Climate crisis, cities, and health

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Introduction

More than ever, the climate crisis is becoming a health crisis. An estimated 5 million people globally die each year because of suboptimal temperatures,[1] with a large proportion of heat-related mortality (37%) attributable to human-induced climate change.[2] The last few years have been the hottest on record and high temperatures claimed over 60 000 lives in Europe alone in 2022, with cities the most affected[3] and temperatures in cities projected to increase.[4,5] Urban heat islands that result from excessive asphalt and concrete in cities contribute to an increase in temperature and premature mortality.[6] Just over half of the world's population (56%) now lives in cities and that percentage is expected to reach nearly 70% by 2050.[7]

The Conference of the Parties (COP) had its first health day at COP28 and over 120 countries have endorsed the COP28 UAE Declaration on Climate and Health. This historic and important event recognises and provides evidence that the climate crisis is also a health crisis and that people's health can benefit from climate action. The Declaration promotes the health arguments for climate action and health co-benefits of mitigation and discusses the strengthening climate resilience of health systems.[8] Currently, the impacts of the climate crisis already lead to large health burdens and health-care costs. Therefore, climate action is also about preventing premature deaths and disease and reducing health-care costs.

Seven of eight globally quantified safe and just Earth system boundaries have already been exceeded.[9] Cities, and particularly a high-income urban lifestyle, have a large impact on the planet,[10] but are probably also the most sustainable way to house large populations. The ecological footprints of cities far exceed the surface area that they occupy, and urban areas cannot be decoupled from the peri-urban and rural areas on which they depend for resources. Urban areas cover only 3% of the Earth's land surface, but accounted for 67–72% of combined global CO_2 and CH_4 emissions in 2020,[11,12] and are a major contributor to biodiversity loss.[13] However, cities can also provide key solutions to the climate crisis because of their proximity to everyday destinations and greater access to financial and human resources, knowledge, and innovation.[10,14,15] In Europe, initiatives that aim to reduce greenhouse gas emissions and achieve carbon neutrality include the EU's Green Deal,[16] which is a response to the Paris Climate Agreement[17] and provides a roadmap for cities.

A recent review of large-scale multiple city studies showed a clear relationship between urban and transport planning and environmental quality, greenhouse gas emissions, and health.[18] Therefore, better urban planning could be a solution to reduce climate change impacts and improve health. The health co-benefits of climate action are well recognised and documented, but the urgency to implement them is still missing. Climate mitigation strategies targeting land use, transport, buildings, and waste management have shown multiple quantified health co-benefits, such as reduced premature mortality and rates of disease.[19]

In this Lecture, I provide an overview of potential climate action measures at the nexus of urban planning, environment, climate, and health to achieve climate neutral, liveable, and healthy cities. This Lecture is not a comprehensive or systematic review, but provides a brief overview of possible climate actions that cities can implement and that can improve the health of citizens.

Climate change and health

The impacts of climate change are by now well documented. Climate change leads to increased extreme weather events, such as, heatwaves, cold spells, floods, and droughts, wildfires, and increased exposure to allergens. Landscape changes are caused by loss of urban forest, deglaciation, river disappearance, desertification, water shortage leading to migration, economic decline, and social disruption.[20]

Health effects include, but are not limited to, premature mortality, cardiorespiratory disease (strokes and heart attacks), infectious diseases, cancer, respiratory diseases,[20,21] and poor mental health (eg, anxiety, stress, schizophrenia, mood disorder and depression, suicide, aggressive behaviours, and despair).[22] The poorest are often the most affected.

Climate change is largely caused by our dependency on, or more precisely, addiction to fossil fuels. This relative cheap and available energy source has powered the world economies, but also caused warming of our planet, more extreme weather events, and many externalities that have not been included in the cost–benefit analyses. The use of fossil fuels has also led to, for example, car-centric asphalt-dominated urban planning and extensive urban sprawl, which have detrimental effects on health.[15,18]

Our cities at risk

A study by C40, an organisation of cities working on climate action, estimated that around 200 million individuals living in over 350 cities live with summer temperature highs of over 35°C (95°F),[23] which is hotter than most people can sustain.[24] C40 projected that by 2050, around 970 cities will be at least this hot, with particularly high temperatures in Asia, Africa, and North America. As a result, heatwaves will become far more frequent and intense. In 2024, Cairo, the capital of Egypt, has average high temperatures of 34°C (93°F) in the

summer. During heatwaves, temperatures in Cairo have reached as high as 48°C (118°F) and by 2050 this will be a lot more common across the world.[23] Heatwaves have also led to more wildfires that affect cities as we recently saw in New York, USA, and Athens, Greece.

A climate forecast of major cities compared current and future climate conditions and found that cities from the north hemisphere are shifting to warmer conditions and cities from the tropics are shifting to drier conditions (ie, cities tend to shift towards the sub-tropics). The authors of this study predicted that Madrid's climate in 2050 will resemble Marrakech's climate today, Stockholm will resemble Budapest, London will resemble Barcelona, Moscow will resemble Sofia, Seattle will resemble San Francisco, and Tokyo will resemble Changsha.[25]

However, temperature increase is not the only risk to citizens; rising sea levels are another risk, as many cities are built near the sea, such as New York City, Miami, Shanghai, Bangkok, and Dhaka. According to C40, the total urban population at risk from sea level rise, if emissions do not go down, could number over 800 million people, living in 570 cities, by 2050.[26]

Finally, increased air pollution levels, partly due to fossil fuel burning, are still an important problem in cities and claim many lives each year.[27] Fossil fuel burning is estimated to be responsible for 5 million premature deaths each year.[28] Decarbonisation and thereby reducing air pollution sources is essential and has benefits both inside and outside of cities.[29] The Fossil Fuel Non-Proliferation Treaty, backed by more than 100 countries at COP28, to phase out fossil fuels goes some way to reduce emission sources.

For more on the **Fossil Fuel Non-Proliferation Treaty** see https://fossilfueltreaty.org/

Cities should take climate action and thereby promote health

Cities have an important role in climate action to reduce CO_2 emissions. Such emissions are determined by multiple factors, including the size, urban form, density, and transport systems in cities, and these can be changed.[30,31]

Because of their high population density, cities have many potential advantages: reducing the amount of travel and shortening commute time; decreasing car dependency; lowering rates of energy use per person; limiting the consumption of building and infrastructure materials; maintaining a diversity of choice among workplaces, service facilities, and social contacts; and limiting the loss of green and natural areas outside the cities; among others.[32]

Compact cities are the leading paradigm of sustainable urban living, but might have drawbacks. A recent study in nearly 1000 European cities identified four basic urban configurations on the European continent, which were labelled compact high-density cities, open low-rise medium-density cities, open lowrise low-density cities, and green low-density cities. The results show that high-density compact cities have 10–15% higher mortality rates, less green space, poorer air quality, and a stronger urban heat island effect, but lower greenhouse gas (CO_2) emissions per person, compared with other urban configurations, and particularly green low-density cities. In contrast, greener and less densely populated cities have lower mortality rates, lower air pollution levels, and a lower urban heat island effect, but higher carbon footprints per person (figure 1).[33]

These findings do not mean that compact cities are bad, only that we need to introduce appropriate policy measures to reduce the current health burden and high mortality rates and take full advantage of the benefits that such policies might offer. An example is Barcelona, a compact city with a mortality rate comparable to the average mortality rate of compact cities in the study.[33] Lowering air pollution levels, shifting away from cars, and increasing green space, cycling lanes, and physical activity would substantially reduce the mortality rate (table)

The Lancet *Pathfinder Commission* has documented various interventions that address both greenhouse gases and health. Although not specifically for cities, many of these interventions can be implemented in cities. The Commission showed that many actions to mitigate greenhouse gas emissions also deliver health co-benefits, for example, as a result of reduced air pollution, consumption of healthy diets, and increased physical activity.[40] Climate measures in the transportation sector resulted in a median reduction of 60 years of life lost per 100 000 individuals per year.

In cities, these mitigation measures could include reducing emissions from household heating and motorised traffic, promoting low carbon active transport through improved infrastructure, introducing incentives for walking, cycling, and public transportation, providing healthy food environments, increasing green space, implementing new models, such as the Barcelona Superblocks, 15-minute cities, low-traffic neighbourhoods, and car-free neighbourhoods, and implementing low emission zones and parking restrictions. A shift to more sustainable and healthier urban and transport planning is essential, for example, shifting from private car use to (electric) public transport, walking, and cycling.

Urban and transport planning

Electric cars have often been proposed as the panacea, but only go some way to reduce emissions. Electric cars are not the solution for some urban issues, such as healthy use of public space, urban heat islands, and low physical activity in the population. Furthermore, the mining and production of batteries has large environment impacts.[41]

Innovative novel urban models, such as the Paris 15-minute city,[42,43] Barcelona Superblocks,[36,44,45] London low-traffic neighbourhoods,[46–48] and the Vaugban Freiburg car-free neighbourhood,[49] which prioritise people over cars

Figure 1: **Effects of different city configurations in Europe**
NO_2 is an indicator for air pollution. Based on Iungman and colleagues (2024).[33]

should be urgently implemented and can reduce private car use, lower air pollution levels, and increase physical activity, all of which contribute to better health.[49,50]

Increasing the infrastructure for active transport, such as by increasing the number of safe cycle lanes, increases the uptake of cycling, increases physical activity, reduces mortality,[38,51] and reduces CO_2 emissions.[52,53] More than 10 000 premature deaths could be prevented in 167 European cities if one of four trips were by bicycle.[38] In three cities in New Zealand, investments in cycling, pedestrian, and green space decreased CO_2 emissions by 1149 tons, increased active travel by 30%, and reduced the health burden by 34·4 disability-adjusted life-years per year, due to improved cardiac and respiratory health.[54]

Furthermore, road pricing[55,56] and (ultra) low emission zones[57] are effective ways to reduce private car use, CO_2 emissions, and air pollution concentrations. Effective legislation is essential to protect public health and guide business into the right direction.[58]

Baierl and colleagues[59] modelled policy measures for four different scenarios in five major European cities—Brussels, Madrid, Greater Manchester, Milan, and Warsaw—and showed that zero-emission transport in European cities is possible around 2030 with ambitious and multiple measures. The four scenarios differed in their focus and emphasis (active, shared and public

	Reduced annual number of premature deaths	Reduced annual mortality rate per 100 000 individuals
Reducing air pollution, noise, and excess heat to internationally recommended levels; increasing green space and physical activity to the levels recommended by WHO[34]	2904	213
Reducing air pollution levels to the new WHO recommended levels[35]	1886 air pollution 1307 $PM_{2·5}$ 829 NO_2	139 air pollution 96 $PM_{2·5}$ 61 NO_2
Implementing 503 of the original Superblocks in Barcelona, which prioritise people over cars, reduce private car use, air pollution, and noise levels, and increase physical activity and green space, all of which contribute to better health[36]	667	51
Increasing green space to provide every citizen with sufficient access to green space according to WHO[37]	337	27
Providing every street in Barcelona with a cycle lane, cycling rates would increase to an estimated 19% of the transport mode share[38]	248	15
Either shifting 40% of all short car trips to cycling or shifting half of short car trips to cycling and half to public transport[39]	76 cycling only 54 cycling and public transport	5 cycling only 3 cycling and public transport

Barcelona has a mortality rate similar to the mean rate of the compact cities in the study (ie, 1124 deaths per 100 000 people) and much higher than the mortality rate in green low-density cities (ie, 1003 deaths per 100 000 people). The estimates are rough calculations that deduct the attributable mortality burden of a specific exposure from the total mortality. $PM_{2·5}$=particulate matter with particles that are 2·5 microns or less in diameter.

Table: **Policy measures to reduce mortality rates in Barcelona, Spain**

transport, electrification of vehicles, or a combination of all) and the level of ambition (current policies and plans *vs* transformative measures). The authors showed that combination policies and transformative measures provided the best outcomes.

Greening of cities

Nature-based solutions are an effective way to increase green infrastructure, lower urban heat island effects and air pollution, contribute to carbon sequestration, and improve physical and mental health.[6,60] Urban heat islands contribute to a proportion of the premature mortality in summer months and one-third of premature mortality due to urban heat islands could be avoidable if there were 30% tree cover in European cities.[6] New concepts, such as the 3–30–300 green space rule (ie, people should be able to see three trees from their window, live in an area with 30% tree cover, and live within 300 m distance of a park), are aspirational and provide both climate and health benefits.[61]

Housing

Denser and carbon neutral housing (eg carbon neutral three or four storey apartment blocks, with solar power and heat pumps) is possible and necessary to address the current housing and climate crises and lower CO_2 emissions.[62] Improving and insulating large parts of the old housing stock is essential. Complying with environmental quality standards, such as the US Leadership in Energy and Environmental Design green building certification, has been modelled to reduce CO_2 emissions (by 30·6 megatons), improve air quality, and prevent premature deaths (n=298), hospital admissions (n=171), asthma exacerbations (n=11000), and respiratory symptoms (n=54000).[63] Green roofs are an option to mitigate the urban heat island effect. A recent study showed that 30% city-wide green roof coverage could decrease mean summer temperatures by 1·5°C and heatwave mortality by 23–37%.[64] Furthermore, architecture is needed that does not rely on air conditioning, but includes (ancient) natural cooling methods, and city planning of cool narrow streets and shaded courtyards.[65]

Future cities

The world's urban population is still increasing and an estimated 2·2 billion people will move to cities between 2021 and 2050, particularly in Asia and Africa.[66] On other continents, such as Europe, some cities are growing while others are shrinking. A lot of urban infrastructure is still to be planned and built, which provides a great opportunity to make future cities more sustainable than existing cities, with sufficient density and better and healthier transport infrastructure and systems that have a focus on health. A major concern, however, is the ongoing urban sprawl, with Europe leading the way, which increases car dependency in spite of the urgent need for decreased car dependency and more compact cities.[67] Urban sprawl increases travel distances and reduces the opportunity to create cost-effective public transport systems and active transportation.

Governance and participation

Advancing transformative change

First, a solid evidence base is often regarded as essential to make the case for transformational change. However, it is not only the evidence that is needed, but also the development and usage of tools for practitioners working on urban and transport planning to assess the impact on, for example, health.[19] Second, embracing the complexity of cities is key, and this requires combining different disciplines, theories, and approaches; using experimental, qualitative, and quantitative methods; including behavioural and socioeconomic research, in a consistent and interdisciplinary manner; and being aware of feedback loops and unintended consequences.[19] The interaction of people with their social, political, cultural, and physical environments is a particular challenge for effective climate action. Finally, there is still insufficient awareness and urgency. Knowledge translation is a key, but often overlooked aspect, where the knowledge must be understandable and convincing to the policy makers, citizens, and others.[19] Engagement of researchers with policy makers and communities is essential to maximise impact on decision making. A convincing narrative is key and focusing on health might be a topic of importance to all stakeholders.

Current barriers

A paucity of political will and commitment, together with relative short election cycles, is one of the most fundamental barriers to climate action.[19] Struggles for power and influence, resistance of vested interest and lobbying, resistance of (some) citizens, and short-term election cycles make long-term transitional policy making challenging and reduce political capital.[19,58,68] Finance and finance systems are other important aspects, particularly under the current economic frameworks and models where externalities are generally not (fully) accounted for. Economic benefits apply to a select group of individuals and companies, and society picks up the costs. Furthermore, financial restraints, such as high upfront costs, budget limitations, and funding access, are important barriers for cities and citizens. Also, those (departments) that pay for climate measures might not reap the financial benefits, for example, the mobility department pays for cycle lanes, but do not get the benefits of reduced health care costs. Finally, silo thinking exists in many cities, reducing interaction between various departments—eg, urban planning, mobility, environment, climate, public health, education, and business—and resulting in different policy agendas and priorities and a fight for the scarce (financial) resources that are available, rather than an overarching coherent set of policies that is required to address an important

threat, such as climate change. Common goals and visions, workshops and courses bringing different departments together, shared budgets, and committed leadership might overcome some of these issues.

Approaches, such as Health in All Policies (HiAP), should be implemented and are key for local decision-making processes in the context of climate policies to promote public health interventions as these actions involve many sectors.[69] HiAPP systematically takes into account the health implications of any policy decisions, seeks synergies, and avoids harmful health impacts to improve population health and health equity across sectors. Health is generally not a priority for urban planners, but they should make health a priority in planning and setting appropriate indicators.[70]

Finally, the insufficient urgency that often exists, slow decision-making processes, and slow implementation of policy measures need to be overcome to reduce the global climate impacts. The prioritisation of day-to-day problems over long-term visionary and strategic thinking occurs too often; the reverse should take place.

What can medical societies and clinicians do?

Medical and scientific societies and health-care professionals can have an important role in the design and implementation of preventive measures to reduce the disease burden in cities, but are too often not engaged, for example, in urban planning and transport processes and formulation of climate action plans. Such societies and individuals are often well trusted and they should engage in policy processes; communicate with policy makers and other relevant stakeholders (eg, transport engineers and urban planning, environment, and education experts) on the importance of climate action and healthy urban transitions; develop cross-sectoral collaborations; and implement guidelines for patients.[58] Advocacy by medical societies can make an important contribution to change, as was shown by the recent new EU Ambient Air Quality Directive.[58] Health-care professionals should advocate on behalf of their patients and communities for climate action under the unanimous motto: climate crisis is a health crisis. Furthermore, health-care professionals should engage with the COP—eg, the COP28 health day. Finally, health-care professionals should promote social prescribing by general practitioners, such as active transport, walking to work, connecting with nature, and engaging in the local community.[20,21] Health is made in our communities, in our streets, in our neighbourhoods, in our cities; and prevention is better than cure.

Conclusion

Urban and transport planning practices have a large impact on greenhouse gas emissions, air pollution levels, green space availability, urban heat island effects, and disease burden. Cities therefore provide a great opportunity to address the climate crisis and promote environmental quality and health. Many climate measures are available, but what appears to be particularly lacking are political leadership, finance, and behavioural change, which are essential to making transitional changes, and of course urgency. Transitional change is difficult, but we cannot continue as we do now if we want to have a future for the next generations.

A better, more health-oriented narrative of climate action might help, particularly if immediate health benefits could be shown. But we also need a more integrated and holistic vision of what our cities should be and should look like to capture the imagination of politicians, decision makers, and citizens and change their behaviour (figure 2). This vision is often still missing. A shift away from our car-centric planning and more greening are essential.

Figure 2: **Utrecht, Netherlands, a progressive city that prioritises sustainable and healthy mobility**

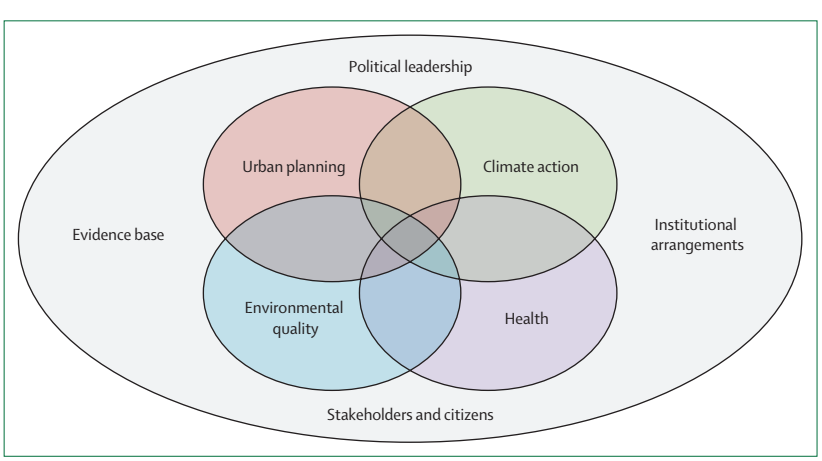

Figure 3: **Close collaboration between urban planning, environment, climate action, and health is essential for a transitional and healthy change**

Prevention is better than cure and the medical profession should become more involved in planning in our cities to address the climate crisis and reduce the disease burden (figure 3). Innovation should not only be thought of in terms of medical care, but also of measures in our streets, neighbourhoods, and cities to improve the health of citizens. Health should be a priority in any urban planning and not be left to the medical profession.

By 2050, cities that have embraced climate action will be cleaner, greener, more resilient, and more liveable, with urban environments that prioritise sustainability and the health and wellbeing of their residents (panel). Cities that

***Panel*: Scenarios that illustrate the range of potential outcomes for cities by 2050, highlighting the crucial importance of proactive and sustained climate action**

Carbon neutral, liveable, and healthy (high climate action and success)

- Overview: cities that aggressively pursue climate action and successfully implement comprehensive sustainability strategies will thrive. These cities will be marked by resilience, sustainability, and a high quality of life.
- Sustainable infrastructure: extensive use of green building materials, renewable energy, and resilient infrastructure. Public transport is fully electric, and streets are designed and prioritised for pedestrians and cyclists.
- Abundant green spaces: parks, urban forests, and green roofs are integrated into urban design, reducing heat islands, and enhancing biodiversity.
- Thriving local economies: green industries flourish, creating jobs in renewable energy, energy efficiency, and sustainable agriculture. Circular economies reduce waste and promote local production.
- High quality of life: clean air and water, healthy ecosystems, and equitable access to services and amenities. The city is a leader in climate innovation and global cooperation.

Struggling adaptation (moderate climate action with challenges)

- Overview: cities that take moderate climate action face mixed outcomes. Some initiatives succeed, others fall short due to financial, political, or technical barriers. These cities manage to operate, but with substantial challenges.
- Partial infrastructure upgrades: some buildings and transport systems are upgraded for energy efficiency and resilience, but older infrastructure remains vulnerable to climate impacts.
- Inconsistent green spaces: some neighbourhoods have access to parks and green infrastructure, while others, particularly those in low-income areas, do not have these benefits, exacerbating inequality.
- Economic strain: investments in climate action are uneven, leading to economic stress in sectors reliant on fossil fuels. Job losses in traditional industries are only partly offset by gains in green sectors.
- Ongoing climate risks: cities face recurring climate-related challenges, such as flooding, heatwaves, and air pollution, leading to periodic disruptions and health issues.

Climate resilience at a cost (delayed climate action with reactive measures)

- Overview: cities that delay climate action until the impacts of climate change become severe will be forced to take reactive measures. These cities focus on adaptation rather than prevention, resulting in a reactive and expensive approach to climate resilience.
- Expensive retrofitting: as climate impacts worsen, cities invest heavily in retrofitting existing infrastructure to cope with extreme weather, leading to high costs and disruptions.
- Emergency responses: frequent use of emergency measures, such as evacuations during floods or power rationing during heatwaves. The city is in a constant state of crisis management.
- Social inequality: the high cost of adaptation falls disproportionately on low-income residents, exacerbating social inequality and leading to increased tensions and displacements.
- Economic instability: reactive measures strain city budgets, diverting funds from other essential services and stalling economic growth. The city struggles to attract investment and maintain economic stability.

Urban decline (low or no climate action)

- Overview: cities that fail to take meaningful climate action will experience severe degradation. These cities face environmental, social, and economic collapse, becoming increasingly uninhabitable.
- Infrastructure collapse: ageing and poorly maintained infrastructure fails under the strain of extreme weather, leading to frequent power outages, water shortages, and transportation breakdowns.
- Environmental degradation: pollution, deforestation, and loss of green spaces lead to poor air and water quality, contributing to widespread health problems and reduced biodiversity.
- Mass migration: as living conditions deteriorate, residents with the means to do so flee to safer areas, leading to population decline, abandoned neighbourhoods, and increased crime.
- Economic and social breakdown: cities face economic collapse as businesses close, jobs are lost, and public services deteriorate. Social unrest and conflict become common as residents compete for scarce resources.
- Failed governance: local governments are overwhelmed by the scale of the crises, leading to ineffective governance, corruption, and a loss of public trust. Cities become a symbol of climate failure.

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do not take decisive climate action by 2050 are likely to be characterised by environmental degradation, social inequality, economic decline, and a lower quality of life for their residents. The contrast between cities that act and those that do not will become increasingly stark, with inaction leading to potentially irreversible consequences. 2050 is tomorrow and urgency in climate action is essential. Stop looking for excuses not to act, act now.

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