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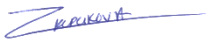
		Signature			
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Contents

1 Introduction

The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (the 'EIA Regulations') requires the Environmental Statement arising from the EIA to describe and assess the direct and indirect significant effects on population and human health in an appropriate manner. This document provides a review and summary on the links between the health determinants (environmental, social and economic factors that influence health) and health and wellbeing outcomes.

The purpose of the document is to provide an overview of the scientific consensus on the potential health outcomes associated with impacts on health determinants assessed in the Health Chapter of the Environmental Statement (ES) (Chapter 15),

based on a review of available primary[1], secondary[2] and grey[3] literature. The evidence presented underpins the qualitative judgements on health outcomes made in the assessment.

2 Scope and Methodology

2.1 Scope of the review

The purpose of this document is to provide an overview of the scientific consensus on the types of health outcome associated with impacts on health determinants assessed in the health assessment presented in Chapter 15 of the ES. A literature search has reviewed relevant evidence published between 2014 and June 2021.

A comprehensive review of primary evidence is beyond the scope of this health assessment. Therefore, the review is mainly focused on secondary sources, such as systematic reviews, and grey literature, such as government reports and policy statements, that reflect a scientific consensus on the available evidence. Primary literature is referenced where relevant, or where secondary literature has not been found.

The spatial scope of the search included collecting evidence from the UK and high-income/developed countries internationally, as these countries are likely to have a comparable public and environmental health legislative and regulatory context.

2.2 Literature sources

The following search engines and databases were used in conducting this review:

- Google and Google Scholar;
- Biomed Central;
- JSTOR;
- National Institute for Health and Care Excellence (NICE) Evidence Search;
- PubMed;
- ScienceDirect; and
- Scientific American.

[1] A primary source is also called an original source and is any source of information that was created at the time under study. Secondary sources are typically based on primary sources.
[2] A secondary source is a source that documents an event, period, or issue in history that was produced after the event, period or issue has happened. These include textbooks and literature reviews.
[3] Grey literature comprises information produced on all levels of government, academia, business and industry in electronic and print formats not controlled by commercial publishing. Examples of grey literature include government reports. policy statements and issues papers.

2.3 Search for evidence on health determinants

The topics covered in this review correspond to the health determinants that have been assessed in the health sections of the ES, as set out in the Environmental Impact Assessment Scoping Report that was submitted for the Proposed Development. These are listed below. Further, under each health determinant, evidence for vulnerable groups[4] relating to the corresponding determinant is provided, where relevant and where evidence is available.

- Access to health and social care services and other social infrastructure
- Access to healthy food
- Access to open space and nature
- Access to work and training
- Accessibility and active travel
- Air quality, noise and neighbourhood amenity
- Climate Change
- Crime reduction and community safety
- Housing design and affordability
- Social cohesion and inclusive design

The available literature on links between the above determinants and health outcomes is, in general, not explicitly related to infrastructure projects. The search terms used in relation to broad determinants of health included ‘health’ OR ‘wellbeing’ OR ‘well-being’ AND:

- climate/climate change/carbon
- crime/violence/crime rate;
- education/training/employment/unemployment/jobs/income/regeneration;
- green space/greenspace/open space/nature;
- Healthcare/neighbourhood services/local facilities/local services;
- healthy food;
- housing/residential;

[4] For the purposes of the health assessment of the Proposed Development, the term 'vulnerable groups' refers to groups of individuals who are made vulnerable by the situations and environments they are exposed to (as opposed to any inherent weakness or lack of capacity). This includes groups of people who may be more likely to be exposed to a change in a health determinant, or to experience health effects as a result of exposure.

- neighbourhood quality/visual amenity/ air pollution/ particulate mater/ nitric oxide/ noise/ aircraft noise/ road traffic noise/ sense of place/built environment;
- social capital/isolation/cohesion; and
- transport/active transport/active travel/connectivity/physical activity/exercise/ local services/local facilities;

2.4 Evaluating the strength of evidence

The strength of evidence for health outcomes associated with health determinants has been evaluated and classified as follows:

- strong: a wide range of peer-reviewed research studies showing similar associations. The association is widely accepted by the public health community and there is consensus on the specific causal factors, the mechanism of effect and the strength of association;
- moderate: a range of peer-reviewed research studies showing similar associations. The association is widely accepted by the public health community, though there may be debate about the specific causal factors, the mechanism of effect and/or the strength of association; or
- weak: a few peer-reviewed/non-peer reviewed research studies to suggest an association, or studies showing conflicting findings.

It should be noted that weak evidence does not necessarily indicate an absence of association between a health determinant and a health outcome but shows that there is uncertainty in the assessment of the likely effect. Further, while different levels of evidence within the review are useful for the purpose of comparison, lower levels of evidence may still be valid and reliable.

3 Summary of evidence

3.1 Access to health and social care services and other social infrastructure

Services and social infrastructure such as healthcare, education, social networks and social interaction can be inclusionary or exclusionary, thereby impacting on people's physical and mental health[5]. It has been found that access to public services and social infrastructure such as health, education and community facilities has a direct positive effect on human health[6].

5 Global Research Network on Urban Health Equity (2010) Improving urban health equity through action on the social and environmental determinants of health

6 HUDU (2013). HUDU Planning for Health. Rapid Health Impact Assessment Tool. (NHS) London Healthy Urban Development Unit

Evidence[7] has stated that the accessibility of local shops, community services and healthcare facilities may be affected by:

- effects on the capacity of existing services;
- physical accessibility (i.e. distances travelled and transport connections);
- social and/or cultural access (i.e. communication issues); and
- separation imposed by a new piece of physical infrastructure.

Research has suggested that 'access to local shops, post offices, places of entertainment and community activity all contribute to well-being'[8]. It has been estimated that 5% of adults in Great Britain reported feeling a sense of isolation due to difficulties accessing local shops and services[9]. Furthermore, the same research also reported that over a fifth of adults reported that they knew someone who felt a sense of isolation due to difficulties accessing local shops and services.

Everyone has a fundamental right to preventative health care and the right to benefit from medical treatment and there have been many recent initiatives to improve access to health services[10]. Access to reach healthcare services is affected by the accessibility of transport modes, availability of financial support for those on low incomes and the location of healthcare services[9]. Groups impacted by disability and of certain ages can also experience even greater barriers to health and social care services[11]. Access to healthcare is important for communities as healthcare offers information, screening, prevention and treatments. Restricted access to healthcare prevents patients gaining necessary treatments and information.

Access to social infrastructure including leisure and cultural facilities is a determinant of health and wellbeing. According to research 'leisure activities can have a positive effect on people's physical, social, emotional and cognitive health through prevention, coping (adjustment, remediation, diversion), and transcendence'[12]. People participate in cultural activities for a number of reasons including personal growth and development, to learn new skills, enjoyment and entertainment and as a 'means of creative expression', or 'to meet new people' and to 'pass on cultural traditions'[13].

Vulnerable groups

Long-term illness sufferers, the disabled and the elderly are the most vulnerable group which are likely to suffer from a lack of local healthcare services as they are less likely to access services outside the vicinity.

7 Quigley, R. and Thornley, L., 2011, Literature Review on Community Cohesion and Community Severance: Definitions and Indicators for Transport Planning and Monitoring, Report to New Zealand Transport Agency, Quigley and Watts Ltd

8 Harding, T., 1997, A Life Worth Living: the Independence and Inclusion of Older People, London: Help the Aged, cited in Randall, C., 2012, Measuring National Well-being – Where we Live,2012, Office for National Statistics

9 Randall, C., 2012, Measuring National Well-being - Where we Live – 2012, Office for National Statistics

10 Commission of the European Communities (2009) Solidarity in health: Reducing health inequalities in the EU

11 Hamer, L., 2004, Improving patient access to health services: a national review and case studies of current approaches, Health Development Agency

12 Caldwell, L.L. (2005) Leisure and health: Why is leisure therapeutic?

13 New Zealand Government, 2007, Social Report: Leisure and Recreation, Ministry of Social Development, New Zealand Government

Children are the most vulnerable group in terms of access to educational services and this greatly influences their health outcomes. School can provide greater opportunities in later life and the provision of health promoting behaviours and activities in schools can also encourage healthy behaviours.

Access to social infrastructure is also particularly important for the more deprived portion of the population as it can improve their quality of life which they may otherwise not be able to afford. This could lead to health, employment and social benefits that could balance the social gradient and improve social cohesion.

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking access to healthy food to health and wellbeing is considered to be ***moderate.***

3.2 Access to healthy food

Access to healthy food and a nutritious diet can prevent health effects and chronic diseases related to obesity. Poor diet and nutrition, together with smoking and alcohol accounted for many coronary heart disease and cancer deaths[14].

The National Survey for Wales in 2019-20 recorded information on the health-related lifestyles and behaviours of adults living in Wales[15]. It showed that 61% of adults in Wales are classified as overweight or obese including 25% who are obese.

A Department of Health[16] report detailed the most prevalent health risks for an obese man can include:

- five times more likely to develop type 2 diabetes;
- three times more likely to develop cancer of the colon; and
- more than two and a half times more likely to develop high blood pressure – a major risk factor for stroke and heart disease.

An obese woman, compared with a healthy weight woman, is:

- almost thirteen times more likely to develop type 2 diabetes;
- more than four times more likely to develop high blood pressure; and
- more than three times more likely to have a heart attack.

As the California Center for Public Health Advocacy outlined[17] the availability of healthy eating food outlets which sell high quality, nutritious food at affordable prices is an important factor influencing food choices. It can encourage a healthier

[14] Department of Health, (2004). ‘ Choosing Health Summaries: Diet and Nutrition’. Public Health White Paper. Department of Health.
[15] Welsh Government (2020). Healthy Weight Healthy Wales: renewed priorities for 2020 and 2021.
[16] Department of Health (2011) Healthy Lives, Healthy People: A call to action on obesity in England.
[17] California Center for Public Health Advocacy (2008) Designed for Disease: The link between local food environments and obesity and diabetes

diet and thus lower the health risks associated with higher calorific and sugar intake and low consumption of fruit and vegetables. Higher numbers of fast-food outlets and convenience stores (as opposed to grocery stores or produce vendors) increased the likelihood of diabetes and obesity for individuals.

Vulnerable groups

It has been noted that people on low incomes suffer disproportionately more from diet-related diseases. Difficulties are wider than a lack of money, relating to worse access to transport and to shops that sell good quality affordable food, particularly fruit and vegetables.

Children are also disproportionately affected. Those children who grow up in food insecure homes are more likely to have poor health and worse educational outcomes compared with children who grow up without food stress[18]**Error! Bookmark not defined.**.

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking access to healthy food to health and wellbeing is considered to be ***moderate.***

3.3 Access to open space and nature

A review by Public Health Wales[19] concluded that the provision of greenspace was found to be beneficial for improving physical and mental health and wellbeing and '*the use of green space depended on perceived quality, including safety and facilities such as toilets, cafes, and play areas*'.

A review by Public Health England[20] concluded that living in a greener environment can promote and protect good health, and aid in recovery from illness and help with managing poor health. People who have greater exposure to greenspace have a range of more favourable physiological outcomes. Greener environments are also associated with better mental health and wellbeing outcomes including reduced levels of depression, anxiety, and fatigue, and enhanced quality of life for both children and adults. Greenspace can help to bind communities together, reduce loneliness, and mitigate the negative effects of air pollution, excessive noise, heat and flooding.

An evidence review by the World Health Organisation (WHO)[21] in 2016 showed that urban green spaces (parks, vegetation, and street trees) have beneficial effects on health, such as improved mental health, reduced cardiovascular morbidity, obesity and risk of type 2 diabetes, and improved pregnancy outcomes. Natural

[18] Marmot et al (2020) Health equity in England: The Marmot Review 10 years on
[19] Public Health Wales (2012). Green space, reduction of health inequities and cost effectiveness of interventions.
[20] Public Health England (2020). Improving access to greenspace - A new review for 2020
[21] World Health Organization (2016). *Urban green spaces and health – a review of evidence*. Available at: https://www.euro.who.int/en/health-topics/environment-and-health/urban-health/publications/2016/urban-green-spaces-and-health-a-review-of-evidence-2016

spaces also support and facilitate social interaction, providing indirect benefits for mental health by increased sense of community belonging[22].

A systematic review in 2020, based on fourteen studies, found that there was a positive association between exposure to green space and mental health and wellbeing in adolescents[23]. A 2017 review of literature examining the association between access to green space and the mental wellbeing of children concluded that access to green spaces promoted attention and memory, fostered supportive social groups and self-discipline and improved symptoms of attention deficit hyperactivity disorder[24].

A 2017 study found a positive relationship between access to green spaces and mental wellbeing, including in places with a nature focus and spaces designed for recreational and sporting activity[25]. A 2019 study[26] showed that an increase in one hectare of greenspace within 300m of residents was associated with a statistically significant increase in life satisfaction, worth and happiness. An evidence review by Natural England[27] found evidence that people with poorer health tend to benefit more from physical activity in natural environments.

Vulnerable groups

A Public Health Wales review[28] found that access to good quality green space can reduce health inequities, but spaces in deprived areas are often of poor quality. Therefore, to increase use of space by vulnerable groups, it is recommended that green space is improved by removing graffiti, providing toilets, seating and other amenities.

A Public Health England report[29] notes that "*disadvantaged groups appear to gain a larger health benefit and have reduced socioeconomic-related inequalities in health when living in greener communities*". This is consistent with Mitchell & Popham (2008) who found that living in areas with green spaces is associated with significantly less income-related health inequality, weakening the effect of deprivation on health[30]. They found that in greener areas, all-cause mortality rates

[22] Rugel, E.J. et al (2019). *Exposure to natural space, sense of community belonging, and adverse mental health outcomes across an urban region*. Environmental Research.
[23] Zhang Y, Mavoa S, Zhao J, Raphael D, Smith M. (2020). *The Association between Green Space and Adolescents' Mental Well-Being: A Systematic Review*. Int J Environ Res Public Health. Sep 11;17(18):6640. doi: 10.3390/ijerph17186640. PMID: 32932996; PMCID: PMC7557737.
[24] McCormick, R. (2017). *Does Access to Green Space Impact the Mental Well-being of Children: A Systematic Review*. Vol 37 pages 3-7.
[25] Wood. L et al. (2017). *Public green spaces and positive mental health – investigating the relationship between access, quantity and types of parks and mental wellbeing*. Health and Place 48:63-71.
[26] Houlden V. et al. (2019). *A spatial analysis of proximate greenspace and mental wellbeing in London*. Applied Geography 109:102036.
[27] Natural England (2016). *Links between natural environments and physical activity: evidence briefing*. Access to Evidence Information Note EIN019
[28] Public Health Wales (2012). Green space, reduction of health inequities and cost effectiveness of interventions.
[29] Public Health England (2020). Improving access to greenspace. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/904439/Improving_access_to_greenspace_2020_review.pdf
[30] Mitchell R, Popham F (2008). 'Effect of exposure to natural environment on health inequalities: an observational population study'. The Lancet, vol 372, no 9650, pp 1655–6

are only 43% higher for deprived groups, compared to 93% higher in less green areas. In conclusion, vulnerable groups accrue greater benefit from living in greener communities and open space should be used as a tool to narrow the health inequalities in populations.

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking access to open space to health and wellbeing is considered to be ***strong.***

3.4 Access to work and training

Access to work

The Marmot Review (2010 and 2020 update), first published in 2010[31], was commissioned by the Department of Health to investigate health inequalities and focused on correlations between health and socio-economic status. The Review stated that *'being in good employment is protective of health. Conversely, unemployment contributes to poor health'.* An updated review published in 2020[32], reinforced the conclusions from the previous report on the social gradient of health, stating that *'There are clear socioeconomic gradients in preventable mortality. The poorest areas have the highest preventable mortality rates and the richest areas have the lowest.'* Data for children in Wales shows that the likelihood of living in income poverty is much greater, and the gap is increasing for those living in workless household compared to living in a working household[33].

Many of the documented linkages between access to work and health are often related to the negative impacts of unemployment, rather than the positive impacts of employment. However, it follows that maintaining high levels of employment opportunities has positive effects on health. Results from a systematic review conducted in 2016[34] found that evidence that employment can be beneficial for peoples' wellbeing, specifically their mental health.

A Briefing by the British Medical Association (2017)[35] stated that '*Most long-term conditions are more common in adults from lower socio-economic groups, including the working poor, such as diabetes, chronic obstructive pulmonary disease, arthritis and hypertension'.* A 2017 report by the Mental Health

[31] Marmot, M., Allen, J., Goldblatt, P., Boyce, T., McNeish D., Grady, M. and Geddes, I. (2010), *Fair society, healthy lives: Strategic review of health inequalities in England post-2010*, The Marmot Review.
[32] Michael Marmot, Jessica Allen, Tammy Boyce, Peter Goldblatt, Joana Morrison (2020*) Health equity in England: The Marmot Review 10 years on*. Institute of Health Equity
[33] Welsh Government (2019) Relative income poverty – Housing tenure, economic status and type of employment, financial year ending 2019
[34] Modini, M., Joyce, S., Mykletun, A., Christensen, H., Bryant, RA., Mitchell, PB., Harvey, SB. (2016) The mental health benefits of employment: results of a systematic meta-review. Australasian Psychiatry.
[35] British Medical Association. (2017). *Health at a price - Reducing the impact of poverty. A briefing from the board of science*. Available at: https://www.bma.org.uk/media/2084/health-at-a-price-2017.pdf

Foundation[36] found that three in four people living in the lowest household income bracket report having experienced a mental health problem, compared to six in ten of the highest household income bracket.

Employment is related to social and psychological well-being; a study commissioned by the Department of Work and Pensions[37] found that "work meets important psychosocial needs in societies where employment is the norm" and that "work is central to individual identity, social roles and social status".

Vulnerable groups

A scoping study[38] investigating the impact of unemployment and precarious employment on the health of young people demonstrated that there is evidence that young people are especially vulnerable to health problems when unemployed or working in precarious conditions.

Furthermore, supporting these findings, a recently published systematic review[39] commissioned by the Public Health Agency of Sweden found an association between unemployment among young people and poor mental health.

These findings are indicative that young people are particularly vulnerable to the negative health effects resulting from unemployment.

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking access to work to health and wellbeing is considered to be ***strong.***

Access to training

Training is a form of work involving the application of physical or mental effort to improve skills, knowledge or other personal resources which can improve chances of employment and career progression.

The Marmot 2010 review[40] highlighted the links between inequalities in educational outcomes and physical and mental health and identified "*Reducing the social gradient in skills and qualifications*" as a priority objective to reduce health inequalities. The review made policy recommendations including increasing lifelong learning opportunities, including work-based learning, to improve health

[36] Mental Health Foundation. (2017). *Surviving or Thriving? The state of the UK's mental health*. https://www.mentalhealth.org.uk/publications/surviving-or-thriving-state-uks-mental-health. Accessed March 2021
[37] Waddell, G., Burton, A. K. (2007) Is work good for your health and well-being? The Stationery Office.
[38] Vancea, M., Utzet, M. (2017) How unemployment and precarious employment affect the health of young people: a scoping study on social determinants.
[39] Bartelink, V, H, M., Guldbrandsson, K, K., Bremberg. (2019) Unemployment among young people and mental health: a systematic review.
[40] Marmot, M., Allen, J., Goldblatt, P., Boyce, T., McNeish D., Grady, M. and Geddes, I. (2010) Fair society, healthy lives: Strategic review of health inequalities in England post-2010, The Marmot Review.

outcomes. The Marmot Review 10 Years On (2020)[41] review emphasised that to reduce health inequalities training and education are important both physical and mental health.

Young adults who undertake training have been shown to have improved somatic and psychological symptoms compared with those who are unemployed. It was noted as particularly important for mental health, general well-being and for the longer-term social development of school leavers[42].

These findings are supported by the results from a systematic review[43] of 41 papers addressing learning at work. The review found that learning at work is beneficial for employee wellbeing, specifically increasing people's ability to cope with stress, improved feelings of self-esteem; hope; and purpose.

A 2020 study comparing life-course trajectories of employment quality and health in the U.S.[44] found that people who were less educated had poorer employment and worse self-rated health. The prevalence of poor/fair self-rated health and moderate mental illness was greatest among individuals who were minimally attached, returning to the labour force, and precariously employed. Another study used data from 26 Organisation for Economic Co-operation and Development (OECD) countries to assess associations between education and health indicators[45]. This found that adults with higher educational attainment had better health and lifespans compared to less educated adults.

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking access to training to health and wellbeing is considered to be ***strong.***

3.5 Accessibility and active travel

Accessibility

Accessibility and the provision of public services such as health, education and community facilities have been found to have a direct positive effect on human health[46].

[41] Marmot, M., Allen, J., Boyce, T., Goldblatt, P., Morrison, J. (2020) Health equity in England: The Marmot Review 10 years on. London: Institute of Health Equity.
[42] Waddell G and Buton A. K. (2006) Is work good for your health and well-being? The Stationary Office.
[43] What Works Wellbeing. (2017) Learning at work and wellbeing: what works?.
[44] Eisenberg-Guyot J., Peckham T., Andrea SB., Oddo V., Seixas N., Hajat A., (2020) Life-course trajectories of employment quality and health in the U.S.: A multichannel sequence analysis. Social Science & Medicine, Volume 264,113327,ISSN 0277-9536, Available oneline at: https://doi.org/10.1016/j.socscimed.2020.113327.
[45] Raghupathi, V., Raghupathi, W. The influence of education on health: an empirical assessment of OECD countries for the period 1995–2015. (2020). Arch Public Health 78, 20. Available online at: https://doi.org/10.1186/s13690-020-00402-5
[46] HUDU (2013). HUDU Planning for Health. Rapid Health Impact Assessment Tool. (NHS) London Healthy Urban
Development Unit

A survey by Randall in 2008 for the Office for National Statistics (ONS)[47] found that 5% of adults in Great Britain reported feeling a sense of isolation due to difficulties accessing local shops and services, and 22% of adults knew someone who felt this way. Overall, the survey highlighted that alongside crime and cleanliness, the most important factors that made a place suitable to live was access to services, particularly health services.

As the WHO[48] explained access to local facilities such as shops, schools, health centres and places of informal recreation are also important for health and wellbeing due to the physical activity taken in getting there and the social interaction on the way there or at the facilities.

Accessibility for local residents to community facilities can play a significant role in promoting or discouraging physical activity. The key influential characteristics of an accessible community noted by Dannenberg et al[49]included proximity of recreation facilities, housing density, street design and accommodation for safe pedestrian, bicycle, and wheelchair use.

Strength of evidence

Based on the criteria set out in Section 2.4, the evidence linking accessibility to health and wellbeing is considered to be ***moderate.***

Active Travel

Active travel applies to modes of transport that require physical activity, in contrast to modes that require little physical effort such as motor vehicles. Therefore, it is the physical activity associated with active travel that brings about health effects. Research suggests that most sustained exercise is taken during the course of everyday activities such as travelling to work or going to the shops, rather than specifically for health purposes[50].

A systemic review[51] has shown that the environment has an effect on people's participation in physical activity which in turn affects their health. The evidence linked transport, the environment and physical activity and includes:

- access to physical activity facilities;
- distance to destinations;
- levels of residential density;
- type of land use;

[47] Randall, C. (2012) Measure National Well-being: Where We Live 2012. Office for National Statistics Report.
[48] WHO (2012) Addressing the social determinants of health: the urban dimension and the role of local government
[49] Dannenberg A.L, Jackson R.J, Frumkin H, Schieber R.A, Pratt M, Kochtitzky C and Tildon H. N (2003) The Impact of Community Design and Land-Use Choices on Public Health: A Scientific Research agenda. American Journal of Public Health
[50] Caldwell, L.L. (2005), Leisure and health: Why is leisure therapeutic?
[51] National Obesity Observatory (2011) Data sources: environmental influences on physical activity and diet

- urban walkability scores;
- perceived safety;
- availability of exercise equipment; and
- the provision of footways.

Altering the environment, particularly an urban landscape may also lead to unintended changes in patterns of mobility, physical activity and therefore eventually population health[52]. Particularly the intervention of transport systems designed to promote active travel such as cycling, and walking can reap health benefits by increasing physical activity, reducing morbidity from air pollution and reducing the risk of road traffic accidents by decreasing the number of journeys undertaken by motor vehicles[53].

A systematic review[54] of built environment effects on physical activity and active transport showed a positive effect of walkability components, provision of quality parks and playgrounds, and installation of or improvement in active transport infrastructure on active transport, physical activity and visits or use of these settings

A 2013 literature review focused on the health benefits of active travel by Saunders et al.[55] determined that, although there is no clear evidence in the effectiveness of active travel in reducing obesity, there has been a rise in the prevalence of obesity which has occurred in parallel with a decline in active travel in the past 30-40 years. Data from a report by the National Obesity Observatory in 2011[56] suggests a number of factors impact active travel including access to fitness facilities, distance to destinations, land use, urban walkability scores, safety, availability of equipment and the provision of footpaths.

More recent research[57] found that people living in walkable neighbourhoods tend to be more physically active and less likely to be obese which could contribute to the reduced risk of diabetes for older adults. Similarly, a study[58] of the UK Biobank cohort found that neighbourhood walkability is associated with lower levels of blood pressure and reduced risk of hypertension. This suggests that there could be wider health implications of walkable neighbourhoods and increased physical activity.

[52] Ogilvile D, Mitchell R, Mutrie N, Petticrew M and Pratt S (2010) Shoe leather epidemiology: active travel and transport
infrastructure in the urban landscape. International Journal of Behavioural Nutrition and Physical Activity 7.
[53] Sustainable Development Commission (2008) Health, Place and Nature
[54] Smith, M., Hosking, J., Woodward, A. et al. (2017) Systematic Literature Review of Built Environment Effects on Physical Activity and Active Transport – An Update and New Findings on Health Equity. Int J Behav Nutr Phys Act **14,** 158. DOI: https://doi.org/10.1186/s12966-017-0613-9
[55] Saunders, L., Green, J., Petticrew, M., Steinback, R. and Roberts, H. (2013), *What are the health benefits of active travel? A systematic review of trials and cohort studies,* PLoS ONE.
[56] NHS, National Obesity Observatory (2011), *Data sources: environmental influences on physical activity and diet, https://khub.net/c/document_library/get_file?uuid=68b8960e-4145-4ed2-b9f8-1ce767f1d2ff&groupId=31798783.*
[57] Booth GL, Creatore MI, Luo J, et al. (2019) Neighbourhood Walkability and the Incidence of Diabetes: An Inverse Probability of Treatment Weighting Analysis. J Epidemiol Community Health.
[58] Sarkar C, Webster C, Gallacher J. (2018) Neighbourhood Walkability and Incidence of Hypertension: Findings from the study of 429,334 UK Biobank participants. International Journal of Hygiene and Environmental Health. 21:3:458-468.

Vernon et al. in 2014[59] suggest that road safety interventions can also help to encourage physical activity by creating a safer physical road environment and reducing the level of danger posed to vulnerable road users. Vernon et al. also noted that that 'road safety has a much wider impact on health than just preventing injuries. This is because some forms of travel (i.e. walking and cycling), and the provision for them, bring more health benefits for individuals and society than others. However, the way that people travel is influenced by concerns about actual or perceived safety; effective intervention to reduce road danger can encourage more people to travel by these active, health-promoting modes.'

The health benefits of physical activity are summarised in a 2011 Department of Health Report[60], which states that 'regular physical activity can reduce the risk of many chronic conditions including coronary heart disease, stroke, type 2 diabetes, cancer, obesity, mental health problems and musculoskeletal conditions'. The report also states that 'even relatively small increases in physical activity are associated with some protection against chronic diseases and an improved quality of life.' A systematic review of reviews and meta-analyses[61] found that physically active older adults are at reduced risk of all cause and cardiovascular mortality, breast and prostate cancer, fractures, recurrent falls, activities of daily living (ADL) disability and functional limitation and cognitive decline, dementia, Alzheimer's disease and depression. Further evidence[62] suggests that lack of physical activity in children can lead to CVD and associated diseases such as obesity which can be tracked from adolescence into adulthood, contributing to premature mortality.

A systematic review and meta-analysis[63] of 150 Cochrane systematic reviews published between 2000 and 2019 found physical activity was associated with a 13% reduction in mortality and an improvement in quality of life. Another systematic review and meta-analysis[64] assessing objective physical activity found a 40% decreased risk for mortality in individuals in the highest category of light, moderate to vigorous and total physical activity compared to the lowest.

A literature review of studies from various countries examining the relationship between physical activity and happiness[65] showed that as little as 10 minutes of physical activity per week resulted in increased levels of happiness. A systematic

[59] Vernon, D. (2014), Road Safety and Public Health, Royal Society for the Prevention of Accidents (RoSPA).
[60] Department of Health (2011), *Start Active, Stay Active: A report on physical activity from the four home counties*, Chief Medical Officers. Available online at: https://www.gov.uk/government/publications/start-active-stay-active-a-report-on-physical-activity-from-the-four-home-countries-chief-medical-officers.
[61] Cunningham C, O' Sullivan R, Caserotti P, Tully MA. (2020). Consequences of physical inactivity in older adults: A systematic review of reviews and meta-analyses. Scand J Med Sci Sports. 30(5):816-827.
[62] Kumar, B, Robinson, R and Till. S (2015), Physical activity and health in adolescence. Clinical Medicine. Vol 15 267-72.
[63] Posadzki, P., Pieper, D., Bajpai, R. *et al.* Exercise/physical activity and health outcomes: an overview of Cochrane systematic reviews. *BMC Public Health* **20,** 1724 (2020). https://doi.org/10.1186/s12889-020-09855-3
[64] Ramakrishnan R., He JR., Ponsonby AL., Woodward M., Rahimi K., Blair SN., Dwyer T., (2021), Objectively measured physical activity and all-cause mortality: A systematic review and meta-analysis, Preventive Medicine,Volume 143,106356,ISSN 0091-7435, https://doi.org/10.1016/j.ypmed.2020.106356.
[65] Zhang, Z. & Chen, W. (2018), A Systematic Review of the Relationship Between Physical Activity and Happiness. Journal of Happiness .pp 1-8.

review undertaken by the Department of Health and Human Services[66] in the US, noted that a major finding of the evidence was that regular physical activity reduced the risk of clinical depression and depressive symptoms among people both with and without clinical depression. Physical activity was also found to reduce the severity of those symptoms irrespective of number of depressive symptoms. The review also found that perceived quality of life is improved by regular physical activity. A cross-sectional and longitudinal study[67] found that walking had positive associations with psychological and social wellbeing, strolling in nature with emotional and social wellbeing and endurance training with subjective health. A systematic review and meta-analysis[68] of 42 studies including 37,408 individuals found a significant protective effect of physical activity on depression further highlighting the importance of physical activity on mental health.

Vulnerable groups

Although all groups are shown to benefit from regular exercise, the benefits to children and the elderly are particularly emphasised. The importance of exercise for children is highlighted in terms of benefits in building up bone density, avoidance of weight gain, links to health status in later life, and in establishing habits, which may be more difficult to begin in later life [69,70.] The benefits for the elderly include retention of mobility, cognitive function and independence[71.]

A report by PHE[72] has reported that people with lower socioeconomic status, older people, people with disabilities, women, minority ethnic groups (specifically Bangladeshi and Pakistani women), and lesbian, bisexual, transgender people are particularly vulnerable to physical inactivity[73].

Strength of evidence

Based on the criteria set out in Section 2.4, the evidence linking active travel to health and wellbeing is considered to be ***strong.***

[66] 2018 Physical Activity Guidelines Advisory Committee. 2018 Physical Activity Guidelines Advisory Committee Scientific Report. Washington, DC: U.S. Department of Health and Human Services, 2018. Available online at: https://health.gov/paguidelines/second-edition/report/pdf/PAG_Advisory_Committee_Report.pdf.
[67] Kekäläinen, T. et al. (2019), Cross-Sectional and Longitudinal Associations between Leisure Time Physical Activity, Mental Well-Being and Subjective Health in Middle Adulthood, Applied Research Quality Life, doi.org/10.1007/s11482-019-09721-4.
[68] Gianfredi V, Blandi L, Cacitti S, Minelli M, Signorelli C, Amerio A, Odone A. (2020). Depression and Objectively Measured Physical Activity: A Systematic Review and Meta-Analysis. *International Journal of Environmental Research and Public Health*. 17(10):3738. https://doi.org/10.3390/ijerph17103738
[69] Department of Health and Social Care. (2019) UK Chief Medical Officers' Physical Activity Guidelines. Available from: https://www.gov.uk/government/publications/physical-activity-guidelines-uk-chief-medical-officers-report
[70] Department of Health. (2004) Choosing Health Summaries: Diet and Nutrition. Public Health White Paper.
[71] Department of Health. (2004) Choosing Health Summaries: Diet and Nutrition. Public Health White Paper.
[72] Public Health England. (2020) Health Matters: Physical Activity – Prevention and Management of Long Term Conditions. Available from: https://www.gov.uk/government/publications/health-matters-physical-activity
[73] Public Health England. (2016) Health Matters: Getting Every Adult Active Every Day. Available from: https://www.gov.uk/government/publications/health-matters-getting-every-adult-active-every-day

3.6 Air quality, noise and neighbourhood amenity

Air quality

The WHO recognises outdoor air pollution as a major environmental health problem for all countries including high-income countries[74]. Guidance from Public Health Wales[75] states that epidemiological studies have shown that long-term exposure to air pollution (over years or a lifetime) reduces life expectancy, due to cardiovascular and respiratory diseases and lung cancer. Short-term exposure (over hours or days) to increased levels of air pollution can also have a range of health effects, including effects on lung function, asthma, as well as increases in respiratory and cardiovascular hospital admissions, and mortality.

A Public Health England review[76] of interventions to improve outdoor air quality and public health found evidence that air pollution is the largest environmental risk to the health of the public in the UK. The review found that:

- it is estimated that between 28,000 and 36,000 deaths each year are attributed to human-made air pollution in the UK;
    - In Wales, an estimated 1,000 to 1,4000 deaths each year are attributed to long-term air pollution exposure[77]
- there is a close association with cardiovascular and respiratory disease, including lung cancer;
- there is emerging evidence that other organs may also be affected, with possible effects on dementia, low birth weight and diabetes; and
- it concluded that the most impactful interventions would be those that reduce emissions of air pollution at source.

Vulnerable groups

A UK Department for the Environmental, Food and Rural Affairs (DEFRA)[78] found that in England that there is a tendency for higher relative mean annual concentrations of nitrogen dioxide NO_2 and PM_{10} in the most deprived areas of the country. This distribution can largely be explained by the high urban concentrations driven by road transport sources, and the higher proportion of deprived communities in urban areas. If exceedances of National Air Quality Standards are considered, the correlation between poor air quality and deprivation

[74] WHO Topic Sheet. (2018) Ambient (outdoor) air quality and health. Available online at: https://www.who.int/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health.

[75] Public Health Wales. (2020) Air pollution and health in Wales

[76] Public Health England (2019). *Review of interventions to improve outdoor air quality and public health*. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/795185/Review_of_interventions_to_improve_air_quality.pdf.

[77] Public Health Wales. (2020) Air pollution and health in Wales

[78] Department of Environment, Food and Rural Affairs, Netcen, Department for Communities and Local Government. (2006) National Statistics. Air Quality and Social Deprivation in the UK: an Environmental Inequalities Analysis - Final Report to Department of Environment, Food and Rural Affairs AEAT/ENV/R/2170.

is stronger, showing that when the most polluted areas are considered, the greatest burden is on the most deprived communities, and very little on the least deprived. Studies from Wales show that people who live in most deprived areas are more likely to be harmed by air pollution exposure as the levels of air pollution are the highest and the levels of health the lowest[79].

The DEFRA review also identifies age as a key indicator of susceptibility to air pollution: 'children and elderly groups are deemed more susceptible to certain health impacts'. Similarly, a recent Public Health Wales[80] report has stated that children, older people, and people with chronic health problems such as pre-existing cardiovascular and respiratory conditions are the most vulnerable to air pollution. People who work in highly polluted areas may also be at a higher risk of pollution – related health problems as they regularly travel in or through polluted areas.

According to the Lancet Commission on pollution and health[81] children are at high risk of pollution related disease and even extremely low-dose exposures to pollutants during windows of vulnerability in utero and in early infancy can result in disease, disability, and death in childhood and across their lifespan. Research has shown that exposure to particulate matter affects children's lung development, including deficits in lung function[82,83].

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking air quality to health and wellbeing is considered to be ***strong.***

Noise

According to the WHO[84], *'excessive noise seriously harms human health and interferes with people's daily activities at school, at work, at home and during leisure time. It can disturb sleep, cause cardiovascular and psychophysiological effects, reduce performance and provoke annoyance responses and changes in social behaviour'.*

A European Commission publication in 2015[85] cited evidence that *'living in a quiet area has a positive impact on health. A study assessed quality of life for*

[79] 7 Brunt H et al. (2017). Air pollution, deprivation and health: Understanding relationships to add value to local air quality management policy and practice in Wales, UK. https://academic.oup.com/jpubhealth/article/39/3/485/3076806
[80] Public Health Wales. (2020) Air pollution and health in Wales
[81] Landrigan, P.J., et al. (2018) The Lancet Commission on Pollution and Health, Lancet 391:462-512
[82] Guo C, Hoek G, Chang LY, et al. (2019) Long-Term Exposure to Ambient Fine Particulate Matter (PM2.5) and Lung Function in Children, Adolescents, and Young Adults: A Longitudinal Cohort Study. Environ Health Perspect. 127(12):127008. DOI:10.1289/EHP5220
[83] Public Health England. (2019) Review of Interventions to Improve Outdoor Air quality and Public Health. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/795185/Review_of_interventions_to_improve_air_quality.pdf
[84] World Health Organization (2017), Noise. Available online at: http://www.euro.who.int/en/health-topics/environment-and-health/noise.
[85] European Commission, Science for Environment Policy (2015). *Thematic issues: Noise impacts on health.* Available online at: http://ec.europa.eu/environment/integration/research/newsalert/pdf/47si.pdf.

people living in quiet and noisy locations and found that those who lived in quiet locations – particularly in rural areas – had a better quality of life'.

The 2018 WHO guidelines on Environmental Noise for the European Region[86] undertook a series of systematic reviews synthesising exposure and associated impacts on health to develop a set of guidelines to protect human health. Recommendations were formulated based on the strength of evidence from various noise sources including road traffic, railway, aircraft, wind turbine and leisure noise. The systematic reviews concluded that there was evidence for an association between aircraft noise and sleep disturbance, annoyance, reading skills and oral comprehension in children and cognitive impairment, with suggestive but weaker evidence for effects on cardiovascular disease and mental health.

A review commissioned in 2020 by Department of Environment, Food and Rural Affairs (Defra)[87] considered how evidence has changed since the publication of the WHO Environmental Noise Guidelines. This found associations between noise and medication use and interview measures of depression and anxiety. Associations with some cancer outcomes were also observed, although the quality of evidence across studies remains low for these outcomes.

Strength of evidence

Based on the criteria set out in Section 2.4, the evidence linking noise to health and wellbeing is considered to be ***strong.***

Neighbourhood amenity

A study in 2015[88] sought to quantify the relationship between environmental aesthetics and human health by comparing geographic data against self-rated health. This found that *'inhabitants of more scenic environments report better health, across urban, suburban and rural areas, even when taking core socioeconomic indicators of deprivation into account, such as income, employment and access to services.'*

A Position Statement published by the Landscape Institute in 2013[89] looked at evidence linking the quality of places with health and wellbeing across a range of environmental, social and lifestyle determinants. This document cited evidence to suggest that health and wellbeing are influenced positively by a variety of factors including the perceived attractiveness of the environment.

[86] World Health Organisation Regional Office for Europe (2018). *Environmental Noise Guidelines for the European Region*. Available at: http://www.euro.who.int/__data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf
[87] Clark, C., Crumpler, C., & Notley, A. H. (2020). *Evidence for Environmental Noise Effects on Health for the United Kingdom Policy Context: A Systematic Review of the Effects of Environmental Noise on Mental Health, Wellbeing, Quality of Life, Cancer, Dementia, Birth, Reproductive Outcomes, and Cognition*. International journal of environmental research and public health, 17(2), 393. Available at: https://doi.org/10.3390/ijerph17020393
[88] Seresinhe, C., Preis, T. and Moat, H. (2015). *Quantifying the Impact of Scenic Environments on Health*, Scientific Reports.
[89] Landscape Institute (2013). *Public Health and Landscape – Creating healthy places.*

Vulnerable groups

A 2020 literature review[90] assessed the association between neighbourhood aesthetics and childhood obesity, physical activity and active transport to school in individuals aged <18 years from 25 studies. Two thirds (75%) of studies reported non-significant associations between neighbourhood aesthetics and physical activity and weight whereas half (50%) of studies showed that neighbourhood aesthetics is associated with active transport to schools. This suggests that the findings are mixed, and more research is needed to understand the epidemiological relationship.

A literature review[91] assessing the association between the built environment and physical activity in the elderly found that aesthetically pleasing scenery such as greenery is positively associated with physical activity in the individuals over 65 years of age.

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking visual amenity to health and wellbeing is considered to be ***weak***

3.7 Climate Change

Climate change is the projected rise in global temperatures as a result of anthropogenic development which is likely to contribute to continued changes in weather patterns, rising sea levels and increased frequency and intensity of extreme weather events.

The most recent UK Climate Projections (UKCP18)[92] have stated that the UK should expect warmer temperatures, with a predicted increase of 0.7 °C to 4.2 °C in winter, and 0.9°C to 5.4°C, in summer, by 2070. Furthermore, by 2070 wetter winters and hotter, drier summers are forecast, with UK average changes estimated as -1% to +35% for winter, and -47% to +2% for summer, where positive values indicate more precipitation and negative values indicate reduced precipitation. These new projections are broadly consistent with earlier projections (UKCP09), but with slight difference in the extreme ends of the projected ranges.

There are direct impacts linking the environment and health such as heat-related effects, flooding and poor air quality and indirect impacts such as fuel poverty, access to green space and disruption to services and access such as healthy food[93].

[90] Qu, P, Luo, M, Wu, Y, et al. (2020). Association between neighborhood aesthetics and childhood obesity. *Obesity Reviews*. 1– 19. https://doi.org/10.1111/obr.13079
[91] Bonaccorsi G, Manzi F, Del Riccio M, Setola N, Naldi E, Milani C, Giorgetti D, Dellisanti C, Lorini C. (2020). *Impact of the Built Environment and the Neighborhood in Promoting the Physical Activity and the Healthy Aging in Older People: An Umbrella Review.* International Journal of Environmental Research and Public Health. 17(17):6127. https://doi.org/10.3390/ijerph17176127
[92] Met Office. (2018) UK Climate Projections (UKCP).
[93] Paavola J. (2017) Health impacts of climate change and health and social inequalities in the UK. Environmental Health.

Many of the health impacts are therefore interrelated with the health determinants and associated health impacts previously mentioned.

Vulnerable groups

Chalmers et al.[94] concluded that certain people are expected to be the most vulnerable to climate change and this includes:

a. poorly housed or non-mobile individuals;

b. the population living in high risk places such as flood zones and coastal locations; and

c. socially isolated or those individuals otherwise unable to adapt to change.

Paavola (2017)[95] examined how social and health inequalities influence the health impacts of climate change in the UK. Findings demonstrated that age, pre-existing medical condition/s and social deprivation are key factors that make people more vulnerable to experiencing the adverse health outcomes related to climate change impacts.

Heat-related effects

Research undertaken by Hajat et al. (2014)[96] modelled climate change effects on human health, calculating projections of temperature-related mortality for the UK during the 2020s, 2050s and 2080s. The study concluded that the current annual baseline of heat-related deaths is around 2000 deaths, with an expected rise by around 257% (7,140 deaths) by the 2050s. An earlier study by Hajat et al. (2007) found that elderly people and women are most vulnerable to risk of heat mortality[97].

The 2019 report[98] of The Lancet Countdown on health and climate change elucidates the pathophysiological consequences of heat exposure, including heat stress and heat stroke, acute kidney injury, exacerbation of congestive heart failure and increased risk of interpersonal, and collective violence.

There are also particularly vulnerable groups who are at a greater risk of serious harm from heat extremes including babies, young children, the elderly, people taking diuretic drugs and those suffering from dementia, respiratory ailments, neurological conditions or diabetes[99].

[94] Chalmers H, Pilling A and Maiden T. (2008) Adapting to the Differential Social Impacts of Climate Change in the UK.
[95] Paavola J. (2017) Health impacts of climate change and health and social inequalities in the UK. Environmental Health.
[96] Hajat S, Vardoulakis S, Heaviside C and Eggen B. (2014) Climate change effects on human health: projections of temperature-related mortality for the UK during the 2020s, 2050s and 2080s. Journal of Epidemiology & Community Health.
[97] Hajat S, KOvats RS, Lachowycz L (2007) Heat – related and col-related deaths in England and Wales. Occup Environ Med 2007;64:93–100
[98] The Lancet. (2019) The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate.
[99] Defra. (2012) UK Climate Change Risk Assessment: Health Sector Report.

Allergens, infectious disease and vectors for disease

Climate change can influence allergens, particularly allergenic plants by changing flowering times and distribution leading to negative impact for allergic people by lengthening the allergy season[100].

The Intergovernmental Panel on Climate Change (IPCC)[101] have reported that warmer conditions generally favour the production and release of airborne allergens (e.g. fungal spores and plant pollen) and, consequently, there may be an effect on asthma and other allergic respiratory diseases such as allergic rhinitis, as well as effects on conjunctivitis and dermatitis. Further, it was reported that climate extremes may promote the transmission of certain infectious diseases, and the vulnerability of populations to these diseases will depend on the baseline levels of pathogens and their vectors.

In addition to this, a review on the impact on human health of climate changes by Franchini & Mannucci (2015)[102] found that changes in temperature and rainfall might enhance the spread of infectious diseases, with many infectious agents and their vectors being sensitive to climatic conditions.

Increased precipitation, rising sea levels and flooding

The Health Protection Agency[103] outlined the direct and indirect health effects of flooding. Direct effects include physical trauma, injuries and drowning. Indirect effects include damage from infrastructure, water supplies, displacement and disruption to people's lives.

Rising sea levels and increased sea temperatures associated with climate change may also increase marine pathogens and harmful algal blooms which are harmful to human health[104].

Increased precipitation, rising sea levels and flooding can also increase the risk of contamination to water supplies[105] however this is generally a low risk in the UK.

A review by Palinkas and Wong (2019)[106] aimed to examine the mental health impacts of different types of climate-related events, including floods. The results describe that there is substantial literature documenting the negative effects flood have on mental health and well-being, including elevated rates of anxiety and stress disorders, sleep disruption, post-traumatic stress disorder and suicidal ideation.

[100] Health Protection Agency. (2012) Health Effects of Climate Change in the UK 2012.
[101] IPCC. (2014) IPCC Fifth Assessment Report: Climate Change 2014 (AR5) - Working Group II Report 'Impacts, Adaptation and Vulnerability'.
[102] Franchini M and Mannucci P.M. (2015) Impact on human health of climate changes. European Journal of Internal Medicine.
[103] Health Protection Agency. (2012) Health Effects of Climate Change in the UK 2012.
[104] Defra. (2012) UK Climate Change Risk Assessment: Health Sector Report.
[105] Health Protection Agency. (2012) Health Effects of Climate Change in the UK 2012.
[106] Palinkas A.L and Wong M. (2019) Global climate change and mental health. Current opinion in psychology.

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence climate change to health and wellbeing is considered to be ***strong.***

3.8 Crime reduction and community safety

Community safety is crucial in determining health and wellbeing. It has been stated that 'a healthy community protects and improves the quality of life for its citizens, promotes healthy behaviours and minimizes hazards for its residents, and preserves the natural environment.'

The effects of crime on health include both direct effects, for example through violence, and indirect social and psychological effects arising from fear of crime[107].

The same factors that affect local crime rates often seem to affect health[108]. A recent report on Measuring National Wellbeing[109] has also identified crime as a key indicator in determining wellbeing.

Hirschfield[110] showed that victimisation or fear of crime may manifest itself through symptoms such as stress, sleeping difficulties, loss of appetite, loss of confidence and health harming 'coping' mechanisms such as smoking and alcohol consumption. The research also suggested that community problems such as disorder and antisocial behaviour, which are not strictly criminal offences, can have adverse effects on health.

A recent review undertaken by Lorenc et al[111] looked at qualitative evidence on the fear of crime and the environment. The report notes that most research on crime and health focused on the direct health effects suffered by victims of crime. However, indirect effects of crime and its broader influence on individuals and communities may also have important effects on wellbeing.

The study by Lorenc et al[112] examines the consequences of fear of crime, stating that 'relatively few participants see fear as having serious mental health effects, although several report some degree of psychological stress as a result of fear. A much more widely perceived consequence of fear is to limit people's activities, including social and cultural activities, sometimes leading to social isolation. Participants from across the population report such limitations, but they appear to

[107] British Medical Association (1999). 'Health and Environmental Impact Assessment: an Integrated Approach'. Earthscan Publications Ltd.
[108] Greater London Authority (2005) 'Review of the London Health Strategy High Level Indicators'. London Health Commission.
[109] Randall, C. (2012), Measuring National Well-being, Where we Live,Office for National Statistics
[110] Hirschfield.A, (2003). 'The Health Impact Assessment of Crime Prevention'. Sourced from NHS National Institute for Health and Clinical Evidence.
[111] Lorenc, T., Petticrew, M., Whitehead, M., Neary, D., Clayton, S., Wright, K., Thomson, H., Cummins, S., Sowden, A., Renton, (2012). A. Fear of crime and the environment: systematic review of UK qualitative evidence, BMC Public Health. 13: 496.
[112] Lorenc, T., Petticrew, M., Whitehead, M., Neary, D., Clayton, S., Wright, K., Thomson, H., Cummins, S., Sowden, A., Renton, (2012). A. Fear of crime and the environment: systematic review of UK qualitative evidence, BMC Public Health. 13: 496.

be more serious for women, older people and people with disabilities. Parents also report placing serious restrictions on children's activities.'

The design of the built environment can influence levels of crime and perceptions of community safety with interventions such as street lighting helping to reduce crime, and design that promotes 'eyes on the street' helping to reduce anti-social behaviour.

Vulnerable groups

Social inequalities are particularly marked in urban environments, with different population subgroups experiencing impacts to different degrees. For example, the National Survey for Wales (2018-19)[113] found that people who were in material deprivation were found to be less likely to feel safe in their local area, compared with those who were not in material deprivation. Further, older people are identified as being particularly likely to suffer as a result of fear of crime.

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking crime and community safety to health and wellbeing is considered to be ***moderate.***

3.9 Housing design and affordability

There is evidence linking housing quality and tenure with mental and physical health. According to the 2011/12 Subjective Well-being Annual UK Population Survey[114], 80% of those who owned their property reported 'medium' or 'high' levels of life satisfaction, compared with 67.8% of those who rented. Of those in rented accommodation, 6 out of 10 reported 'low' satisfaction with life, compared with 1 in 5 of those who owned their accommodation outright or with a mortgage. The Annual Population Survey (APS) dataset covering the period between January 2014 to December 2016 shows that people reporting the poorest personal well-being are more likely to rent their home and less likely to have a mortgage[115].

A systematic review in 2019[116] suggested that prior exposure to housing disadvantage (overcrowding, mortgage delinquency, housing mobility, housing tenure, subjective perceptions of inadequate housing, eviction, and physical housing conditions) may impact mental health later in life.

[113] Welsh Government (2020) **What factors are linked to people feeling safe in their local area?**
[114] Randall, C. (2012). *Measuring National Well-Being – Where we live*, Office for National Statistics.
[115] Office of National Statistics (July 2018)., *Understanding well-being inequalities: Who has the poorest personal well-being*.
[116] Singh, A. et al. (2019), *Housing Disadvantage and Poor Mental Health: A Systematic Review*, American Journal of Preventative Medicine: 57(2):262−272.

A 2015 study of the effects of relocation at older age on cognitive function[117] showed that involuntary residential relocation has a negative impact on wellbeing, including increased stress and isolation, particularly for older people.

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking the status and condition of housing to health and wellbeing is considered to be ***moderate.***

4 Social cohesion and inclusive design

Social cohesion is defined as the quality of social relationships and existence of trust, mutual obligations and respect in communities or the wider society[118]. This is closely related to levels of inequality or exclusion within a given community.

Social cohesion is also closely linked to social capital which the World Bank has defined as "…the institutions, relationships and norms that shape the quality and quantity of a society's social interactions... Social capital is not just the sum of the institutions which underpin a society – it is the glue that holds them together"[119].

The physical environment can directly influence social capital and social cohesion, as social networks rely on high quality, accessible spaces where people can meet to pursue their hobbies and interests and interact socially. This includes transport infrastructure, which enables residents to integrate within and move outside of their own community.

Social cohesion has been linked to volunteering, the empowerment of individuals and ethnic diversity. It also provides opportunities for communities to participate in the planning of healthcare services and social infrastructure, improving community cohesion and positively impacting mental health and well-being[120].

Social cohesion has been shown to positively correlate with a reduced fear of isolation and positive mental health. In contrast, inequalities within a population and crime and safety can erode social cohesion within a community[121].

According to one evidence review[122] social capital may have various effects on health:

[117] Wu, Y., Prina, A., Barnes, L., Matthews, F. and Brayne, C. (2015). *Relocation at older age: results from the cognitive function and aging study*, Journal of Public Health.

[118] World Health Organisation. (2003). Social Determinants of Health: The Solid Facts 2nd Edition.

[119] The World Bank. (1999) What is Social Capital? PovertyNet.

[120] Department for Communities and Local Government. (2008) Predictors of Community Cohesion: Multi-level Modelling of the 2005 Citizenship Survey.

[121] Department for Communities and Local Government. (2008) Predictors of Community Cohesion: Multi-level Modelling of the 2005 Citizenship Survey.

[122] Cave, B., Curtis, S., Aviles, M. and Coutts, A. (2001) Health Impact Assessment for Regeneration Projects. Volume II Selected Evidence Base, East London and City Health Action Zone, University of London.

- protect health by buffering against the effects of life events which may be damaging to health;
- have physiological effects, through the hormonal system, on the body's response to stress and functioning of the immune system;
- reduce isolation, which is associated with disease, accidents and suicide;
- enable people to cope with illness better and have better prognoses when ill; and
- reduce or protect against mental health problems, such as anxiety and depression.

A literature review conducted in 2017 found that social capital influences the self-management of chronic diseases, such as diabetes and chronic obstructive pulmonary disease, as well as self-reported health, depressive symptoms, body mass index, and positive health behaviours[123]. This review highlighted several ways in which social capital can influence health: "through a direct extension of resources to an individual via reciprocity exchange (e.g. caregiving, transportation to medical appointments), through its effect on health-related behaviours (e.g. tobacco and alcohol use, diet, exercise), or by its impact on other social determinants, such as education, employment and volunteering. Social capital also affects health by mitigating the threat of stress-inducing circumstances." Social capital can influence health through 'collective efficacy' where cohesive groups undertake health-promoting action together.

A systematic review[124] on social capital and multiple health outcomes carried out in 2019 found evidence to suggest a positive correlation between social capital and mental and physical health, and that social capital contributes to lower mortality. The analysis found that it was difficult to assess whether an increase in health outcome was due to an increase in social capital, which limits the ability to understand whether and how social capital interventions can improve health. Another 2019 systematic review[125] of studies assessing social capital and physical health (most frequently self-reported health and mortality) identified mixed findings. The study suggested that social capital may be an important protective factor for some physical health outcomes, but that more research is needed to draw conclusions on the associations.

A systematic review conducted in 2020[126] found positive associations between social cohesion and several population health outcomes including physical activity, health weight and depression. A 2020 meta-analysis of studies into the

[123] Cockerham, W. (2017) The Social Determinants of Chronic Disease. American Journal of Preventive Medicine. 52, S5-S12.

[124] Ehsan, A., et al. (2019), *Social capital and health: A systematic review of systematic reviews*, SSM Population Health, doi:10.1016/j.ssmph.2019.100425.

[125] Rodgers J., Valuev AV., Hswen Y., Subramanian S.V., (2019). *Social capital and physical health: An updated review of the literature for 2007–2018.* Social Science & Medicine, Volume 236, 112360, ISSN 0277-9536,

https://doi.org/10.1016/j.socscimed.2019.112360.

[126] Pérez E, Braën C, Boyer G, Mercille G, Rehany É, Deslauriers V, Bilodeau A, Potvin L. (2020). *Neighbourhood community life and health: A systematic review of reviews*. Health Place. 61:102238. doi: 10.1016/j.healthplace.2019.102238. Epub 2019 Nov 14. PMID: 31735517.

relationship between social capital and health[127] found significant positive associations between social capital types (cognitive, structural, bonding, bridging, linking) and health outcomes such as mortality, disease/illness and depression. It was noted that, although significant, the effects were consistently very small.

Multiple studies[128,129,130] suggest a positive correlation between social capital and physical and mental health. However, a systematic review[131] of systematic reviews found numerous non-significant or negative relationships between social capital and health. This review also found that the efficacy of social capital interventions on health remained unclear. It is difficult to assess whether an increase in health is due to an increase in social capital, which limits the ability to understand whether and how social capital interventions can improve health.

The Communities and Local Government (CLG) document Towards Lifetime Neighbourhoods: Designing sustainable communities for all[132] describes lifetime neighbourhoods as being "sustainable communities that offer a good quality of life to all generations".

They should aim to be:

- accessible and inclusive;
- aesthetically pleasing and safe (in terms of both traffic and crime), and easy;
- pleasant to access; and
- a community that offers plenty of services, facilities and open space.

Furthermore, we can add that lifetime neighbourhoods are likely to foster:

- a strong social and civic fabric, including volunteering, informal networks;
- a culture of consultation and user empowerment amongst decision-makers; and
- a strong local identity and sense of place.

The potential health effects of the aspects outlined above, that contribute to the concept of a lifetime neighbourhood, are all further explored within the other determinant sections that make up this literature review.

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[127] Xue, XW. ReedR ., Menclova A.,(2020). *Social capital and health: a meta-analysis,* Journal of Health Economics, Volume 72, 102317, ISSN 0167-6296, https://doi.org/10.1016/j.jhealeco.2020.102317.

[128] Cockerham, W. (2017) The Social Determinants of Chronic Disease. *American Journal of Preventive Medicine. 52*, S5-S12.

[129] Ehsan, A., et al. (2019) *Social Capital and Health: A Systematic Review of Systematic Reviews.* SSM Population Health. DOI:10.1016/j.ssmph.2019.100425

[130] Jennings, V and Bamkole, O. (2019) The Relationship between Social Cohesion and Urban Green Space: An Avenue for Health Promotion. International Journal of Environmental Research and Public Health. 16(3), 452.

[131] Ehsan, A., et al. (2019) Social Capital and Health: A Systematic Review of Systematic Reviews, SSM Population Health. DOI :10.1016/j.ssmph.2019.100425

[132] Ed Harding, International Longevity Centre UK. (2007) Towards Lifetime Neighbourhoods: Designing Sustainable Communities for All. Department for Communities and Local Government.

Vulnerable Groups

An article published in the International Journal for Equity in Health by Uphoff et al in 2013[133] describes social capital, at an individual level, as focusing on personal resources that emerge from social networks where individuals have good access to information, services and support. The article argues that cultural and socioeconomic aspects can act as a barrier to social capital. For example, some types of social capital may only be beneficial to those who have access to them through sufficient economic capital, such as expensive sports clubs.

A systematic review of social capital in children and adolescents found that social capital generated at both the family and community level can influence mental health and behavioural problems in young people, of importance is the young person's own network of social support[134]. Young people also "accrue indirect benefit from their parents having wider and higher quality social support networks"

Some population groups are believed to be at particular risk of social exclusion, including black and minority ethnic (BME) groups, disabled people, lone parents, older people, carers, asylum seekers and refugees and ex-offenders[135].

Strength of evidence

Based on the criteria set out in Section **Error! Reference source not found.**, the evidence linking the social cohesion and inclusive design to health and wellbeing is considered to be ***moderate.***

[133] Uphoff, E., Pickett, K., Cabieses, B., Small, N. and Wright, J. (2013) A Systematic Review of the Relationships Between Social Capital and Socioeconomic Inequalities in Health: A Contribution to Understanding the Psychosocial Pathway of Health Inequalities, International Journal for Equity in Health.

[134] McPherson, K. (2014) The Association Between Social Capital and Mental Health and Behavioural Problems in Children and Adolescents: An Integrative Systematic Review. BMC Psychology.

[135] Wanless. D. (2003) Securing Good Health for the Whole Population. Population Health Trends. HM Treasury/Department of Health.

5 Strength of evidence summary

Error! Reference source not found. shows the strength of evidence linking each health determinant to health and wellbeing based on the criteria set out in Section 2.4.

Table 1 Strength of evidence summary for each health determinant.

Health determinant	Strength of evidence
Access to health and social care services and other social infrastructure	Moderate
Access to healthy food	Moderate
Access to open space and nature	Strong
Access to work and training	
Access to work	Strong
Access to training	Strong
Accessibility and active travel	
Accessibility	Moderate
Active travel	Strong
Air quality, noise and neighbourhood amenity	
Air Quality	Strong
Noise	Strong
Neighbourhood amenity	Weak
Climate change	Strong
Crime reduction and community safety	Moderate
Housing and affordability	Moderate
Social cohesion and inclusive design	Moderate