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Improving population health post-COVID-19 by addressing interacting threats to health and the environment

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Population health worldwide is confronted with three major and closely related threats: non-communicable diseases (NCDs), infectious disease outbreaks, and environmental degradation.[1] NCDs alone contribute to more than 70% of all deaths worldwide, amounting to over 43 million deaths annually, while infectious diseases and environmental risk factors together are responsible for nearly 20 million deaths each year. Increasing evidence suggests that these threats tend to co-occur and interact as a syndemic, in which multiple epidemics coexist and amplify their overall health impact. This interconnectedness aligns with the One Health approach, which recognizes the interdependence of humans, animals, and the environment and promotes cross-sector collaboration. For example, ecosystem degradation and climate change can increase human exposure to zoonotic pathogens and disease vectors, while air pollution from fossil fuel combustion contributes substantially to chronic respiratory and cardiovascular diseases, thereby increasing susceptibility to severe infectious outcomes. Therefore, a systems-level approach is needed for an effective response to the converging threats to population health worldwide.

These interacting threats are not coincidental but arise from common upstream determinants that influence population-level exposures and risks. A recent Lancet Commission on improving population health post-COVID-19 identifies three key systems underpinning the three major threats to population health discussed above: the physical environment and transport systems, agriculture and food systems, and energy systems.[2] Together, these systems determine patterns of population-level exposures, including those related to transport, diet, energy use, and the physical environment, which are associated with the burden of NCDs, infectious disease outbreaks, and environmental degradation. For example, transport and urban systems reliance on private motor vehicles contribute to physical inactivity and ambient air pollution; current food and agricultural systems, marked by intensive production and widespread availability of ultra-processed foods, promote unhealthy diets while exerting pressure on ecosystems; and continued dependence on fossil fuels remains a major driver of climate change and air pollution. Addressing these underlying determinants therefore requires coordinated and sustained action across sectors, rather than isolated or disease-specific interventions. On this basis, the Commission calls for transformative action across these three systems, setting out a shared agenda to build healthy and sustainable physical environment and transport systems, agriculture and food systems, and energy systems.

The post-COVID-19 framing highlights not just a temporal shift but also a transformational change in global health systems. The pandemic strengthened surveillance and early warning for infectious disease threats through expanded laboratory and genomic sequencing capacity and use of multi-source data, supporting earlier detection of abnormal health events. Moreover, the emergence of long COVID underscores that infection can generate persistent, multi-organ chronic sequelae that add to NCD burdens, consistent with the concept of a syndemic and reinforcing the need to integrate infectious disease and NCD prevention and care.[3] In addition, COVID-19 recovery funds created a unique policy window to accelerate transition across these three systems, but they were often used in ways that maintained existing patterns rather than advancing cleaner, healthier pathways. Taken together, these post-COVID-19 developments strengthen both the urgency and the feasibility of acting on the Commission's shared agenda.

Within this shared agenda, transformation of physical environment and transport systems represents a key pathway to improving population health while reducing environmental degradation. Policies in this domain focus on transforming urban form and transport systems to enable active and public travel, reducing reliance on private motor vehicles, integrating green and blue spaces into urban and neighborhood environments, and promoting building standards that reduce harmful exposures while improving energy efficiency. Paris' "15-minute city" and Melbourne's "20-minute neighborhoods" aim to meet daily needs within walking distance while keeping public transport to destinations beyond the neighborhood. These improvements were achieved primarily through reductions in emissions from transport and industry and the phased replacement of coal-based heating, highlighting the potential for structural environmental policies to reduce population exposure to ambient air pollution, with expected benefits for cardiopulmonary health.

Second, agriculture and food systems require substantial reform to improve population health and reduce environmental degradation. Current patterns of food production, processing, and consumption contribute to the syndemic of NCDs, infectious disease risk, and environmental degradation. For example, deforestation for oil-palm cultivation releases substantial amounts of carbon and disrupts ecosystems, while the widespread incorporation of low-cost palm oil into ultra-processed foods has been associated with rising prevalence of obesity and type 2 diabetes. These diet-related NCDs are, in turn, associated with increased vulnerability to adverse infectious disease outcomes. At the same time, habitat disruption and intensive livestock production increase human–animal contact and facilitate the spillover of zoonotic pathogens. Addressing these interacting risks requires a shift towards food systems that support sustainable agricultural practices, ensure access to healthy and affordable diets, limit the production and consumption of harmful foods, and protect land and ecosystems from further degradation.

Third, energy systems must also shift towards cleaner and more sustainable models. Continued reliance on fossil fuel combustion is a major contributor to climate change and a leading source of ambient and household air pollution, accounting for millions of premature deaths globally each year. Addressing these combined risks requires energy systems that transition towards zero-carbon sources and reduce population exposure to harmful air pollutants. Recent developments show such transitions can occur at scale, especially in China: in the first six months of 2025 alone, China added approximately 212 GW of solar power and 51 GW of wind capacity, contributing to a slowdown in the growth of carbon emissions and improvements in air quality.[4] Reducing exposure to polluting household fuels is also critical. In many low- and middle-income countries, the continued use of coal and biomass for cooking and heating remains a major source of indoor air pollution, with particularly severe impacts among women and children. Scaling up access to clean cooking fuels and cleaner heating options can substantially lower population exposure to harmful pollutants, with expected benefits for respiratory and cardiovascular health.

Across these system transformations, equity and justice must be explicitly integrated.[5] The burdens of NCDs, infectious disease outbreaks, and environmental degradation are unevenly distributed, with disadvantaged populations consistently experiencing the greatest harms. Children and future generations are likely to bear a disproportionate share of the long-term consequences of environmental degradation. Efforts to address this clustering of NCDs, infectious disease outbreaks, and environmental degradation must therefore aim not only to improve overall population health, but also to reduce social inequalities and promote intergenerational equity. Policy design should ensure that the benefits of cleaner air, healthier food systems, and climate mitigation are equitably distributed, including through measures such as subsidizing healthy foods and public transport in low-income communities, and implementing climate policies, such as carbon pricing, in ways that do not impose undue financial burdens on those least able to pay. Equitable implementation can advance progress towards the Sustainable Development Goals and deliver health, social, and economic benefits.

Whether system-level transformation improves population health depends on how policies are implemented. In many settings, action is constrained by fragmented governance, limited institutional capacity, and economic interests that conflict with population health goals. These challenges have consistently weakened efforts to reform physical environment and transport systems, agriculture and food systems, and energy systems. Nevertheless, several governance mechanisms have shown promise, including health-in-all-policies frameworks that strengthen policy coherence across departments and keep health and environmental outcomes visible in decision making. This is often delivered through inter-ministerial or cross-sector coordination and is reflected at the city level in networks such as C40 Cities, where nearly 100

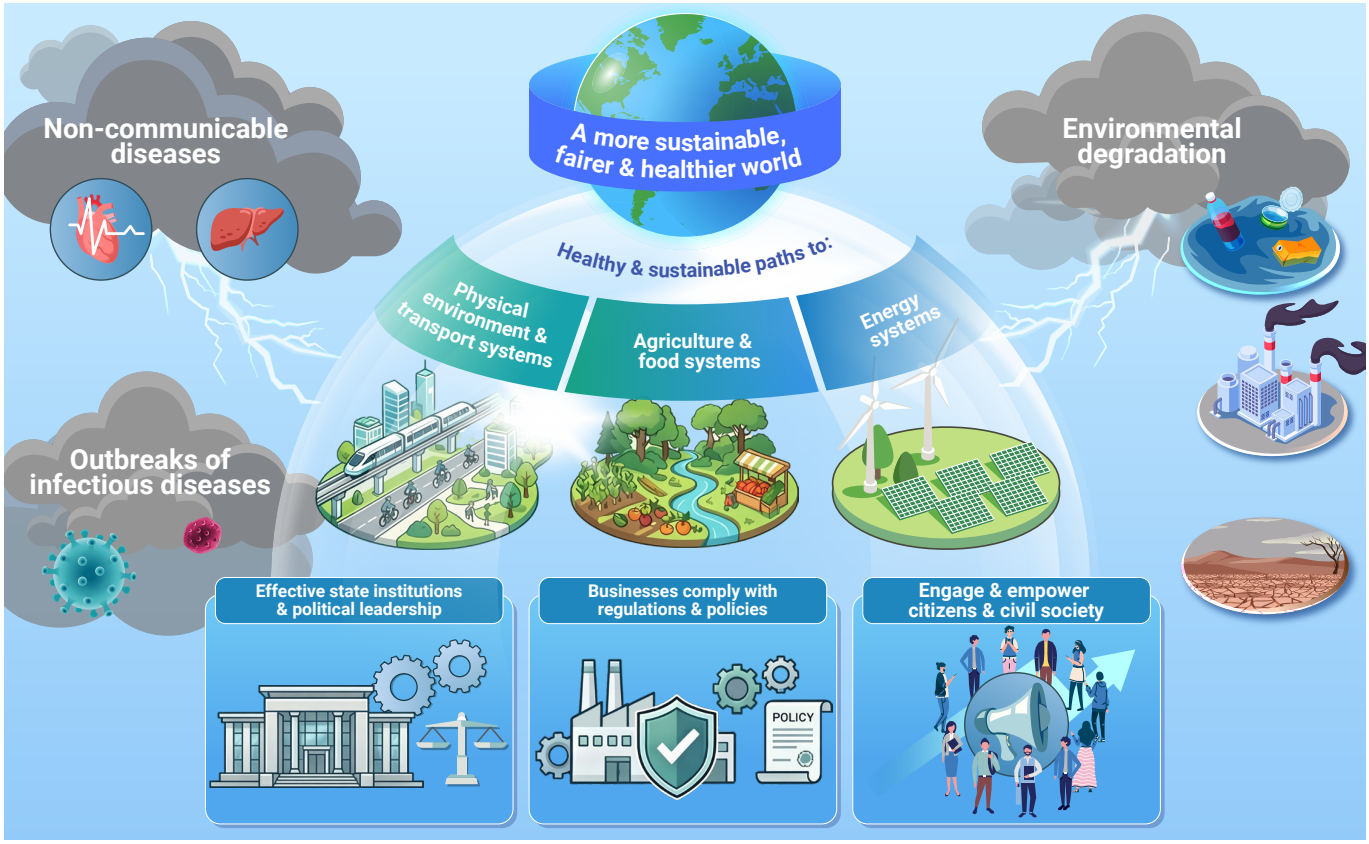

Figure 1. Transformative action across three key systems and governance to address the three major threats to population health Transformative action across the physical environment and transport systems, agriculture and food systems, and energy systems can reduce the interacting threats to population health including non-communicable diseases, infectious disease outbreaks, and environmental degradation and contribute to a more sustainable, fairer, and healthier world. The storm clouds indicate these three interacting threats, and the three pillars indicate the key systems that underpin them. The shield represents protection of population health from these interacting threats. The base represents cross-cutting governance that underpins action across all three systems through coordination across sectors, clear regulatory frameworks, and accountability for health and environmental outcomes. Governance is supported by effective state institutions and political leadership, businesses complying with regulations and policies, and engaging and empowering citizens and civil society, helping address fragmented governance, limited institutional capacity, and economic interests that conflict with population health goals.

mayors share policy tools, track progress towards targets, and accelerate coordinated action across urban policy domains relevant to these system transformations. This coordination is more likely to deliver change when it is paired with accountability metrics and enforceable legal mechanisms. In the UK, ClientEarth's repeated court challenges over unlawful air-quality plans required the government to amend those plans, illustrating how legal action can reinforce accountability. Addressing these barriers requires governance approaches that support coordination across sectors, clear regulatory frameworks, and accountability for health and environmental outcomes, consistent with implementing a One Health approach in practice. Public institutions must also have the capacity to apply existing evidence in policy design and implementation, rather than relying on isolated or short-term measures. Engagement of health professionals, civil society organizations, and local communities can further support implementation by improving policy alignment with local needs, feasibility, and public acceptance (Figure 1).

In conclusion, improving population health after COVID-19 requires sustained attention to the structural determinants of health. The COVID-19 pandemic has highlighted the limitations of fragmented approaches and reinforced the need to address the shared drivers of NCDs, infectious disease outbreaks, and environmental degradation. Improving population health and reducing environmental degradation are closely associated, and policy responses should address this association systematically. Progress therefore depends on investing in systems that reduce harmful exposures and improve living conditions relevant to health, supported by coordinated action across sectors. When implemented consistently over time, such approaches can reduce avoidable disease burden, strengthen societal resilience, and support sustainable development.

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AUTHOR CONTRIBUTIONS

H.W. and L.L. drafted the manuscript, L.L. and T.W. supervised the work. All authors contributed to and approved the manuscript.

DECLARATION OF INTERESTS

The authors declare no competing interests.