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## Editorial

# Urban environmental health interventions towards the Sustainable Development Goals



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## ABSTRACT

The aim of the UN Sustainable Development Goals (SDGs) is to achieve a better and more sustainable future for all by 2030. Since the majority of the global population lives in cities, it is crucial to identify, evaluate and implement urban interventions (such as zero carbon housing, active transport, better urban connectivity, air pollution control, clean household fuels, and protection from heat and flood events) that will improve health and wellbeing and make our natural and built environment more sustainable. This Virtual Special Issue (VSI) comprises of 14 diverse case studies, methods and tools that provide suggestions for interventions which directly or indirectly support the achievement of the UN SDGs.

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## 1. Introduction

The United Nations 2030 Agenda for Sustainable Development, and its Sustainable Development Goals (SDGs) in particular, have focused the attention of researchers, practitioners and policy-makers on interventions that have the potential to provide multiple benefits (“co-benefits”) for health, the environment, and the economy, particularly in urban settings where two-thirds of the world population will live by 2050 (UN, 2018).

Progress towards the SDGs has been made in many areas, but, overall, action to meet the Goals is not yet advancing at the speed or scale required to achieve their specific targets and bring about transformational change. In September 2019, the UN Secretary-General called on all sectors of society to mobilize for a decade of action to accelerate sustainable solutions to the world’s biggest challenges, ranging from poverty and gender to climate change, inequality and closing the finance gap (UN, 2020).

Many of these challenges are experienced in cities around the world, and particularly in rapidly urbanising low and middle-income countries, which face overpopulation, lack of adequate resources and infrastructure, climate change, urban heat islands, extreme weather, air pollution, and related illnesses, inequalities and productivity losses (Salmond et al., 2018; Vardoulakis et al., 2016; Vardoulakis and Kinney, 2019). At the same time, the complex links between the growing burden of non-communicable diseases

(such as cancer, cardiovascular, respiratory, neurodegenerative and autoimmune diseases), urban form and environmental quality are becoming increasingly recognised.

Identifying and promoting effective urban environmental health interventions for addressing the SDGs, such as reducing carbon emissions (Goal 13), which can enhance good health and wellbeing (Goal 3), is urgent (Howden-Chapman et al., 2020). Well-planned, sustainable, changes to urban transport, housing, land use, renewable energy generation, and waste management have the potential to lead to improvements in air and water quality and livability of urban environments, providing multiple benefits including improved public health, reduced inequalities and higher productivity in cities (Vardoulakis et al., 2018). Furthermore, the use of smart sensing technologies and mobile platforms, and the development of advanced techniques for the analysis of big data, when applied appropriately, can revolutionise environmental and public health management in cities (Salmond et al., 2017). Citizen science, awareness raising and behaviour change campaigns are also expected to have an impact on environmental sustainability and urban health, although it is currently unclear whether benefits of such interventions can be sustained over time (Bonney et al., 2016).

The Healthy-Polis Consortium for Urban Environmental Health and Sustainability ([www.healthy-polis.org](http://www.healthy-polis.org)) aims to contribute to the implementation of the SDGs by identifying and evaluating specific policy initiatives, case studies, tools, evidence gaps, and opportunities for research and translation into environmental public health practice in cities around the world. In this Virtual Special Issue, we present a collection of such case studies from 10 countries (4 high income, and 6 middle

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**Table 1**

Case studies presented in the VSI: urban environmental health interventions towards the sustainable development goals by city or region.

Paper	Problem	Intervention	Topic	City or region/country	SDGs
Asumadu-Sakyi et al. (2019)	Exposure to extreme indoor temperatures	Improved thermal performance of houses	Heat and cold	Brisbane/Australia	11, 13
Zhen et al. (2019)	High energy consumption of indoor lighting & health consequences of poor lighting	Optimizing light fixtures	Light	Xi'an/China	3, 7, 11
Jamei et al. (2019)	Need to model urban climates for human health	Overview of climatic and bioclimatic modelling systems case study: ENVI-met	Urban climate	Melbourne/Australia	11, 13
Wu et al. (2019)	Extreme flooding events	Policy evaluation and recommendations for sheltering	Flooding	Anhui province/China	3, 13
Symonds et al. (2019)	Discerning & quantifying impacts of environmental policies on population health and health inequalities	Microsimulation model	Health and inequalities	London/UK	3, 11
Park et al. (2020)	Overheating of urban environments & impact on health	Radiant heat load mitigation strategies	Heat	Hypothetical urban site/Korea	3, 11
Adesina et al. (2020)	Indoor air pollution and health impacts of solid fuel burning	Case study analysis and evidence	Air pollution	Mpumalanga province/South Africa	3, 7
Howden-Chapman et al. (2020)	Impact of transport and housing on health, employment and wellbeing	Evaluation of investment and planning initiatives	Carbon emissions	Auckland and Christchurch/New Zealand	3, 6, 10, 11, 13
Xue et al. (2020)	Spatial heterogeneity and difficulty measuring air pollution over large areas	Satellite-derived spatiotemporal PM <sub>2.5</sub> concentrations	Air pollution	Various city clusters/China	3
Vommaro et al. (2020)	Climate change risk in urban areas	Indicators are proposed to identify and reduce municipal climate risks	Urban climate	State of Maranhão/Brazil	13 (13.1 & 13.2)
Mazorra et al. (2020)	Need for sustainable cooking solutions which minimise indoor air pollution	Comprehensive analysis of cooking solutions co-benefits at household level	Cookstoves	Casamance/Senegal, The Gambia and Guinea Bissau	3, 5, 7, 13
Macmillan et al. (2020)	Constraints on improving active transportation choices	Theory and case study approach to identify suburb-level changes for active transport	Active transport	Auckland/New Zealand	1, 3, 4, 5, 8, 10, 11 (11.2), 13, 15, 16, 17
Carmichael et al. (2020)	Establishing the link between buildings and public health	Public health research and evaluation of building policy	Housing	England/UK	3 (3.9), 11 (11.1)
Rother (2020)	Climate impacts on non-communicable diseases	Framework for understanding climatic pathways	NCDs	Sub-Saharan Africa	1, 2, 3, 6, 8, 11, 13

or low income countries; Table 1) and discuss their implications for achieving the SDGs (Fig. 1).

## 2. Urban environmental health case studies

The research presented in this Virtual Special Issue, highlights a number of key interventions aimed at achieving the SDGs and their consequent pathways to health and environmental impact. One of the main direct effects of climate change is the increase in global average temperature, as well as in the frequency and severity of extreme weather events (e.g. heatwaves). This has a disproportionate impact on built up areas due to the Urban Heat Island effect, housing overheating and overcrowding, and the vulnerability of the resident population (Heaviside et al., 2017). Two of the studies included in the special issue focus on temperature related impacts on health and wellbeing due to the poor thermal performance of houses in Brisbane, Australia (Asumadu-Sakyi et al., 2019), and the mitigation strategies aiming to reduce radiant heat load on buildings in Korea (Park et al., 2020).

One of the key challenges when attempting to address Goal 3 (health and wellbeing) is to improve both ambient and household air quality. Xue et al. (2020) focused on satellite-derived air pollution (PM<sub>2.5</sub>) as an evaluation index for health and wellbeing. In their paper, the temporal trends of PM<sub>2.5</sub> and the quantitative potential impact of environmental governance on PM<sub>2.5</sub> were analysed for China. Using environmental regulation intensity and synergy to quantify the influence of governance, they concluded that regulatory measures should be enhanced to further decrease PM<sub>2.5</sub> in the future (Xue et al., 2020). Symonds et al. (2019) used a microsimulation model to quantifying the impact of PM<sub>2.5</sub> exposures on mortality, morbidity and health inequality in London, UK, as an aid to selecting policies likely to have the greatest benefit (Symonds et al., 2019).

In a different context, Adesina et al. (2020) assessed the impact of solid fuel burning in an indoor and ambient environment near coal-fired power plants in South Africa using continuous monitoring of PM<sub>4</sub> in two houses, of which only one used coal as a primary source of

energy. They found significant differences in indoor air pollution levels during the winter season, but also at times high ambient concentrations, which indicated that decarbonisation of household energy and power generation could bring significant benefits for air quality and public health (Adesina et al., 2020). In a comprehensive analysis of cooking solutions in Western Africa, co-benefits of clean cooking solutions (Goal 7, affordable and clean energy) at household level were analysed in relation to Goals 3 (health and wellbeing), 5 (gender equality), and 13 (climate action). Interestingly, the most important co-benefit was related to gender equality (Goal 5), representing 60–97% of the total economic benefit of the intervention (Mazorra et al. 2020).

Carmichael et al. (2020) explored the use of public health research and evidence in policy to regulate new buildings in England to deliver improved public health, climate resilience and a reduced carbon footprint. They showed that public health evidence was hardly referenced in policy, and that a narrow focus on climate mitigation in building regulations results in both positive and negative impacts on health. This highlights the need for a systems approach around urban interventions (Carmichael et al., 2020).

Zhen et al. (2019) demonstrated that optimizing the design of natural lighting in residential buildings can greatly reduce lighting energy consumption and improve indoor environmental quality, as well as the physical and mental health of residents (Goal 3, health and wellbeing) (Zhen et al., 2019). Jamei et al. (2019) provided an overview of different types of climatic and bioclimatic modelling systems and presented their main benefits and shortcomings in urban applications (Jamei et al., 2019).

Human vulnerability assessment is an important tool within the scope of Goal 13 (climate action), as it can help develop adaptation strategies in the context of regional climate change. Vommaro et al. (2020) demonstrated the application of a modelling method to evaluate human vulnerability to climate change in the state of Maranhão, Brazil. Using a municipal vulnerability index based on socioeconomic, demographic, climate, epidemiological, and environmental aspects, they identified the most vulnerable areas under climate change (Vommaro et al., 2020).

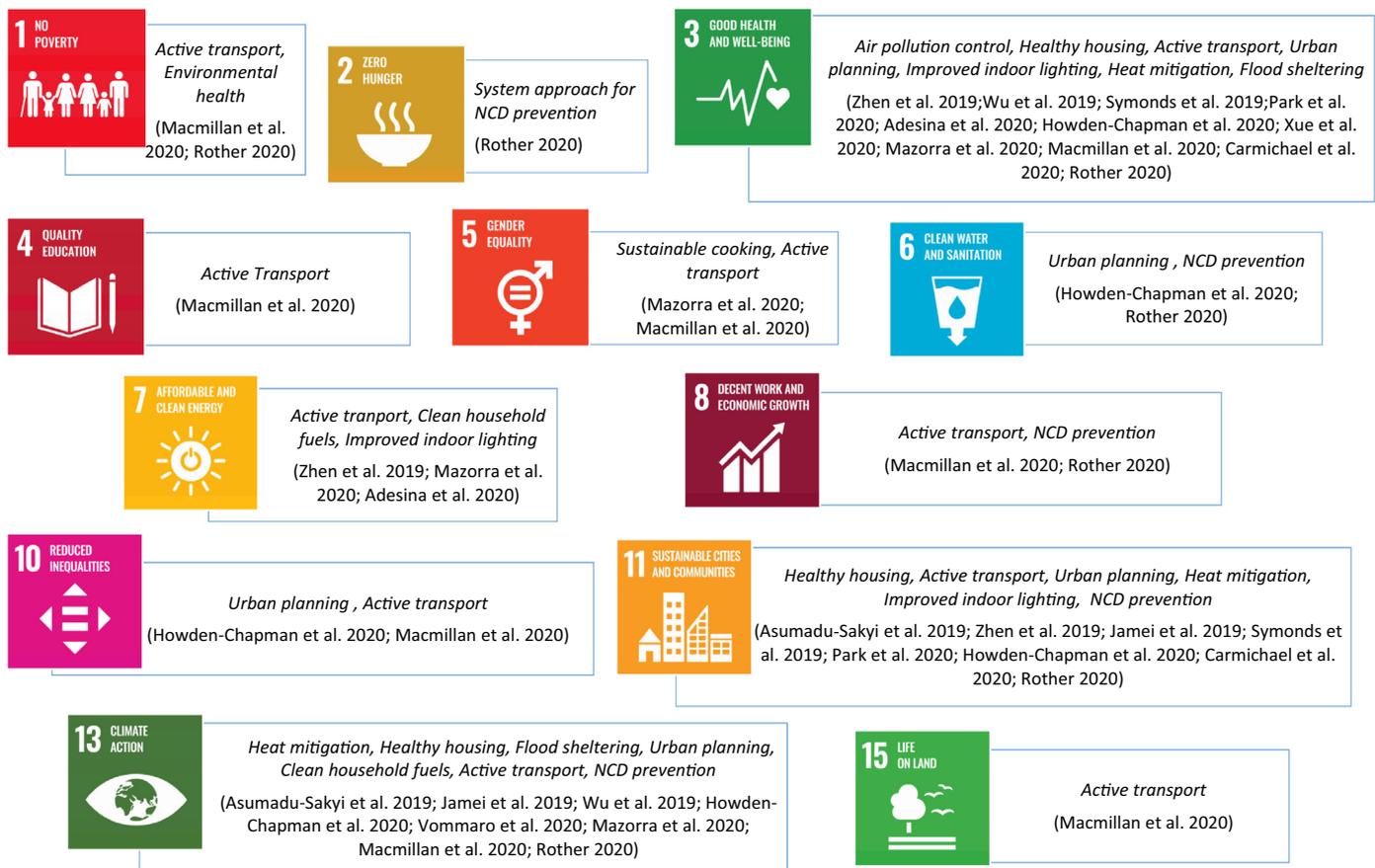


Fig. 1. Urban environmental health interventions discussed in the Virtual Special Issue in relation with the SDGs.

Wu et al. (2019) identified good practice and lessons learned from China's response to severe flooding in Anhui province in 2016. Good practice included using early warning systems to advise communities of risks and enforce evacuation in the flood zone, preparing and using schools as shelters with open-ended periods of operation, and providing stable shelter accommodations with medical and public health services, clean drinking water and food, sanitation, and toilet hygiene through multiagency cooperation. They concluded that disaster mitigation strategies need to be integrated with climate adaptation plans in cities (Wu et al., 2019).

Two studies from New Zealand focused on active transport (Macmillan et al., 2020), and on integrated urban planning and regeneration (Howden-Chapman et al., 2020). Macmillan et al. (2020) used an active transport case study from Auckland to illustrate the complex causal pathways that contribute to achieving several SDGs, including Goal 11 (sustainable cities) and Goal 10 (reduced inequalities). Howden-Chapman et al. (2020) examined four urban policies involving installation of cycleways and walkways, a central government measure to recentralise employment after the 2011 Christchurch earthquakes, the streamlining of housing developments by reducing land-use regulation, and changes of policy about public housing investment. They demonstrated that having a clear understanding of the benefits of increased physical activity for health could accelerate the reduction of carbon emissions. Furthermore, decisions about infrastructure, housing and job locations could generate health and environmental co-benefits, if supported by broader public transport investments (Howden-Chapman et al., 2020).

There is limited evidence in research, policies and in the SDGs about the impact of environmental factors on non-communicable diseases (NCDs) in urban areas of sub-Saharan Africa, although 80% of NCDs

are taking place in low- and middle-income countries and are linked to a third of the deaths in sub-Saharan Africa. Rother (2020) poses the question: what would these statistics look like if environmental risk factors (e.g., pollution, climate change) were prevented and controlled. Rother (2020) presents a framework for understanding climatic impacts on climate-sensitive NCDs and achieving the SDGs. This explains how current global mitigation interventions in high income urban settings, with implied health co-benefits for NCD reduction (i.e. use of less polluting vehicles, cycling, walking, public transport, green spaces), experience major implementation challenges in sub-Saharan African cities (i.e. too costly, lack of availability, poor road conditions, gender and cultural norms, security problems). The article recommends more support for research on the climate-NCD nexus, ensuring health professional training includes sustainable health education, and including a focus on climate change and health in primary and secondary school curricula (Rother, 2020).

### 3. Accelerating sustainable development for healthier cities

In the Decade of Action for SDG implementation (UN, 2020), the recovery pathways from COVID-19 are an opportunity for governments, urban planners, environmental public health practitioners, and other stakeholders to Build Back Better our cities (WRI, 2020). The Healthy-Polis VSI: Urban Environmental Health Interventions towards the Sustainable Development Goals provides diverse evidence, case studies and tools to inspire action in cities and regions around the world, so they can emerge healthier and more sustainable in the future post COVID-19. The interventions and tools discussed can be used to provide multiple environmental health solutions, which are context specific. For this reason, it is important to consider the intended and unintended consequences of these interventions by using a cross-disciplinary

systems approach and involving all relevant stakeholders in discussions and decision making. Promoting climate-sensitive urban policies, such as zero carbon housing, active transport, better urban connectivity, clean household fuels, and protection from heat and flood events, will help improve health and wellbeing in cities as we move towards achieving and sustaining the SDGs.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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