How coronavirus disease has changed the environment and health landscape

A POLICY BRIEF
Abstract

Despite robust structures and protocols to deliver the environment and health agenda in countries across Europe and implicit understanding that an infectious pandemic was possible, coronavirus disease (COVID-19), when in hit, was a massive shock. Few operating in the environment and health discipline, at any level, could have anticipated the full range of challenges to the environment, health and equity as the deadly virus circulated and society adopted unprecedented measures to manage and control it. A vast volume of academic and grey literature continues to accrue, with analysis and reflection on what occurred, what can be learnt and the implications for future preparedness. The declaration by WHO on 5 May 2023 that COVID-19 is no longer a public health emergency of international concern and the sobering reality that nearly 2 250 000 people in the WHO European Region died from the disease must engender a period of meaningful reflection and also sustained action. The aim of this policy brief is to support the necessary reflection and action by distilling the impacts of the pandemic on the many domains of environment and health and summarizing the evidence that its roots lie in disregard for events at the interface of human, animal and environmental health.


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Acronyms

COVID-19  coronavirus disease
EHP     Environment and Health Process
HERA    Health and Environment Research Agenda
PM      particulate matter
PM$_{2.5}$ particulate matter measuring ≤ 2.5 µm
PM$_{10}$ particulate matter measuring ≥ 10 µm
WASH    water, sanitation and hygiene
Executive summary

Even in a time made more perilous by the many, accelerating impacts of human-driven change in the natural world and by conflict, the coronavirus disease (COVID-19) pandemic stands out as one of the greatest global shocks in decades. By 5 May 2023, when WHO declared that COVID-19 was no longer a public health emergency of international concern, nearly seven million people had died globally, one third of whom (nearly 2 250 000) were in the WHO European Region (WHO, 2023). Others now live changed, sometimes significantly compromised lives after infection with SARS-CoV-2. Lockdowns and other measures to contain the spread of the virus severely impacted societies, economies and daily life everywhere. Yet, in many countries, social, economic and leisure activities have rebounded to the pre-pandemic situation. The virus has not, however, gone away. In the modes and speed of its transmission, in the social and demographic patterns of those most affected, in its zoonotic origins, and in society’s insufficient preparedness, the pandemic has raised a daunting agenda for society and its institutions. The agenda is for health protection and resilience, with the nexus of environment and health at its core. Moreover, the agenda is made more urgent by the strong probability of future zoonotic pandemics, which will, very plausibly, co-occur with climate-related emergencies.

National and subnational authorities are central players in managing the pandemic and in addressing the deficits in health protection, equality, sustainability and resilience brought to light by COVID-19. Progress will require an appropriate blend of policies and actions tailored to national and local circumstances. The next steps for every country are, however, best founded on a clear, shared understanding of how the SARS-CoV-2 virus emerged, how it spread and the many ways in which the pandemic impacted and continues to impact a number of domains in environment and health.

Drawing on a supporting literature review (WHO Regional Office for Europe, 2023a) and, selectively, from extensive grey literature, the aim of this brief is to summarize the impacts of COVID-19 on the environment and health landscape. It also presents lessons from the experience of the pandemic, with lockdowns, travel bans, stay-at-home policies and other restrictions, which can inform future environment and health activities. A companion paper, Delivering effective environment and health in a changed European landscape (WHO Regional Office for Europe, 2023b) addresses a wider context for environment and health in Europe in the 21st century and includes a compendium of concepts, approaches and tools to support national and subnational activities.

A number of key lessons emerge from this document and the literature reviewed during its preparation. Some are relevant for the wider discipline and all of society, while others are specific to domains of environment and health.

- With surprisingly little warning, a deadly infectious disease can course through communities and in hospitals and threaten to overwhelm established systems in weeks, days or even hours, regardless of the level of affluence and development of the countries involved.
- There is abundant evidence of the frequency with which zoonotic infections now jump from wildlife to humans. Knowledge of the context and mechanisms involved indicates that further pandemics can be expected.
- Future pandemics are very likely to co-occur with climate-related emergencies.
such as floods, wildfires, droughts and extreme weather events, highlighting the requirement for resilience in society and its institutions.

• Measures to mitigate the spread of infection profoundly impact global and national economies, the functioning of society, the day-to-day lives of individuals and their health and well-being.

• In common with many other emergencies and large-scale disruptive events, pandemic disease and the societal response disproportionately affect vulnerable communities, exposing and exacerbating inequality.

• The pandemic has revealed major deficits in preparedness and resilience throughout society, its institutions and its services. These must be addressed rapidly to anticipate future pandemics and co-occurring climate-related emergencies.

• COVID-19 has done much to re-establish infection as a priority for environment and health in low-, medium- and high-income countries.

• Many of the underlying conditions that make individuals and groups particularly vulnerable to serious illness after infection with SARS-CoV-2 are generated, to differing degrees, by adverse environmental exposure, notably air pollution.

• The importance of redoubling efforts and directing resources to water, sanitation and hygiene (WASH) and wastewater management has been reinforced by COVID-19 and the (now more acutely) recognized threat of future pandemics.

• Waste management systems designed and scaled for steady-state operations have very limited resilience. Careful reflection on future-proofing waste management operations is now essential.

• The public health case to improve ventilation in buildings has been highlighted during the pandemic. Improved ventilation can prevent airborne spread of infection and reduce the concentrations of other indoor pollutants of health significance.

• COVID-19 has revealed the vulnerability of food systems and food chains in a pandemic, which undermines food security, health and well-being in certain locations and at certain times.

• Lockdowns and other measures to contain the pandemic profoundly changed public spaces and how they are used. Lessons from the pandemic and existing knowledge can be exploited to create and deliver a new vision of healthy, equitable, resilient public spaces.

• Experience and lessons from the pandemic must be built upon to secure greater health sector capacity and resilience in anticipation of future pandemics and co-occurring climate-related emergencies.

References

WHO Regional Office for Europe (2023a). Delivering effective environmental health: A compendium of concepts, approaches and tools to accelerate action in the WHO European Region. Copenhagen: WHO Regional Office for Europe. (https://apps.who.int/iris/handle/10665/368167, accessed 26 June 2023)

Although many aspects of day-to-day life in Europe now closely mirror pre-pandemic conditions, the COVID-19 story, with the associated human tragedy and its profound social and economic impacts, is not over. Three years since its emergence, its global footprint remains immense, and it continues to cast a long shadow across the world. Moreover, in the absence of effective preventive action, infectious pandemics of zoonotic origin are predicted to emerge more frequently and kill more people, highlighting gross inequality, successively disrupting society and potentially devastating the global economy (IPBES, 2020).
These challenges are superimposed on other threats to population health, many of which, particularly climate change, share COVID-19’s origins in humanity’s treatment of nature and its persistent disregard for developments at the interface of human, animal and environmental health (WHO Regional Office for Europe, 2021a). Managing the destructive impacts of human activity that now contribute to fires, floods, heatwaves, droughts and famine is a modern imperative. Yet, humankind’s most daunting 21st century task must be to re-establish a “safe operating space for humanity” (Rockström et al., 2009), in which such threats recede. This is both a public health and an existential challenge. Environment and health, its concern being to understand and manage the nexus of the environment (built and natural) and human health and well-being, is central to a coherent societal response.

For nearly 35 years, the European Environment and Health Process (EHP) has represented a Europe-wide forum for addressing environment and health issues. In successive ministerial conferences, the EHP has secured agreement on priorities within an evolving environment and health agenda that can be addressed by countries. The EHP covers both new and established concerns in environment and health in areas such as air quality, chemical safety, climate change, water, sanitation and hygiene (WASH), wastewater management, waste, and contaminated sites. Accelerating threats to health due to the changing climate inevitably feature strongly within the EHP, while cross-cutting themes such as inequality and economics have also been developed. Recent ministerial conferences have identified the health-promoting potential of green, blue and natural environments; healthy, equitable, sustainable urban spaces; and building environmentally sustainable health systems. All are central components of a modern agenda for environment and health.

The EHP is sensitive to the different national circumstances of the 53 countries in the WHO European Region and consistently reinforces the local or “proximal” context as the crucible for environmental health activity. It is here that environmental factors interact with social, economic and other influences to create and/or destroy health, well-being and equity. Moreover, acting at the national, and especially local, scale of cities, towns and rural centres gives traction to the global sustainability agenda, which is central to tackling climate and other global health challenges. Thus, for example, the Ministerial Declaration and its compendium of actions from the 6th Ministerial Conference in Ostrava, Czechia (WHO Regional Office for Europe, 2017) are explicitly aligned with national commitments under the United Nations 2030 Agenda for Sustainable Development, with its 17 Goals (United Nations, 2015a) and with the 2015 Paris Agreement on Climate Change (United Nations, 2015b).

The Sustainable Development Goals, adopted by the General Assembly of the United Nations in 2015, consist of 17 global goals for improving the planet and the quality of human life around the world by the year 2030. Of particular relevance to the EHP, the response of individual countries is identified as vital to progress in achieving the Goals. Actions at the nexus of environment and human health could significant advance progress, individually and collectively.

Six years on from Ostrava and more than half way to the 2030 deadline for achieving the Goals, participants in the 7th Ministerial Conference in Budapest, Hungary, in 2023, face a Europe made still more perilous and unequal by continuous warming of the planet, shrinking biodiversity and accelerating change in many Earth systems (Rockström et al., 2009; Steffen et al., 2015; Persson et al., 2022).

Thus, while climate change may be Earth’s most pressing health and existential challenge, other global environmental changes such as biodiversity loss, land use changes and pollution also threaten humanity’s health and existence. Against this backdrop, planning for
mitigation, adaptation and resilience assumes huge importance, nationally and locally. Yet, COVID-19 and the more acutely recognized future pandemic threat make the task more urgent and complex. It has been observed, for example, that COVID-19 has “aggravated climate risks” and that the pandemic shows “the interconnected and compound nature of risks, vulnerabilities, and responses to emergencies” (IPCC, 2022).

Reinstatement of infection at the core of the European environment and health agenda, which was long dominated by noncommunicable diseases, is a significant qualitative change for environment and health as a discipline, with operational implications. The pandemic has shown that multiple issues for health, well-being and equity, some of which are unanticipated, emerge when a readily transmissible, deadly respiratory infection circulates in society.

The purpose of this policy brief, which is based on a literature review (WHO Regional Office for Europe, 2023a) is to present an overview of how COVID-19 changed the environment and health landscape and the lessons that can be derived for the discipline from the COVID-19 pandemic. This includes understanding the changes that the circulating virus and the measures to contain it have made in specific domains of environment and health. For example, there have been important, arguably unanticipated, lessons about how a viral respiratory pandemic can profoundly impact the waste sector or introduce new environment and health concerns into the home. Yet, if society is to reduce future pandemic threats and “build forward better” after COVID-19, it is no less important to understand how the virus emerged in the first place and spread to pandemic proportions. Furthermore, the role of human behaviour and attitudes to the environment in these processes must be recognized. National and subnational authorities are also responsible for these issues, through environment and health activity.

Although public health concepts and frameworks such as planetary health (Whitmee et al., 2015), ecological public health (Rayner & Lang, 2012) and One Health (WHO Regional Office for Europe, 2021b) predate the pandemic and differ in important respects, each is an important recognition of the complex interdependence of the health of ecosystems, of humans and of other species. They thus express humanity’s dependence on a properly functioning natural world for health, well-being and continued existence. These frameworks are summarized in a companion paper, Delivering effective environment and health actions. A compendium of concepts, approaches and tools for the WHO European Region (WHO Regional Office for Europe, 2023b).

One Health is of particular relevance for the task of “building forward better” in the wake of COVID-19 (WHO Regional Office for Europe, 2021b). As a unifying approach, it sustainably balances and optimizes the health of people, animals and the environment and, in this way, reduces the risk that zoonotic pathogens will jump from wildlife to humans. One Health is endorsed by an alliance consisting of the Food and Agriculture Organization of the United Nations, the World Organisation for Animal Health and WHO, with the United Nations Environment Programme – the so-called “quadripartite group”. In expressing support for a new working definition of One Health (see Box 1), the group observed that, by mainstreaming the approach, they could more effectively prevent, predict, detect and respond to zoonoses and wider global health threats and promote sustainable development (WHO, 2021). One Health is presented as a means of mobilizing multiple sectors, disciplines and communities to work together on climate change and ecosystem threats to health and sustainable development while addressing the collective needs for clean water, energy, air and safe, nutritious food. Of particular relevance to the EHP, the One Health approach can be applied to communities and at subnational and national levels as well as globally and regionally. A recent report (WHO Regional Office for Europe, 2022) provides a
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Box 1. Definition of One Health

One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants and the wider environment (including ecosystems) are closely linked and interdependent.

The approach mobilizes multiple sectors, disciplines and communities at varying levels of society to work together to foster well-being and tackle threats to health and ecosystems, while addressing the collective needs for healthy food, water, energy, and air, taking action on climate change and contributing to sustainable development.


The global shock of COVID-19, coupled with recognition of humanity’s role in its emergence, continues to generate a significant amount of literature on building forward better in the wake of the pandemic. WHO provided an early authoritative contribution with their Manifesto for a healthy green recovery from COVID-19 and its six concise “prescriptions” (see Box 2) (WHO, 2020a). These prescriptions remain entirely apposite and indicate the intention to go further than early detection and control of disease outbreaks. Specifically, they reflect the need for humanity to reduce its impacts on the environment and thereby reduce the risk of future pandemics at source. A second publication (WHO, 2020b) presents more than 70 “actionables” or practical steps for implementing the prescriptions. A central, often repeated message of the Manifesto is that society cannot go back to the way things were done before.

Box 2. Six prescriptions for a healthy, green recovery from COVID-19

1. Protect and preserve the source of human health: Nature.
2. Invest in essential services, from water and sanitation to clean energy, in health-care facilities.
3. Ensure a quick, healthy energy transition.
4. Promote healthy, sustainable food systems.
5. Build healthy, livable cities.
6. Use tax-payers’ money to fund pollution reduction.


Building forward to a better, more resilient world in the wake of COVID-19 and climate change is echoed in other green recovery initiatives around the world. Although the European Green Deal (European Commission, 2019) was published before the pandemic, the aim of its package of policy initiatives is to set the European Union on the path to a green
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transition. Many such initiatives and frameworks call for integrative approaches and emphasize the equity and interdisciplinarity that are necessary for transformative change. There is also increased focus on low-carbon energy and energy-saving programmes and, linked to this, energy security, which has been accelerated by the current conflict in Ukraine and the attendant energy crisis. This focus is evident in, for example, the European Commission’s REPowerEU Plan (European Commission, 2019, 2022), which addresses energy saving, clean energy production, diversification of energy supplies, and fast-forwards the green transition.

As the environment and health community shapes and prioritizes its activities and identifies partnerships, it must be more alert than ever to the interconnectedness and interdependence of activities for health, equity and environmental sustainability. The effectiveness of the environment and health agenda will be judged not only in terms of progress towards the established goals of the discipline but also by its capacity to seize opportunities to ensure co-benefits and to avoid unintended negative consequences in various policy areas. Nevertheless, an ever-present danger is that, amid the understandable desire to re-establish “normal life” in all its social, commercial, economic and cultural dimensions, the lessons of the pandemic will be forgotten or not acted upon. This would waste the opportunity to address the many deficits in health, equity, sustainability and, critically, resilience that have been so tragically revealed by COVID-19.

A new research agenda in environment and health that has emerged from the COVID-19 pandemic, has been explored extensively within the European Union Horizon 2020-funded Health and Environment Research Agenda (HERA) project (Health and Environment Research Agenda, 2020).

References

**Companion literature review to this policy brief**


**Empirical academic articles**


**Publications by statutory bodies, agencies and other authoritative public sources**


Further reading

CHAPTER 2

COVID-19: Where did it come from, and how did it spread?
2.1 The origins of COVID-19

Zoonotic diseases emerge and spread into human populations when nature’s resilience is weakened. Like many such diseases, COVID-19 has its origins in the diverse microbes present in animal reservoirs; yet, its emergence is entirely driven by human activities (IPBES, 2020).

Deforestation, agricultural expansion and intensification, livestock farming, hunting and urbanization all directly impact wildlife habitats, as does human-generated noise and light pollution, and, of course, climate change. When habitats are damaged, biodiversity loss is an inevitable consequence. In turn, this reduces the number of potential animal hosts for zoonotic pathogens, increasing the likelihood of viruses crossing over to humans. This risk is multiplied where human contact with wildlife and livestock is greatest and where stressed animals shed viruses. After transfer to humans, infections may rapidly achieve epidemic or pandemic proportions, when, as in COVID-19, infection spreads through road networks, urban centres, global travel, trade routes and others (IPBES, 2020).

Bats are believed to carry many different types of coronavirus and are considered the probable primary host of SARS-CoV-2, the virus responsible for COVID-19. A WHO investigation into the origins of SARS-CoV-2 (WHO, 2020; Zhou et al., 2020) noted that transfer to humans had probably occurred through a secondary host, possibly, although not definitively, a pangolin. Studies have revealed a number of animal species that are susceptible to infection with the virus (WHO, 2020). In practice, humans can come into contact with wildlife in various ways, through hunting, poaching and the (now international) wild meat trade. Wet markets, where live animals and meat are sold, are obvious potential sources of contamination and are also settings where human–human transmission may be amplified. The involvement of a wet market is certainly plausible in the genesis of COVID-19 and other recent viral crossovers (Wang et al., 2020; WHO, 2020; Zhou et al., 2020; Wu, 2021).

References

Companion literature review to this policy brief

Empirical academic articles


Publications by statutory bodies, agencies and other authoritative public sources


Further reading
2.2 Transmission of SARS-CoV-2 in the environment

SARS-CoV-2 is an “enveloped virus”. That is, its genetic material is packed inside an outer layer, or envelope, made up of proteins and lipids; the envelope embodies the familiar “spike proteins” for attaching to human cells during infection. The structure of the virus is important because, as is the case with other enveloped respiratory viruses, the SARS-CoV-2 envelope can quickly degrade on contact with the environment. Thus, many environmental factors, such as temperature, humidity and surface conditions, can affect survival and transmission (WHO, 2020a; CDC, 2021a).

Three routes of transmission of the SARS-CoV-2 virus are recognized. The first is direct droplet transmission in which infected individuals release droplets when coughing, sneezing, singing, talking or breathing heavily. These droplets are then inhaled or alight on the mucosa of an uninfected individual in close proximity to the infected person, resulting in infection.

The second route is droplet deposition on surfaces or objects (fomites), which, if touched by an uninfected individual who subsequently touches the mucosa of their eyes, nose or mouth, can result in infection. It has been reported that, under laboratory conditions, viruses can remain viable on surfaces for periods ranging from a few hours to 9 days, depending on the nature of the surface, although the length of viability is reduced in less conducive environmental conditions (WHO, 2020a). It is notable that the United States Centers for Disease Control and Prevention consider the risk of surface fomite transmission to be low (CDC, 2021a). While recognizing its lesser importance as a route of transmission, WHO strongly emphasizes the importance of good hygiene and of regular disinfection of touched surfaces such as door handles, handles and countertops (WHO, 2020a). Cleaning (with soap or detergent) and disinfection reduce the risk of transmission from surfaces or fomites, while hand hygiene and avoiding touching the face remain the primary preventive approaches. The virus has been reported to survive on hands for between 10 min to several hours.

The third route of transmission is transfer of the virus in aerosols, primarily to individuals in close proximity, potentially over much longer distances and in poorly ventilated settings. Infective aerosols comprise the smallest droplets directly exhaled by infected individuals; the very small particles generated as droplets carrying the virus dry out in the air. Once infectious particles are aerosolized, they can remain suspended in air for many hours, enabling transmission of the disease through inhalation by others at some distance from the source. Laboratory studies suggest that viruses can remain viable in aerosols for as long as 16 h, but, again, environmental factors such as temperature and humidity may reduce this time considerable.

One review cited four studies conducted by combined epidemiology and genome sequencing that provide convincing evidence of long distance (> 2 m) airborne transmission. The authors concluded that SARS-CoV-2 can be transmitted from an infectious individual to others more than 2 m away in a range of indoor non-health-care settings, even where the infected person is asymptomatic or pre-symptomatic (see WHO Regional Office for Europe, 2023).

Despite its significant potential range, aerosol transmission remains greatest 1–2 m from the source at which the concentration of the very fine droplets is highest. More remote transmission indoors is a particular risk when
an infected individual exhales the virus for more than 15 min in conditions of insufficient ventilation, where there is no singing, shouting or physical activity and where uninfected individuals are in the space for long periods (CDC, 2021b; WHO, 2020b).

References

Companion literature review to this brief

Publications by statutory bodies, agencies and other authoritative public sources


Further reading


2.3 The home environment and other indoor settings

For all the reasons outlined above, the indoor environment is the most important setting for transmission of respiratory viruses. Most obviously, while indoors, people are often in close proximity to others, facilitating large droplet transmission from infected to uninfected individuals. Similarly, transmission through the aerosol route is also much more likely indoors because small infective particles suspended in the air become concentrated, particularly where ventilation and air circulation are limited. Aerosols present particular challenge for infection control because they extend the distance at which people might become infected, circumventing many infection control protocols. As stated above, the SARS-CoV-2 virus has been found to be capable of retaining stability and viability in aerosols for several hours, depending on environmental conditions.

A recent review, citing evidence of long-distance airborne transmission of SARS-CoV-2 in indoor settings such as restaurants, workplaces and venues for choirs, posited that insufficient air replacement is a key contributing factor (see
WHO Regional Office for Europe, 2023). The authors argued that their results indicate the importance of mitigation measures in indoor settings, in particular adequate ventilation. So-called “congregate settings”, such as refugee camps, prisons and long-term care institutions, homeless shelters, slum areas and crowded households, where people live in very close proximity, are considered especially risky. War and other situations that result in mass migration can create many contexts in which there is a high risk of indoor viral transmission. The various challenges of preventing the spread of SARS-CoV-2 and protecting individuals indoors are covered in a plethora of important sector-specific guidance, which cannot be summarized here.

The COVID-19 pandemic has also highlighted a quite different set of health-relevant impacts related to the indoor environment in pandemic situations. These originate in lockdowns, travel bans, stay-at-home orders, working from home and home schooling that result in more time being spent in the home. When people are obliged to spend more time at home, especially in crowded situations, sufficient ventilation cannot be assumed, thus allowing the build-up of all indoor pollutants. Increased emissions of particulate matter (PM) and volatile organic compounds from increased domestic cooking, cleaning and indoor tobacco smoking have been observed. There is a reported tendency to clean homes more frequently, often with stronger chemicals and detergents, to control infection (see section 2.10).

The challenges of maintaining thermal safety and comfort are magnified where people are obliged to spend a long time indoors and especially when the household income is reduced. For many households, the issue may be one of fuel poverty and inability to heat the home, while, for others, stay-at-home policies simply exacerbate existing challenges of extreme heat. The climate of the WHO European Region is warming quickly and dangerously, accelerating the rates of temperature increase and driving the unprecedented frequency and intensity of heat waves (WHO Regional Office for Europe, 2022a).

Indoor environments can also create hazardous exposure to extreme heat. Occupancy profiles and behavioural factors (each potentially modified by pandemic disease) and building characteristics (over which occupants can often exercise very limited control) are important. Extreme heat, in combination with requirements to remain at home, magnify heat-related health risks. Furthermore, the people who are most vulnerable to complications of COVID-19 are those who are the most vulnerable to the effects of heat. This group includes the elderly and people with medical conditions such as asthma, diabetes and heart disease. A clear lesson from COVID-19 is that public health challenges in a warming world will be modified and magnified in any pandemic situation. Many WHO Member States have prudently revised their “heat-health action plans” to take account of the risk of COVID-19. In the European Region, WHO has adjusted its regular summertime advice to minimize the adverse health effects of hot weather by integrating it with advice on protection from SARS-Co-V-2. This is now presented in a fact sheet, which is available in 15 languages (WHO Regional Office for Europe, 2022b).

From the perspective of equity, options for cooling the indoor environment, including active cooling technologies such as air conditioning, are often least accessible to vulnerable individuals and poorer households.

A further consideration for environment and health has been the stress-related impacts of pandemic control measures. A desire to better understand these impacts has resulted in significant research. When people are obliged to spend more time in their homes, they may experience unaccustomed isolation or, in other cases, crowding and unwelcome proximity to other household members. These changes may induce anxiety and stress; more cases
of depression, post-traumatic stress disorder and feelings of frustration, anger, isolation and hostility have all been described. These conditions can result in behaviour such as self-harm, induce thoughts of suicide or increase the incidence of domestic violence.

While these effects raise concern that obviously goes beyond the scope of environment and health, the physical characteristics of the home and its immediate environs are clearly an important part of a complex picture. A key lesson from COVID-19 is that pandemic control measures such as stay-at-home policies, working from home and home schooling can have a significant bearing on mental health. At the very least, this requires reflection on the characteristics of houses and their environs that determine their fitness for purpose in this and future pandemic situations.

There are, of course, many other reasons why a pandemic might negatively affect individual mental health. These include personal anxiety due to fear of contracting the disease; the implications of widespread economic and industry contraction; isolation from friends, family or supportive networks; reduced employment and income; and reduced housing or food security and fuel poverty.

Some reviews found that people’s experiences of lockdowns are linked their situations before the pandemic; ethnic minorities, people living in deprivation and the young in particular struggled much more in lockdown with distress, isolation or overcrowding and a feeling of being overwhelmed (see WHO Regional Office for Europe, 2023). Another clear finding is that secondary stressors in people’s life circumstances had profound effects on their risks of developing symptoms of mental disorders and that the stressors were exacerbated by events associated with the pandemic. There have been calls for longitudinal cross-disciplinary research on social, contextual and protective factors as well as on mechanisms of action and public engagement. A recurring theme in the literature, building on the experiences of the pandemic, is the need to build back in a “fairer” way.

Working at home has been associated with unhelpful blurring of the lines between work and home, and, during the pandemic, psychosocial risk factors related to teleworking (remote working through the Internet, e-mail, and telephone) increased. These factors present a risk to an individual’s mental and physical well-being. It has also been proposed, however, that flexible remote working might have a long-term positive impact on psychosocial risk factors such as the work–home balance, social relationships and communication.

Better understanding of the multiple interacting determinants of stress in a pandemic should lead to a more coherent societal response and definition of a clear role of environment and health in what is inevitably a complex area.

References

Companion literature review to this policy brief

Publications by statutory bodies, agencies and other authoritative public sources

Further reading


2.4 Water, sanitation and hygiene (WASH) and wastewater management

SARS-CoV-2, the virus responsible for COVID-19 is a coronavirus, a viral group that is not known to be transmitted through water. Lack of evidence that COVID-19 has been transmitted through water or wastewater is therefore not wholly surprising. As noted, enveloped viruses such as SARS-CoV-2 are vulnerable to environmental conditions and are rapidly inactivated in passage through the gastrointestinal tract. Moreover, standard water treatment involving filtration and disinfection and standard wastewater treatment protocols are known to inactivate viruses of similar morphology and chemical structure to SARS-CoV-2 (WHO, 2020a). There have also been no reports of faecal–oral transmission of the virus (WHO Regional Office for Europe, 2022). Nonetheless, WASH and wastewater management have important roles in the overall response to COVID-19.

WASH services are vital for preventing and controlling infections of many types, including SARS-CoV-2 (WHO, 2020b). By extension, ensuring evidence-based, consistent application of WASH (and waste management) practices in all settings (schools, homes, health-care facilities) helps prevent human-to-human spread of SARS-CoV-2. Additionally, maintaining hygienic practices and reducing the risk of surface transmission relies significantly on access to fresh water. In this context, the fact that over 44 million people in Europe still lack access to piped water in their homes, and 31 million do not have access to basic sanitation is an important deficit (United Nations, 2019, 2020). With respect to WASH in the context of the pandemic, readers are directed to the 2019 global baseline report on WASH in health-care facilities, which reports substandard WASH in
health-care facilities in every region of the world (WHO/UNICEF, 2019).

WASH and wastewater management have also become more important, because non-viable viral fragments (RNA) of SARS-CoV-2 are consistently found in wastewater samples when COVID-19 cases are present in a community (WHO, 2022a). Wastewater is a mixture of domestic sewage and water from industrial, commercial, agricultural and other sources, such as storm water. Non-infectious SARS-CoV-2 fragments can find their way into wastewater from the faeces, urine, sputum and saliva of symptomatic, asymptomatic, pre-symptomatic or convalescent patients (WHO, 2022a; WHO Regional Office for Europe, 2022).

During the pandemic, detection of viral fragments in wastewater led to routine surveillance of wastewater to complement diagnostic testing for public health management of COVID-19. The approach provides early warning and additional evidence on the strain of virus circulating in the population. Thus, beyond simply detecting the presence or absence of the virus, trends in concentrations and variants of concern or interest can be identified. Wastewater surveillance can also help in planning and evaluating interventions for managing the pandemic (WHO 2022b).

A further issue related to wastewater that was brought to the forefront by COVID-19 is antimicrobial resistance. Antimicrobial resistance already claims an estimated 700 000 lives annually, worldwide and is one of humanity’s greatest health threats. Wastewater can convey antimicrobial resistance in the environment, as 30–90% of all antibiotics are excreted in an active form by humans. Sustained release of active antibiotics into wastewater has been a particular concern during the pandemic. Especially in the early stages, antibiotics were often prescribed even when secondary bacterial infections were not present. Reports on the prevalence of secondary bacterial (and fungal) infections inevitably vary considerably, but one study that reported 8% bacterial co-infections also noted that 72% of COVID-19 patients admitted to hospital had been treated with antimicrobials (see WHO Regional Office for Europe, 2023). Overprescribing of antibiotics can reduce the efficiency of wastewater treatment and, of greater concern, increase levels of antibiotic-resistant microorganisms and the transfer of resistant genes into the environment. Conventional physical and chemical wastewater treatment processes can reduce the levels of antimicrobials to some extent but are not wholly effective. More advanced technologies such as membrane filtration and advanced oxidation can increase the effectiveness but are not widely used. Reducing the use of antibiotics for humans and animals is currently the most promising route for slowing the development and spread of antibiotic resistance.

References

Companion literature review to this policy brief

Publications by statutory bodies, agencies and other authoritative public sources

2.5 Waste and waste management

In view of widely different local contexts, the reported impacts of the pandemic in the waste sector have been inconsistent. Some trends can, however, be seen as the pandemic has progressed and more reports and analyses have emerged. As in other domains of environmental health, learning from the experience of COVID-19 can inform the resilience agenda.

Although there have been no recorded cases of transmission of SARS-CoV-2 due to handling waste, the possibility that waste from non-clinical and (of course) clinical settings could be contaminated with SARS-CoV-2 has significant implications. People who manage municipal solid waste had to recognize the likelihood that infective material would be present, whether introduced unwittingly by asymptomatic individuals or people with mild symptoms or due to flagrant disregard for good practice. Thus, waste that might otherwise have been regarded as innocuous and handled as normal domestic waste was, for precautionary reasons, often regarded as contaminated, with the attendant implications for storage, treatment and overall capacity (United Nations, 2020).

Many reports cited increased food waste during the pandemic (see, e.g. Leal Filho et al., 2022). This has been attributed variously to panic buying to stock up on food, changes in consumer behaviour and changed consumption patterns (e.g. more takeaway food). Disruptions in food chains were widely reported, which led to disposal of large amounts of food that could not be processed or distributed because of the pandemic or could not be sold as a result of decreased demand. While, overall, reports of increased food waste are consistent, consumers generally reported changes in their own behaviour over time, claiming to have adopted more sustainable practices and therefore reduced food waste. It has also been suggested that strategies to prevent food waste may have been motivated primarily by socioeconomic factors related to the pandemic rather than environmental concern.

Another, tangible impact of the pandemic in the waste domain relates to plastic. The global manufacture and use of plastics had already increased many-fold in the decades before the pandemic and had become a headline environmental concern. Accumulations of plastics are found in many environmental compartments, and microplastics are being isolated from water, soil and living organisms. Plastics are used in the manufacture of personal protective equipment and also in many applications in COVID-19 diagnosis and
treatment, thus creating a huge demand. Much of this plastic ended up in clinical waste but also in municipal solid waste. At the same time, control of the use of single-use plastics reportedly weakened during the pandemic, with a reduction in plastic recycling, slowing the recovery of the recycling sector.

While there is consensus that plastic waste greatly increased during the pandemic (see, e.g. United Nations, 2020), reports of other impacts on municipal solid waste during the pandemic have not been wholly consistent. Some studies reported decreased levels of domestic waste, citing, for example, improvements in domestic food management and consequent reductions in food waste. A reduction in the commercial waste component of municipal solid waste was also observed, and tourist sites experienced falls in the volume of waste in public spaces and public events. Although industrial waste is not classed as municipal solid waste, many countries witnessed decreased levels as industrial activity slowed sharply. Despite contradictory reports from different locations, the overall experience was an increase in municipal solid waste levels during lockdown, which caused sometimes overwhelming pressure on waste management arrangements, from inception to disposal (WHO, 2020; United Nations, 2022).

The content of municipal solid waste has also been affected. An increase in paper and plastic packaging waste was attributed to the boom in online shopping and increased consumption of takeaway food. Pressure on waste management arrangements everywhere was exacerbated by personnel shortages as waste management personnel contracted COVID-19, self-isolated or sheltered (United Nations, 2020).

The reduction in waste recycling, and especially plastics recycling, is variously attributed to personnel shortages, reductions in waste sorting by householders and a fall in oil prices in early lockdown (United Nations, 2020). An unexpected consequence has been increased reliance on landfill. In addition to the wider environmental dis-benefits of landfill, pressures on landfill facilities are thought to have contributed to illegal dumping and the release of toxic pollutants during the pandemic. Any increase in landfill is inconsistent with progress towards sustainable development goals and entrenches practices that are damaging to the natural environment. Concern has been expressed that the pandemic may lead to the creation of additional landfill sites.

The pressure on waste management systems and the overwhelming of arrangements fuelled concern about illegal dumping, littering and open burning of waste (United Nations, 2020). These activities damage terrestrial and marine ecosystems and introduce another plausible risk of viral transmission. In 2020, a 280% increase in illegal dumping of plastic waste was recorded worldwide. Stay-at-home policies also resulted in home clearances and “do-it-yourself” home improvements, which, when linked to closure of public facilities, further contributed to illegal dumping and its attendant infection risk.

The accumulation of personal protective equipment and other plastic litter in both terrestrial and aquatic environments has been an unfortunate consequence of the pandemic. Winds, storms and water runoff have carried this waste into the sea, onto beaches and to inland waterways, where it continues to impact wildlife, which become entangled in and ingest it. In addition, as discarded facemasks weather, they are a significant source of secondary microplastics, particularly the micro- and nanofibres that are so damaging to marine organisms and soil biota.

The pandemic massively increased health sector waste (e.g. masks, personal protective equipment, vaccine and test kits, gloves) while simultaneously reducing the capacity of health-care workers to manage waste because of increased patient loads and COVID-19-related work (WHO, 2022). The pandemic has thus highlighted the need to improve the environmental sustainability of...
health-care waste management. Innovative solutions are required to reduce waste, such as "smart" procurement, recycling of general health-care waste, promoting safe reuse of personal protective equipment and non-burn technologies (WHO, 2022). At national level, progress may require improving regulation and standards for health, creating lines for waste management within health budgets, improving the monitoring of waste handling practices and enhancing workforce capacity to safely manage waste.

The global pandemic presents a dynamic, challenging context in which to deliver and maintain services, particularly where, as with waste management, failure to maintain the integrity of the service has had significant implications for public health, occupational health, aesthetics and amenities.

References

Companion literature review to this policy brief

Empirical academic articles

Publications by statutory bodies, agencies and other authoritative public sources


Further reading

2.6 Ambient air

While the risk of outdoor transmission of SARS-CoV-2 is much lower than indoors, the possibility that ambient air pollution may play a role in the severity of disease and its outcomes and in transmission of the infection during the pandemic has been explored. Although, in many locations, activities have now rebounded to pre-lockdown levels, there has been considerable interest in determining the impact that infection control measures such as lockdowns and travel bans had on the levels of pollution in towns and cities.

The conclusion that SARS-CoV-2 infection and COVID-19-related mortality are linked to ambient (outdoor) air pollution is based on a number of epidemiological studies that have correlated population levels of SARS-CoV-2 infection, hospitalization and mortality with levels of air pollutants. In the early days of the pandemic, some epidemiological studies were criticized for methodological shortcomings; however, while limitations remain, more focused studies with managed controls and with better...
access to data on these numbers of cases and deaths have emerged in this fast-moving area of research.

A recent review of studies on ambient air quality and COVID-19 showed that PM measuring ≤ 2.5 µm (PM$_{2.5}$), PM measuring ≤ 10 µm (PM$_{10}$), ozone, nitrogen dioxide and carbon monoxide are most frequently associated with the spread of SARS-CoV-2 and the number of COVID-19 cases (WHO Regional Office for Europe, 2023). The evidence was found to be less consistent in relation to the number of deaths; PM$_{2.5}$ and nitrogen dioxide were most frequently associated with more deaths, while no association was found between PM$_{10}$ and ozone with deaths.

Two mechanisms have been proposed by which ambient air pollution could be linked to transmission of SARS-CoV-2. The first is that small airborne particles provide a nucleus around which infective droplets coalesce, contributing to infectious aerosols, which allow the virus to travel further and infect individuals at greater distances (see section 2.3). The evidence for this “droplet nuclei” theory of transmission in outdoor air is rather weak, as the enzymes that break down viral RNA are likely to act early and limit the environmental persistence of the virus. The second proposed explanation is that exposure to air pollution increases susceptibility to infection, and there is interest in determining whether air pollution enhances the capacity of the SARS-CoV-2 virus to invade epithelial cells, facilitating infection.

Epidemiological investigations have also provided evidence of an association between long-term air pollution levels, the severity of infection and mortality rates in populations. Although research into the mechanisms involved continues, the epidemiological associations themselves appear to be reasonably robust. There is evidence, for example, of an association between long-term exposure to PM$_{2.5}$ and nitrogen dioxide and hospitalization and mortality from COVID-19.

Theories about the mechanism whereby more severe disease is linked to polluted air (all of which require additional investigation) include the fact that exposure to air pollutants contributes to underlying health conditions – cardiac disease, immune and metabolic disorders, respiratory diseases and cancers – which place affected people at greater risk of severe disease after infection (co-morbidities theory). Other suggested mechanisms linking the severity of COVID-19 to air pollution include the capacity of air pollution to weaken the immune system, potentially rendering individuals less able to fight off the infection; pre-existing air pollution-related inflammation of the respiratory system and also more generally in the body, compounded by COVID-19-induced inflammation; and increased viral load in inhaled air, related to the droplet nuclei theory of transmission described above.

In summary, the evidence for a role of ambient air pollution in SARS-CoV-2 transmission and in adverse outcomes after infection is inadequate but currently evolving. Nonetheless, there is every indication that the emergence of COVID-19 adds to the already compelling public health case for a rapid reduction in ambient air pollution. WHO has published new global air quality guidelines, based on an extensive systematic review of evidence, which provide recommended air quality guideline levels and interim targets for six key air pollutants (WHO, 2021).

A different area of enquiry is the relation between COVID-19 and changes in ambient air quality resulting from mitigation policies. Reductions in industrial and economic activity and levels of road transport resulted in better air quality throughout the world. In general, the recorded reductions in pollutant were greater where baseline pollutant levels had been higher, e.g. at lower elevations and in more densely populated areas. Pollutants for which reductions were observed were PM$_{10}$, PM$_{2.5}$, nitrogen dioxide, carbon monoxide, sulfur dioxide and benzene. A recent review reported that the greatest, most robust decrease was seen for nitrogen dioxide,
while another reported strong reductions in PM$_{2.5}$ and PM$_{10}$ in 75% of the studies included. Increases in ground-level ozone, a secondary pollutant of public health significance formed primarily by chemical reactions between oxides of nitrogen and volatile organic compounds, were also a feature of lockdowns.

A further review identified ozone, sulfur dioxide and ammonia as the air pollutants for which the associations with lockdowns were null or worsened (see WHO Regional Office for Europe, 2023). The concentrations of ozone increased by up to 7.6% and were linked to reductions in nitric oxide emissions. Increased emissions of sulfur dioxide were attributed in several studies to industrial activity, and one study indicated that the increases in sulfur dioxide levels were directly linked to increased power generation during lockdowns. These findings provide further impetus for increasing energy generation from sustainable sources. The evidence on ammonia (a primarily agricultural pollutant) was mixed. The concentrations were unsurprisingly static when agricultural activity remained the same but greater when they increased. Predictable decreases in industrial emissions were seen as factories and industrial plants were shut down during lockdowns. This was especially the case for PM, ozone, nitrogen dioxide and nitric oxide.

The levels of stratospheric ozone, however, increased in response to COVID-19 restrictions, as a result of decreases in the emissions of greenhouse gases.

Although the findings are somewhat unclear and not homogeneous because of application of different restrictions in different locations, researchers generally reported an unequivocal positive impact of the pandemic on ambient air quality. With the end of lockdowns and overall resumption of normal activities, pollutant levels are reported to have rebounded in many regions and air pollution to have returned to near pre-COVID-19 levels.

### References

**Companion literature review to this policy brief**


**Publications by statutory bodies, agencies and other authoritative sources**


### 2.7 Food

As is the case for drinking-water, there is no evidence that people have been infected with SARS-CoV-2 by swallowing the virus in or on food. Also, although contact transmission of viruses on food packaging is certainly possible, that route has not been directly implicated in transmission of SARS-CoV-2. For food, however, as in other domains, maintenance of strict hygiene practices is an essential first-line preventive approach (WHO, 2020). The literature does, however, show many other associations between COVID-19 and the food sector that merit attention from the perspective of environment and health.
Increasing demand to feed a growing global population and greater demand for meat as a result of rising economic prosperity has been identified as a key driver of the increasing frequency of zoonotic diseases observed during the past 80 years. COVID-19 is one such disease. Perhaps the most striking feature of the literature on COVID-19 and food is the plethora of research studies, surveys, reviews and reports on how measures to manage and control the pandemic have impacted food systems and food chains across the globe, and their implications for food availability, food accessibility and the types of food being consumed. This body of literature is important in relation to COVID-19 but also provides wider lessons on the food-related challenges that can be expected in future pandemics and other disruptive global events, not least those that will result from climate change.

COVID-19 mitigation strategies profoundly affected local and global food systems and food chains and, in many instances, undermined food security.

A “food chain” is the linear sequence of activities involved in producing and distributing food, from the farm to the consumer, whereas a “food system” encompasses a broader set of environmental, social and economic processes and relations that influence how food is produced, processed and consumed. The Food and Agriculture Organisation of the United Nations (FAO, 1996) has stated that

*Food security exists where all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life.*

The COVID-19 pandemic and associated mitigation strategies and policies had various consequences, which highlighted fundamental weaknesses in food systems and chains, characterized by complex global interdependence. Shortages of farm and factory workers, limited access to food, restrictions in the transport of farm commodities, changes in consumer demand, shutdown of food production facilities, lack of certainty about food quality and safety, food trade policy restrictions and delays in transport of food products illustrate the inherent vulnerability of industrial food systems in a pandemic situation.

Although workers in agriculture, food production and sales were generally exempt from lockdown restrictions, most European countries witnessed decreases in agricultural product trading. Agriculture and food production decreased as international trade disruptions and travel bans cut off supplies of essential materials such as seeds, grains and fertilizers. These events led in turn to increased food prices. Moreover, travel bans, job insecurity, loss of migrant workers, quarantine restrictions and other factors reduced the labour force for agriculture and food production, disrupting many food supply chains.

Restrictions on transport and mobility were, perhaps inevitably, most disruptive for long supply chains, resulting in price rises in some countries. Another environment and health-related consequence of disruption to food chains was increased volumes of food waste along the chain, from primary production to consumption (see section 2.5).

The hospitality sector was severely affected by lockdown policies, resulting in acute cash flow problems, staff lay-off and redundancies and, with these, a dramatic reduction in food demand. Although further research is required, there is at least some evidence that local marketing channels and short food supply chains were more resilient to pandemic-driven disruptions.

The pandemic also caused a significant switch to online food purchase. Although the long-term impacts of this change are not yet clear, it is plausible that the habit of online grocery purchase, once established, may persist for some. Reviewers noted that marginalized communities and individuals without Internet
access were denied the opportunity to obtain food in this way, potentially increasing their risk of infection. Consumer anxiety during the pandemic has been reported to have triggered behaviour such as hoarding and panic-buying, which led to short-term shortages. The evidence suggests, however, that this was not a protracted phenomenon.

Changes in consumer preferences were also observed, some people reporting that they had followed a less healthy diet due to issues of affordability and “comfort eating”.

Use of meal delivery apps increased markedly as the desire and opportunity to go to restaurants and even food retail outlets decreased. In many cases, people were reluctant to risk exposure to the virus, and meal delivery apps provided a practical solution. Meal delivery apps had been a component of the food supply chain in Europe for over 20 years (WHO Regional Office for Europe, 2021a,b), but their use increased sharply during the pandemic. Whatever the reason, any increase in use of meal delivery apps is likely to have implications for the types of food that are available, accessible, produced and consumed by individuals and, by extension, for their health. Although some restaurants prioritize use of fresh, minimally processed ingredients, many rely on energy-dense, nutrient-poor, ultra-processed foods. Such meals, in addition to their impact on obesity, increased dietary exposure to refined carbohydrates, unhealthy fats, additives, preservatives and other artificial ingredients, while often fail to provide sufficient dietary fibre, vitamins and minerals, placing consumers at greater risk of noncommunicable diseases and obesity. Such outcomes carry both an individual and a societal cost.

Changing consumer preferences during the pandemic were found to impact the structure of demand for food in other ways. Longer time spent at home as a result of lockdown policies made the public more aware of purchasing non-perishable, highly conservable food items, whether online or from shops. Many also embraced activities such as cooking and home baking. These developments were reported to decrease the demand for highly processed foods.

Broad consensus is found in the literature that the pandemic threatened food security globally. Society witnessed the consequence of disrupted food supply chains and reduced income. Some individuals, families and social groups were disproportionately vulnerable, including, predictably, families on low or unstable incomes. Loss of income and rising food prices resulted in more food poverty and increased use of food banks. Pandemic mitigation measures closed schools, social assistance shelters and food shelters in some countries, restricting access to food for the most vulnerable groups. Food insecurity was reported to be significantly greater in rural regions, and this finding should inform region-specific mitigation strategies for future global pandemics and for climate-related and other emergencies. Throughout the literature, there are indications that, for the food sector, COVID-19 was an issue not only of health and economics but also of equality.

Overall, an important contribution of the pandemic was elucidation of the many interconnections, mutual dependence and shared agendas between environment, health and the food sector. These links will become ever more important in coming decades as climate change, biodiversity loss, land use change, pollution and other factors simultaneously undermine food security and damage health and well-being. For example, increasing pollution of various types influences water quality, crop yields, nutritional value, animal health and the chemical safety of food, which are all essential components of food systems. In turn, future health and well-being rely totally on a sustainable, healthy food system.

One Health (WHO Regional Office for Europe, 2021c) offers a useful framework for viewing and understanding the interconnections and mutual dependence of the food, environment and
health sectors (WHO Regional Office for Europe, 2022). When applied to food systems, One Health provides better understanding of the role of connections between environmental, animal and human health in healthy, sustainable food production and consumption. It also shows the importance of food security and food safety in promoting public health. Adopting a One Health approach involves designing programmes, policies, legislation and research in ways to ensure co-ordination, communication and working together of multiple sectors to achieve better public health outcomes (WHO Regional Office for Europe, 2022).

The pursuit of food security in the context of sustainable development and the pandemic requires integrated, inclusive policy-making across disciplines and breaking down of conventional, siloed ways of working. Approaching food security in a coherent way in light of the pandemic will require a systematic approach to the involvement of local, national, regional and international stakeholders.

References

Companion literature review to this policy brief

Publications by statutory bodies, agencies and other authoritative public sources


2.8 Public spaces

Public spaces provide the shared local context for people's lives. Their characteristics and how people relate to them are critical determinants of health, well-being and equity. The restrictions of the pandemic transformed how public spaces were used and valued and by whom in ways that may be a legacy for health, well-being and equity.

The reduction in road traffic was one of the most visible impacts of COVID-19 restrictions. By late March 2020, only a few months into the pandemic, global road transport activity had fallen, on average, to 50% of the average for 2019 (International Energy Agency, 2020). The associated changes in air quality are described above under Ambient air. Added bonuses were reductions in accidents, congestion and noise levels, consistent with reduced traffic volumes.
It was reported in one review that soundscapes had been improved and the experience of natural sounds was enhanced, with the attendant restorative and other benefits, including better perceived health. In one study, a substantial decrease in adverse cardiovascular events was reported due to a reduction in aircraft noise (see WHO Regional Office for Europe, 2023).

As infection control measures became stricter, public transport use also decreased sharply, promoting reconfiguration of transport systems and leaving city centres and transport hubs deserted for a time. Other infrastructure changes were made to protect staff and customers from infection. As the pandemic continued, concern was expressed about a sustained modal shift away from public transport and potential bankruptcy of public transport systems. Evidence for this position is mixed and varies by location and mode of transport.

More positively, during the pandemic, people are reported to have used more active forms of travel to maintain their physical and mental health and/or to avoid the perceived risk of infection by taking public transport. SARS-CoV-2 RNA has been identified in air samples from public transport vehicles during the pandemic, although no evidence has been presented on its viability. Public transport, especially when crowded, is a highly plausible source of transmission. For infection control purposes, authorities supported the shift to active travel and encouraged it in various ways, commonly by introducing additional cycle lanes, improved walking paths and extended pedestrian areas. Working at home limited social mixing and facilitated social distancing, inevitably reducing traffic and the related pollution, ostensibly with no harm to the economy. Certain service sectors, however, such as food and catering outlets for office workers, were negatively affected by work-from-home measures.

Inequality within and between countries and social groups is a recurring theme in reviews of the impacts of lockdowns on public spaces and their use. Many lower-income workers continued to move around during the pandemic, while higher-income “knowledge” workers could often work from home. Further, low-income communities, the elderly and key workers, who generally rely more on public transport, were disproportionately affected by contractions in that sector. People who went to work were more likely to be exposed to the virus while at work and in transit. Social divisions and inequality may also have been exacerbated by observed socioeconomically stratified use of public spaces during lockdowns. Knowledge workers who could work from home were more likely to make greatest use of parks, promenades and green spaces, while those obliged to go to their workplace had fewer opportunities. Inequality is also seen in the provision and maintenance of green spaces, as public spaces were often the only outdoor spaces for recreation open to people on low incomes living in the most cramped conditions, whereas green spaces in low-income neighbourhoods are often smaller, fewer and less well maintained than those in wealthier neighbourhoods.

Despite social patterning, use of green spaces during the pandemic is generally reported to have increased, as did the appreciation and benefits of users. Green spaces and green infrastructure close to users’ homes were used more and accorded greater importance than before. Reductions in use were found to be the result of very strict lockdown measures or fear of catching the virus. Neighbourhood green spaces were reportedly associated with reduced levels of anxiety during lockdown and quarantine.

Overall, the events and experience of the pandemic add to growing evidence of the relations between green spaces, green infrastructure and good physical and mental health. Moreover, COVID-19 has taught society that creating and supplementing green spaces to ensure access for all social groups is
an important dimension of a resilient future-proof infrastructure. Green space is also widely identified as a setting for physical exercise and a source of well-being that contributes to urban sustainability.

The evidence on physical activity during the pandemic is somewhat contradictory, both opportunities and challenges being described. One study of adults in the United Kingdom reported reduced physical activity (commuting and activities at recreational facilities) and significantly increased sedentary behaviour (including sitting, reclining and using screen-based devices) and a much lower overall prevalence of physical activity than before the pandemic. In the same study, three potential determinants of frequency of physical activity during the pandemic were identified: physical opportunity (access to gyms, parks, gardens), social environment (social cues, social support from friends and family, existing norms), and reflective motivation (willingness, drive). Other studies found socioeconomic differences in the likelihood of physical activity in older adults, higher socioeconomic status and sociability predicting more activity (see WHO Regional Office for Europe, 2023).

Substantial variations were reported in the use of public spaces, which almost certainly reflects the fact that mitigation policies varied spatially (between and within countries) and also temporally (changing to meet changing levels of transmission, infection and severity of infection over time) and socio-cultural differences.

References

Companion literature review to this policy brief

Publications by statutory bodies, agencies and other authoritative public sources

Further reading

2.9 The health sector

The huge systemic shock of COVID-19 impacted nowhere more acutely than the health sector and health care workers. The pandemic placed huge demands on these workers, who faced significant threats to their own health and that of their families, with many COVID-19-related fatalities. Many were obliged to treat large numbers of patients in a high-pressure environment, with high mortality rates, while adhering to strict infection control measures. For further discussion of the pressures on health care workers and the effects on their physical and mental health, see, for example, Billings et al. (2021) and WHO (2021).

Countries and regions in which the rate of SARS-CoV-2 transmission was high had massive increases in hospital admissions and in the demand for intensive care beds in order to ventilate seriously ill patients. Concern that
health services could rapidly be overwhelmed was a major driver of the restrictions introduced during the pandemic. Comorbidity was an important factor in determining outcomes. In a number of countries, higher rates of lung cancer and Alzheimer disease were associated with higher rates of COVID-19 mortality, and higher rates of SARS-CoV-2 infection and death occurred in countries with high rates of diabetes and obesity. Thus, the evidence strongly indicates that the underlying health of populations was a key factor in the impact of COVID-19 on the health sector, although progressive introduction of effective vaccines reduced the percentage of patients who required hospitalization and intensive care.

Another factor in the spread of SARS-CoV-2 was the distribution of health infrastructure and services. It was noted in one review that countries’ health-care system influenced the mortality rate, even in countries with low rates of infection. In general, countries with adequate numbers of hospital beds, doctors, intensive care beds and primary medical services had lower rates of mortality.

Although vaccination was subsequently instrumental in reducing the percentage of infected patients who required hospitalization and intensive care, caseloads could rise again. This could occur, for example, with the emergence of a highly transmissible variant of SARS-CoV-2 and/or one against which vaccines offer less protection.

In addition to reflection on society’s resilience and, not least, its health systems, it is also important to consider how to create a more environmentally sustainable health sector to reduce the risk of future pandemics and to mitigate the wider consequences of humanity’s impact on the natural world, such as climate change.

The rapid increase in the numbers of people hospitalized with COVID-19 led to a commensurate increase in the volume of waste generated from clinical settings (see also section 2.5). Waste management systems have struggled to cope during the pandemic and have, on occasion, been overwhelmed. Waste from clinical settings includes plastics and other waste associated with COVID-19 diagnosis, treatment and vaccination, such as glass vials, empty disinfectant bottles and vaccine containers. In China during the pandemic, it was estimated that an infected patient generated 3.4 kg of health-care waste per day. In Hubei (China), a 600% increase in clinical waste overwhelmed their disposal systems. France and Netherlands (Kingdom of the) reported increases of 40–50%. In Wuhan (China), additional waste plants were constructed and mobile units deployed to cope with the increase in hospital waste. Improper clinical waste management can expose patients, health workers and waste handlers to injuries, infections, poisoning and air pollution. The rapid increase in the volume of waste from clinical settings has resulted in guidance on sorting, segregation, transport, storage and sustainable waste management to achieve resilience beyond the pandemic.

The environmental and human health impacts of antibiotic prescribing are outlined above (see section 2.4). Particularly in the early stages of the pandemic, when testing capacity was limited and treatment had not been optimized, antibiotics were widely used to treat suspected bacterial and fungal co-infections of the respiratory tract. In some cases, antimicrobials were used as a precautionary measure, while antimicrobial therapy was part of a standard package of care for hospitalized patients in other countries. These practices have been reported to have resulted in more inappropriate prescribing and potentially accelerated the increase in antimicrobial resistance. Other factors considered likely to have resulted in more prescriptions for antibiotics include delayed presentation, telephone consultations, prescribing before confirmatory laboratory testing, and self-medication in countries where antibiotics can be obtained without
prescription. There is concern that the increased use of antimicrobials and the biocides used in disinfection in both the health sector and more widely will further fuel the evolution of antimicrobial-resistant organisms and their release into the environment (see also section 2.5).

Another COVID-19-related issue of environment and health significance is viral transmission in the health sector. The virus can be transmitted by all types of contact and inhalation. The risk is increased in the health sector, with concentrations of SARS-CoV-2-infected individuals and of people who are vulnerable due to age or pre-existing illness. The proportion of transmission in the health sector contributed by each route remains to be established, although decreasing the number of virus particles in indoor spaces must clearly result in lower rates of transmission. Engineering tools can be used to remove, contain and dilute the concentrations of the virus in spaces in which COVID-19 patients are evaluated and treated, and air filtration–recirculation provides long-lasting benefits by removing and diluting all airborne contaminants.

References

Companion literature review to this policy brief

Empirical academic articles

Publications by statutory bodies, agencies and other authoritative public sources

Further reading


2.10 Chemicals

During the pandemic, there has been a huge increase in the purchase and use of disinfectants to mitigate the risk of infection in private homes, public places, transport, health-care settings, schools, retail outlets and others. The capacity of the virus to survive on surfaces such as metal, glass and plastic for periods ranging from several hours up to 9 days has highlighted the importance of effective disinfection (WHO, 2020). Alcohol-based hand sanitizers have been used in vast quantities to mitigate the capacity of coronaviruses to survive on skin for periods variously estimated at between 10 min and several hours.
Disinfectants used for surface cleaning include household bleach (sodium hypochlorite), alcohol, hydrogen peroxide and quaternary ammonium compounds. Although disinfectants can be effective in preventing and controlling the spread of the virus in premises, if misused, they are potentially hazardous to humans as well as to the environment (WHO, 2020). A significant increase in poisoning, primarily through inhalation, has prompted reminders to read the guidance on use of specific products, particularly with respect to the recommended concentrations, use of personal protective equipment and room ventilation. Unintentional poisoning must be prevented to avoid an additional burden on already overstretched health systems.

Overuse of chemicals such as chlorine-based disinfectants and by-products can also lead to their presence in wastewater and a corresponding threat to the environment, particularly aquatic life.

References

Companion literature review to this policy brief

Further reading
CHAPTER 3

Taking stock

While the ways in which COVID-19 affected countries throughout the world could not be foreseen, it has been observed that a pandemic of zoonotic origin was entirely predictable. When it came, the virus administered the biggest global shock in decades, initiating a flood of analyses, academic papers, reviews, reports and guidance. Much of this information is authoritative and useful and was the basis for this brief.

In examining the national and subnational impact of COVID-19 through the lens of environment and health, we have considered not only the changes in individual domains of environment and health, but also the circumstances in which the virus emerged and spread. The exercise has highlighted potential new dimensions for managing the environment for health, well-being and equity and has also emphasized the importance of supporting the traditional environment and health function.
3.1 Generic lessons for environment and health

The most striking lesson of COVID-19 for environment and health, and for all of society, is that infectious disease is not something from the past or that happens elsewhere, but can course through cities, towns and rural places, disrupting communities and hospitals and threaten to overwhelm systems within weeks, days or even hours, regardless of the level of affluence and development. At the same time, the pandemic alerted the population of the European Region to the very real possibility that they, their families and friends could become infected by SARS-CoV-2 with potentially serious consequences and also that the measures introduced to control the pandemic could impact every dimension of their lives. Moreover, it became clear that the pandemic would not be over in a matter of weeks or months but would be a dominant feature of everyone’s lives for an extended, undetermined period.

The population of the European Region came to understand the zoonotic origins of SARS-CoV-2 and that outbreaks and epidemics of infectious disease such as Ebola disease, severe acute respiratory syndrome, Middle East respiratory syndrome and Zika virus disease (which, despite their media profile, had scarcely touched their lives), also originated in animals. They inevitably began to wonder why this was happening, happening now, and what would be next. The media and the wider public became more aware of public health authorities and leaders and their roles, with this, came unprecedented levels of scrutiny.

For environment and health specifically, despite professional understanding of infectious pathogens, their modes of transmission and recognition that pandemic disease of zoonotic origin was (and is) always possible, the shock of COVID-19 was significant. Confirmation of the virus’ zoonotic origins, evidence of its survival in different environmental compartments such as air, water and surfaces, and its modes of transmission made clear that COVID-19 was a global emergency, with the nexus of environment and health at its core. The environment was pivotal to its emergence and spread and was central to the societal response. For the national and subnational environment and health function, SARS-CoV-2 and COVID-19 touched almost every one of the discipline’s traditional domains of activity. For a discipline that (at least in the developed world) had so long been dominated by a mission to better understand and manage the environmental dimension in noncommunicable diseases, it was a shock to find that infection had returned so suddenly to the top of their agenda. COVID-19 also revealed the importance of understanding and addressing the more subtle influences of the environment on mental health during periods of isolation and restriction and what this might mean for making homes, shared facilities and public spaces fit for purpose in a significantly changed context.

Even before the pandemic, environment and health, as a discipline, was coming to terms with the fact that the spatial and temporal scales in which it had traditionally operated – in essence, the “here and now” – were expanding. Climate change and its accelerating impacts had already shown that, while the key environment and health function of any national and subnational authority might be to secure and maintain a safe, healthy environment for people living in the area for which it is responsible, it had also become necessary to consider how economic and social factors and behaviour in any location impact Earth systems (of which climate is only one). By extension, effective national and subnational environment and health must now also include concern for the environment and the health of people living beyond their borders. COVID-19 has massively reinforced this truth. Also, while climate-related events and pandemic disease are separate phenomena, they are inextricably linked, both in their origins
and in the requirement for greater resilience throughout society. The working assumption must be that pandemic disease and climate-related events and disasters will, in future, co-occur. COVID-19 has given more than a hint of the challenges to and deficits in the resilience of society, which will accelerate with the changing climate. Significant vulnerability has been revealed in many areas, some of which are described in the domain-specific sections above.

COVID-19 has both created and revealed inequality throughout society. The poor, people with pre-existing illness, the elderly and specific vulnerable populations were often more exposed and more likely to experience worse outcomes after infection. One clear message from the pandemic is that people in (usually better paid) “knowledge-based” occupations who had the opportunity to work from home more easily, avoided risky exposures. In contrast, those in lower-paid roles were often more exposed to the virus because they were obliged to be in their workplace and to commute, often by public transport.

Since the 5th Ministerial Conference of the EHP in Parma, Italy, in 2010, the WHO Regional Office for Europe has maintained a focus on understanding and measuring environmental health inequality. COVID-19 and the public health response have revealed new dimensions of this task and new areas for investigation on this theme.

The lessons of COVID-19 and the reality of the changing climate are among a number of reasons for environment and health to reflect on its knowledge base and on the skills required in order to be most effective in the 21st century environmental health landscape. This issue is considered in greater detail in a companion paper that address challenges beyond COVID-19 (see WHO Regional Office for Europe, 2023a)

A recurring theme in the articles reviewed in preparing this policy brief is the deficits in knowledge and understanding brought to light by the pandemic and the necessity for systematic establishment of research priorities. When the pandemic struck, the research agenda for a European Union-funded research project to set priorities for environment, climate and health had been under way for over a year. At the request of the funders, the 24-partner HERA consortium established a COVID-19 working group to reflect on the interactions between COVID-19 and the environment, climate and health and the corresponding research required. They also reflected on the impacts of the response to the pandemic and recovery plans on environment and health. The outputs of HERA in these areas remain the most comprehensive, authoritative summaries of the research required on COVID-19-related environment and health (HERA, 2020; Barouki et al., 2021; HERA, 2022).

The entire output of HERA cannot be described here in detail. The interconnections between the pandemic and environment and health issues at many levels were evident throughout the consortium’s work, as was the importance of an integrated global approach that takes account of both infectious agents and other environmental threats. The working group noted that this holistic approach is necessary to find the sustainable solutions and policies necessary to protect both humans and ecosystems. The HERA researchers called for collaborative input from many disciplines in research, echoing another theme found throughout the literature on COVID-19, climate change, environment and health.

Research deficits and research questions were identified under three broad headings: interlinkages of global environmental change and the emergence of the COVID-19 pandemic; the health impact of COVID-19 and environmental stressors; and integrated socioeconomic, political and health implications of COVID-19 and intervention strategies (Barouki et al., 2021). Many deficits in knowledge were identified under these three headings, including topics as diverse as, for example, uncertainties
about the impact of ecosystem changes such as deforestation, land use and road-building on human–wildlife interactions and the subsequent risk of viral spillover; limited understanding of how the immune or cardiometabolic effects of pollutants render populations more susceptible to infection or severe disease after infection; and better characterization of the impacts of the pandemic on urban and rural life, transport and work conditions. In general, HERA called for research to provide the evidence necessary to inform the transformative action required to prevent further pandemics and to better understand inequality in COVID-19 and the response, an important cross-cutting theme in the work of HERA.

The convergence of expertise in HERA and the systematic approach used by the consortium in identifying research priorities provide a resource for reviewing, evaluating and updating research priorities. As the challenges of both environment and health become more urgent, important and complex, a process modelled on HERA might be considered for continuing this important task.
Taking stock

3.2 Domain-specific lessons for environment and health

WASH and wastewater management

The importance of securing and maintaining safe operation of water supply and sanitation systems has been reinforced by COVID-19. For infection control now and for future resilience, WASH must prioritized everywhere, especially in health-care facilities and schools. The pandemic has reminded everyone of the importance of straightforward hand hygiene as the first line defence in preventing and controlling the spread infectious disease; however, this cannot be properly implemented without piped water supplies to every home.

Also in the domain of WASH and wastewater management, COVID-19 has highlighted the public health potential of wastewater surveillance. Surveillance of wastewater for SARS-CoV-2 fragments during the pandemic has been a powerful tool, in combination with diagnostic testing and other public health protocols.

Waste and waste management

Waste systems were found to be ill equipped to deal with a waste stream that has changed quantitatively and qualitatively during the pandemic. The many implications for waste management when a deadly infectious virus is circulating in community and health-care settings have now been revealed and documented. The massive increase in plastic waste associated with diagnosis and treatment is just one example. There are many wider environmental impacts, some of health relevance, when a waste management system becomes overwhelmed or functions sub-optimally. A clear lesson of COVID-19 is that waste management systems designed and scaled for steady-state operations have little resilience.

The threat of future pandemics and the reality of serious climate-related events imply a future that will be anything but “steady state”. Further reflection is necessary on what constitutes a safe, resilient waste management system.

Ambient and indoor air quality

The fact that exposure to air pollution contributes to many of the conditions that make people vulnerable to severe illness and death when infected with SARS-CoV-2 (and other respiratory pathogens) provides yet another compelling public health reason to reduce air pollution rapidly. Moreover, there is some evidence that co-exposure to the SARS-CoV-2 virus and polluted air predisposes individuals to infection and more severe illness, although the underlying mechanisms have yet to be fully elucidated.

Consistent reports of reduced air pollution levels due to infection control measures such as travel bans and lockdowns and dramatic reductions in industrial, commercial and economic activity are unsurprising. Equally predictably, given society’s desire to approach pre-pandemic normality, urban air pollution levels have increased again. The glimpse of an urban landscape in which the air is discernibly cleaner and traffic and other noise sources are much reduced may, however, drive a move towards less polluting, more sustainable ways to live, move and consume.

For the indoor environment, the pandemic has shown the importance of proper ventilation of buildings to reduce aerosol transmission. In recent decades, the pursuit of greater energy efficiency and concern about climate change have created an opposing dynamic. A key lesson from COVID-19 and the climate crisis is that it is time to re-examine the issue of building ventilation through a contemporary public health
Achieving food security in the context of sustainable development, as indicated by the pandemic, requires a fresh approach to policy-making, which is integrated and inclusive, reaches across disciplines and challenges siloed working. A coherent approach to achieving food security demands a systematic approach to involving local, national, regional and international stakeholders.

The food sector

Neither food nor food packaging has thus far been shown to play a role in transmission of the SARS-CoV-2 virus. The pandemic has, however, disrupted food systems and food chains, which has exposed vulnerability, leading in some circumstances to food insecurity, manifesting as food shortages and price rises. Diminished food security can negatively affect health and well-being and disproportionately affects the most disadvantaged members of society.

An important legacy of the pandemic may be its demonstrations of the multiple connections, interconnections, mutual dependence and shared agendas between food, environment and health. COVID-19 has reinforced the importance of viewing the relations between food and human health in terms broader than solely microbiological and chemical food safety.

Current arrangements for producing and distributing food are inconsistent with protection of the Earth’s biophysical systems and the survival of human health and species (including human). Food is already at the centre of discussions on One Health and planetary health. It is important, therefore, to consider how national environment and health constituencies can best work in resolving food-related problems with obvious environmental, health and equity dimensions. Building forward better and more fairly implies changes to the global food system, which relies on extended, environmentally unsustainable food chains and drives deforestation, biodiversity loss, antimicrobial resistance, climate change and diseases with pandemic potential.

Public spaces

Long before the pandemic, a shared aspiration to create towns and cities configured, maintained and managed to deliver health, equity and sustainability was widely shared among individuals and agencies. Much work and literature have already shown that how people live, move and consume, the choices they make and the behaviour they adopt are key to a viable future for humanity. These considerations have led to a focus on transport systems, green spaces, housing and how and from where food is sourced. Concepts such as a 20- or 15-min neighbourhood, where all the prerequisites of living are closely accessible, are holistic expressions of what urban living ought to be.

Yet, the transformational change in familiar urban settings during efforts to control viral transmission was scarcely imaginable. Public transport, air and noise pollution, the use of green and natural spaces and human activity were all profoundly impacted in the ways outlined above and in the accompanying rapid review of reviews.

Despite the economic slowdown, which, for many, resulted in genuine hardship and huge disruption of lives, millions glimpsed at first hand a possible future in which levels of pollution are much lower and people breathe clean air and see their surroundings with, literally, greater clarity. The sounds of nature were appreciated in cities after, perhaps, decades of intrusive traffic noise. Walking and cycling became easier and safer and, although the benefits have not been equally
distributed across society, digital technology allowed new ways of working and connectivity. Use of and attitudes to green and natural spaces were transformed in ways that must be reflected in any agenda for building forward better.

As lockdowns have eased, public spaces have returned in most respects to a pre-pandemic norm, but changes such as those introduced by greater use of digital technology and hybrid working seem likely to endure and are wholly consistent with a more sustainable future. Opinion polls in many countries have shown that one legacy of the pandemic may be greater will to protect the environment, which could increase political support for measures towards those ends. Progress would be greatly increased by active engagement with the social and behavioural sciences. It is essential to exploit the insights from the pandemic to develop interdisciplinary partnerships among natural and social scientists (including behavioural scientists), policy-makers and citizens, with the commensurate skills to deliver a now more clearly defined vision of healthy, equitable, resilient urban settings for the future.

The health sector

The shock to the health sector, including its workforce, of the pandemic continues to be headline news and, by extension, an enduring political concern. In the European Region, the health sector accounts for approximately 8–10% of gross domestic product. It remains a huge consumer of energy and resources and a significant polluter and generator of waste. The health sector is vulnerable to climate change and particularly to extreme weather events, which disrupt its capacity to continue to provide services at times of increased demand, such as in response to pandemics. The COVID-19 pandemic has stretched clinical waste management to breaking point, with consequences for public health and the environment.

It was not entirely predictable that a viral pandemic like COVID-19 would generate such a dramatic increase in antibiotic prescribing in health care and communities. The potential for increasing antibiotic resistance in the environment is discussed above. Yet, although antimicrobial resistance is one of the greatest dangers to public health in the 21st century, the association with COVID-19 has seldom been cited in popular media.

The exacerbated challenges to the health sector due to COVID-19, with the climate change crisis, call for a transition towards environmentally sustainable, climate-resilient health systems as integral to meet aspirations for a healthier, more equitable, sustainable environment. Progress in this area will accelerate progress towards meeting commitments made at the 26th Conference of the Parties to the United Nations Convention on Climate Change.

Chemicals

COVID-19 resulted in a massive increase in the use of chemicals and a commensurate increase in cases of poisoning due to ill-considered use of everyday disinfectants and hand hygiene products. The toxic nature of products used daily has often been disregarded. The pandemic has shown that seemingly “every day and commonplace” chemical products can have profound implications for safety, health and the environment when used without reference to the manufacturers’ guidance. The immediate challenge is one of communication, requiring investment in greater health literacy, better communication and more investment in strengthening poison control centres.

Reference

3.3 Building forward better

A detailed exploration of the components of building forward better, more sustainably, more healthily and in a way that reduces rather than exacerbates inequity is beyond the scope of this brief. The literature reviewed in the review of reviews (WHO Regional Office for Europe, 2023), however, is a useful introduction to what building forward better might mean from the perspectives of food systems, energy, transport, cities and the built environment more generally, the health-care sector, waste and waste management and work. The WHO manifesto for a healthy, green recovery from COVID-19, with its six “prescriptions” (see Box 2) and more than 70 “actionables” remains an excellent framework in which to think about building forward better and more equitably, especially from national and subnational standpoints.

References

**Companion literature review to this policy brief**

**Publications by statutory bodies, agencies and other authoritative public sources**


WHO Regional Office for Europe (2023a). Delivering effective environment and health actions. A compendium of concepts, approaches and tools for the WHO European Region. Copenhagen: WHO Regional Office for Europe. ([https://apps.who.int/iris/handle/10665/368167](https://apps.who.int/iris/handle/10665/368167), accessed 26 June 2023)
CHAPTER 4

Closing reflections
This policy brief offers a “helicopter view” of the impacts of COVID-19 on environment and health, necessarily avoiding the level of detail recognized as necessary for exploring specific problems or issues. Although WHO has now declared that COVID-19 is no longer a public health emergency of international concern, the pandemic will continue to cast a long shadow. Moreover, literature on COVID-19 and the environment continues to accrue, and the knowledge base is increasing. This policy brief draws on the “rapid review of reviews” (WHO Regional Office for Europe, 2023), which covers good-quality reviews published between early 2020 and early 2023. Readers who access the review of reviews will find that its structure is broadly similar to that of this brief, allowing them to find details of some of the summaries. It also facilitates access to the reviews and to primary research.

A consistent theme in published reviews and the massive volume of grey literature is a clear desire for transformational change and widely perceived urgency. The shock of COVID-19 has been immense, and some surveys indicate that COVID-19 has nurtured the desire and urgency well beyond the academic and policy communities that provided the outputs considered. People are now more informed and better equipped to link their experience of pandemic disease and the implications of the warming climate for health, well-being and, ultimately, the survival of our species. Society’s institutions and many spheres of activity are clearly insufficiently resilient.

The next iteration of the EHP could usefully exploit the desire for transformational change. In various sections of the brief, it is noted that the local, or “proximal”, environment is central to environment and health in the 21st century, as it was at the origins of modern public health in the early 19th century. Society has thus travelled full circle over 200 years and, to some, has returned to an environmental and local conceptualization of health. This time, however, we must confront the reality that, as individuals, what we do here and now profoundly affects “there and then”. Thus, despite the global dimensions of the most pressing challenges, they can be influenced by living, moving and consuming in our neighbourhoods and communities to the benefit of the world. This is an empowering realization.

More work is required to develop the analytical approaches and actions for a modern paradigm of health, disease and their determinants. Work must to be done in the area of education, including development of educational material for use in professional training and in continuing professional development of the many professional groups that are involved in delivering a broader approach to environment and health.

Reference

Companion paper to this policy brief
The WHO Regional Office for Europe

The World Health Organization (WHO) is a specialized agency of the United Nations created in 1948 with the primary responsibility for international health matters and public health. The WHO Regional Office for Europe is one of six regional offices throughout the world, each with its own programme geared to the particular health conditions of the countries it serves.

The WHO European Centre for Environment and Health, located in Bonn, Germany, was established in 1989 by the First European Conference on Environment and Health as an integral part of the WHO Regional Office for Europe. The Centre provides technical and scientific expertise on the impacts of the environment on health. It delivers advice on policy and tools to inform and support decisions on air quality, access to safe drinking-water, sanitation and hygiene; minimizing the adverse effects of chemicals; adaptation to and mitigation of climate change; environmental sustainability of health systems; urban health planning, including transport and mobility; and violence and injury prevention. It collaborates with partners on initiatives to address environment-related diseases. The Centre also strengthens national capacity to address environment and health challenges through training courses on environment and health, including health impact assessments.

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