. The office increased sales-generated leads by 97% and leads per call by 101% after moving into the building.[53]

6.2.3 Healthy housing

There may be an increased financial value for healthy homes. A Saint-Gobain commissioned survey of 3,000 UK homeowners and renters' perceptions of health and homes in May 2016 found that 30% were willing to pay more for a home that did not compromise their health and well-being (with buyers accepting a higher cost than renters).[54] Many healthy home design features would be considered mandatory by owners and occupiers and are provided through building regulations.

Developing healthy homes and buildings does not necessarily require additional materials and technologies. Building orientation and design can be used to provide adequate daylight, temperature control and views outside yielding positive health benefits. Integrated design will ensure that potential tensions (such as daylighting and solar gain) are addressed at the early stages, avoiding costs and unintended consequences.

6.3 Benefits to society

Designing healthy buildings and communities can be done in a cost-effective way which delivers benefits to occupants and society at large while maintaining competitive returns to landowners and developers. The risk of viewing healthy design as an add-on that can only be achieved on high-value developments is that society continues to widen the

46. Lassar TJ, Kramer A, Federman M, Hammerschmidt S. Building for Wellness: The Business Case. Washington DC: Urban Land Institute, 2014.   47. Cortright J. Walking the walk: How walkability raises home values in US cities. 2009. http://www.citeulike.org/group/11305/article/5541951 (accessed Aug 22, 2016).   48. World Green Building Council. Building the Business Case: Health, Wellbeing and Productivity in Green Offices. 2016; published online Oct. http://www.worldgbc.org/files/1114/7735/3801/WGBC_BtBC_Oct2016_Digital_Low.pdf (accessed Nov 1, 2016).   49. World Green Building Council. The Business Case for Green Building: A Review of the Costs and Benefits for Developers, Investors and Occupants. 2013.   50. World Green Building Council. Health, Wellbeing and Productivity in Offices - The next chapter for green building. 2014.   51. World Green Building Council.

health gap between the rich and poor. This is particularly relevant for affordable or social affordable housing where residents are more likely to be suffering from multiple health burdens.

There are many co-benefits of integrating healthy design measures into new development. For example, integrating green infrastructure can support well-being, biodiversity, temperature control and flood resilience. As demonstrated by the Skanska UK office and Saint-Gobain call centre, adopting sustainable building standards can also result in productivity and health benefits.

Designing communities for health makes sense financially and is not a special endeavour – it is just good design. According to analysis by NICE, 'high standard' spatial planning can result in significant cost savings for health. For every £1 spent on the planning process to promote walking, cycling and insulating homes, the health service could save £50, £168 and £50 respectively.[55] Built environment professionals can build up a case to justify healthy design policies and measures, but many of these can be achieved at no additional cost, and may in fact bring a greater return on investment.

The Business Case for Green Building: A Review of the Costs and Benefits for Developers, Investors and Occupants. 2013.   52. World Green Building Council. Building the Business Case: Health, Wellbeing and Productivity in Green Offices. 2016; published online Oct. http://www.worldgbc.org/files/1114/7735/3801/WGBC_BtBC_Oct2016_Digital_Low.pdf (accessed Nov 1, 2016).   53. Ibid.   54. UK Green Building Council. Health and Wellbeing in Homes. 2016; published online July. http://www.ukgbc.org/sites/default/files/08453%20 UKGBC%20Healthy%20Homes%20Updated%2015%20Aug%20%28spreads%29.pdf (accessed Aug 22, 2016).   55. Buck D, Gregory S. Improving the public's health: a resource for local authorities. London: The King's Fund, 2013.

7.0 Taking action and future challenges

7.1 How to get started

This paper has established that surveyors, planners, designers and other urban environment stakeholders play an important role in facilitating the development and management of places that will support residents' health and well-being. All property sectors and scales of development can impact health and many measures do not require additional costs.

To integrate health and well-being into your next project, it may be appropriate to consider taking the following actions:

- **Understand your clients and their requirements** – this may include public health evidence, employer's survey data or engagement activities with residents/occupants

- **Remember that some residents/building occupants are more vulnerable and require special consideration** – this may result in the adoption of a range of design strategies to accommodate different needs

- **Determine appropriate policies, design strategies, materials and technologies** – remember the potential for 'win-win' solutions with other sustainability objectives such as climate change and reducing energy costs

- **Arm yourself with data about the costs and benefits** – use industry guidance referenced in this document to determine whether the identified design solutions are cost neutral or when payback could be achieved

- **Consider using a building standard** – sustainable and/or healthy building standards can be applied at multiple building life cycle stages and scales of development

- **Identify metrics to measure your success** – it may help you win further business or persuade relevant parties if you can demonstrate the health and well-being benefits achieved through previous projects.

7.2 Urban health challenges

There are a number of challenges related to urban health that require ongoing consideration. The variability of housing and environmental quality in a city can contribute to significant health inequalities. Related to this, the disassociation between costs and savings across urban stakeholders makes it difficult to develop a business case for improving the design quality of certain types of development. And finally, the complexity of urban systems creates challenges for understanding and managing healthy cities.

7.2.1 Environmental deprivation and inequalities

Within cities there can be great disparities in terms of environmental quality and this environmental deprivation can cause or exacerbate multiple physical and mental health problems. Neighbourhoods with poor built environment conditions are also likely to have poorer education services and fewer job opportunities, creating multiple challenges for residents. These issues require coordination among public and private sector organisations to ensure investment and development activities in these areas can achieve the greatest improvements possible to meet local needs.

7.2.2 Investment and value for healthy places

The cost of improving existing neighbourhoods or increasing the design quality of new development is not likely to be paid by those who would benefit from the investment. This chain of costs and benefits will vary globally according to regulations, healthcare delivery systems, development models and other factors. Built environment professionals can help their clients understand the range of potential benefits (financial and otherwise) that can be achieved by integrating health and well-being objectives into design strategies. There may be many reasons for improving design with return on investment being just one possibility.

7.2.3 Complexity of urban health systems

Cities are complex systems and the urban environment can be seen as a series of sub-systems within the city. Transport networks, green infrastructure, buildings and urban food are all complex sub-systems which interact to affect urban health – with the potential to have both positive and negative impacts. Complex systems are characteristically dynamic, unpredictable, and counterintuitive. Considering complexity as a feature of urban health is important for two key reasons:

1. It hinders our ability to understand the urban environment's impact on health, and

2. It creates challenges for effective policy-making to improve cities.

This complexity makes it difficult to study using traditional research methods and hard to unpick cause and effect. Access to food vendors and diet is a good example.

Many studies have looked at the impact of proximity and accessibility to food vendors on individuals' diet and obesity-related measures. How and where people choose to buy, prepare and consume food is dependent on many factors (cultural, social, economic and environmental). Researchers have had difficulty disentangling the impact of these factors to determine the characteristics of the neighbourhood food environment that would best support health and well-being. Notwithstanding this challenge for the research community, built environment practitioners can make use of the existing evidence base (which is strong in many areas) to ensure health and well-being is adequately addressed in projects.

Complex systems are resistant to policy measures that seek to change their behaviour. A common example relates to traffic congestion. As a city grows, its roads may become clogged with more and more cars. City leaders have been known to try and reduce congestion by widening roads and creating more space for cars. Initially, commuting times may decrease, but over time this results in more people being attracted to drive in the area, thus increasing the demand for road space. An effective policy would be to reduce the number of cars on the road through the provision of public transport options (see Figure 9). Practitioners and policy-makers can apply systems thinking principles to consider the potential for unintended consequences related to health and built environment interventions.

Figure 9: Causal loop diagram of traffic congestion and an alternative policy option for public transport investment
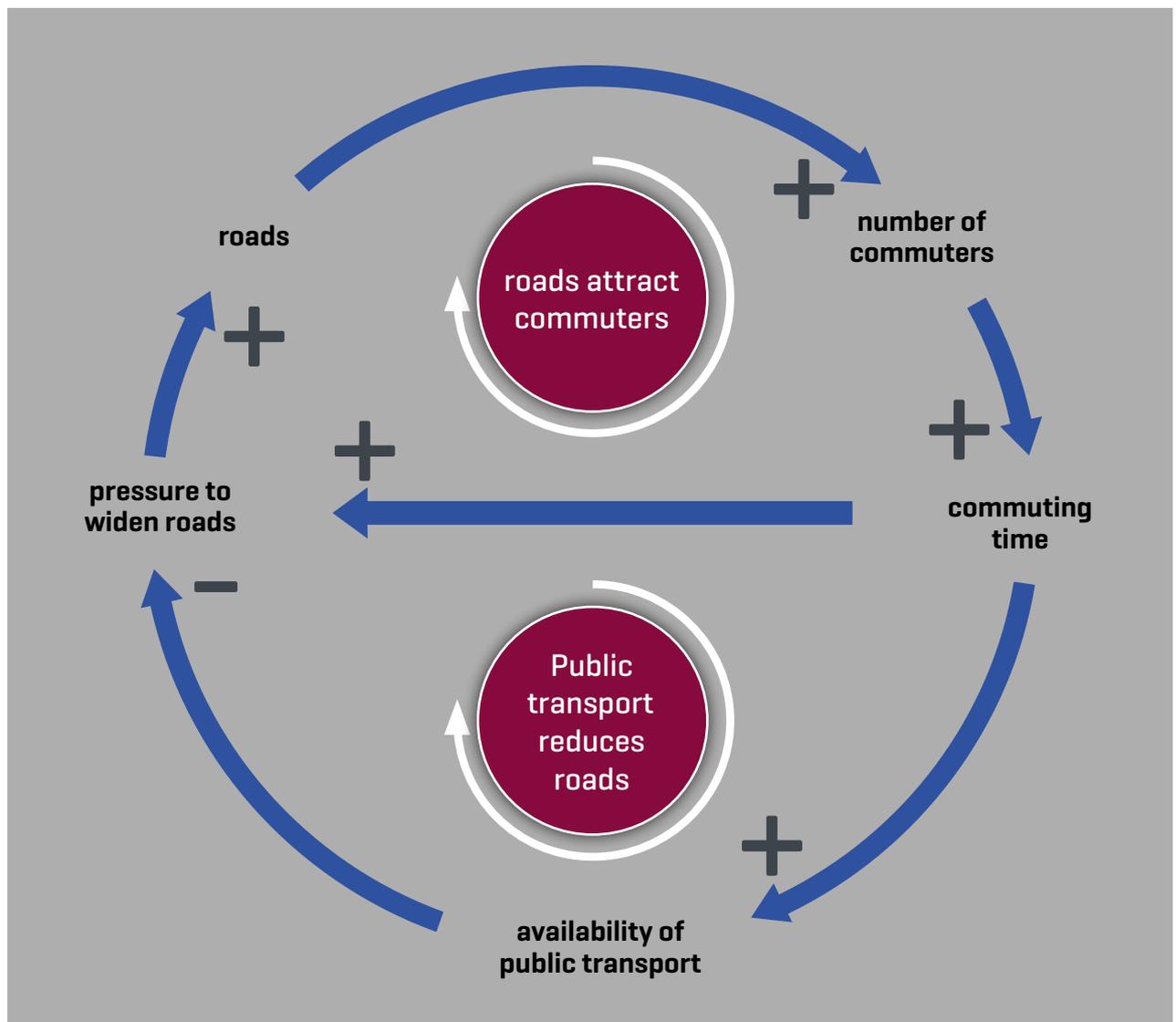
17.0 Appendices

Appendix 1: Comparison of sustainability and healthy building standards

We used existing information about the overlap between BREEAM, LEED and the WELL Building Standard to compare these standards. The BRE and International WELL Building Institute (IWBI) published a detailed comparison of BREEAM and the WELL Building Standard, primarily to aid those who wish to achieve dual certification. The document provides information on each topic within BREEAM and WELL allowing a more detailed comparison than has been done with LEED.[d] We used the information in 'Appendix E: LEED v4 Similarities' from the WELL Building Standard v1 with May 2016 addenda to identify the overlaps between LEED and WELL.[e]

Table 1: Detailed comparison of BREEAM and LEED against the WELL Building Standard

Healthy building topics in the WELL Building Standard (by WELL categories)	Number of overlapping issues	
	BREEAM	**LEED**
Air	15/29	15/29
01 Air quality standards	Partial (excludes radon, covered by UK regulations)	Y
02 Smoking ban	Partial (excludes outdoor ban)	Y
03 Ventilation effectiveness	Y	Y
04 Volatile Organic Compound reduction	Y	N
05 Air filtration	Partial (excludes Air Filtration Maintenance)	Y
06 Microbe and mold control	N	N
07 Construction pollution management	N	Y
08 Healthy entrance	N	Y
09 Cleaning protocol	Partial (In-Use only)	N
10 Pesticide management	Partial (In-Use only)	N
11 Fundamental material safety	Partial (mainly covered by EU regulations)	N
12 Moisture management	Partial (some covered by UK regulations)	N
13 Air flush	Y	Y
14 Air infiltration management	Y	Y
15 Increased ventilation	N	Y
16 Humidity control	N	Y
17 Direct source ventilation	Partial (In-Use only)	Y
18 Air quality monitoring and feedback	Partial (In-Use only covers Indoor Air Monitoring)	Y
19 Operable windows	Partial (covers Full Control only)	N
20 Outdoor air systems	N	N
21 Displacement ventilation	N	N
22 Pest control	N	N
23 Advanced air purification	N	N
24 Combustion minimisation	Partial (covers Low Emission Combustion Sources only)	Y
25 Toxic material reduction	N	Y
26 Enhanced material safety	N	Y

Healthy building topics in the WELL Building Standard (by WELL categories)	Number of overlapping issues	
	BREEAM	LEED
27 Antimicrobial activity for surfaces	N	N
28 Cleanable environment	N	N
29 Cleaning equipment	N	N
Water	1/8	0/8
30 Fundamental water quality	N (covered by EU regulations)	N
31 Inorganic contaminants	N (covered by EU regulations)	N
32 Organic contaminants	N (covered by EU regulations)	N
33 Agricultural contaminants	N (covered by EU regulations)	N
34 Public water additives	N (covered by EU regulations)	N
35 Periodic water quality testing	N	N
36 Water treatment	N	N
37 Drinking water promotion	Partial (some covered by UK regulations)	N
Nourishment	0/15	1/15
38 Fruits and vegetables	N	N
39 Processed foods	N	N
40 Food allergies	N	N
41 Hand washing	N	N
42 Food contamination	N	N
43 Artificial ingredients	N	N
44 Nutritional information	N	N
45 Food advertising	N	N
46 Safe food preparation materials	N	N
47 Serving sizes	N	N
48 Special diets	N	N
49 Responsible food production	N	N
50 Food storage	N	N
51 Food production	N	Y
52 Mindful eating	N	N
Light	10/11	7/11
53 Visual lighting design	Partial (excludes Brightness Management Strategies)	Y
54 Circadian lighting design	N	N
55 Electric light glare control	Y	Y
56 Solar glare control	Y	Y
57 Low-glare workstation design	Y	N
58 Colour quality	Y	Y
59 Surface design	Y	Y
60 Automated shading and dimming controls	Partial (excludes Responsive Light Control)	N
61 Right to Light	Y	Y
62 Daylight modelling	Y	Y
63 Daylighting fenestration	Partial (excludes Window Transmittance in Working and Learning Areas and Uniform Colour Transmittance)	N

Healthy building topics in the WELL Building Standard (by WELL categories)	Number of overlapping issues	
	BREEAM	**LEED**
Fitness	4/8	4/8
64 Interior fitness circulation	N	Y
65 Activity incentive programs	Partial (In-Use only)	N
66 Structured fitness opportunities	Partial (In-Use only)	N
67 Exterior active design	Partial (excludes Pedestrian Amenities and Pedestrian Promotion)	Y
68 Physical activity spaces	N	Y
69 Active Transportation Support	Y	Y
70 Fitness equipment	N	N
71 Active furnishings	N	N
Comfort	6/12	8/12
72 Accessible design standards	Partial (some covered by UK regulations)	N
73 Ergonomics: visual and physical	N	Y
74 Exterior noise intrusion	Y	Y
75 Internally generated noise	Y	Y
76 Thermal comfort	Y	Y
77 Olfactory comfort	N	N
78 Reverberation time	Y	Y
79 Sound masking	N	Y
80 Sound reducing surfaces	N	N
81 Sound barriers	Partial (excludes Doorway Specification and Wall Construction Methodology)	Y
82 Individual thermal control	N	Y
83 Radiant thermal comfort	N	N
Mind	2/17	1/17
84 Health and wellness awareness	N	N
85 Integrative design	N	N
86 Post-Occupancy survey	Y	N
87 Beauty and design I	N	N
88 Biophilia I – qualitative	N	N
89 Adaptable spaces	N	N
90 Healthy sleep policy	N	N
91 Business travel	N	N
92 Building health policy	N	N
93 Workplace family support	N	N
94 Self-monitoring	N	N
95 Stress and addiction treatment	N	N
96 Altruism	N	N
97 Material transparency	N	Y
98 Organizational transparency	N	N
99 Beauty and design II	N	N
100 Biophilia II – quantitative	Partial (excludes Indoor Biophilia and Water Feature)	N
Total overlap	38/100	36/100

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