The Academy of Medical Sciences | THE LANCET

Climate crisis, cities and health

Professor Mark J Nieuwenhuijsen, Director of the Urban Planning, Environment and Health Initiative and Head of the Climate, Air Pollution, Nature and Urban Health Research Programme at ISGlobal.

Thursday 17 October 2024 at 15.30 (BST)

Royal Institute of British Architects (RIBA), London and online

WiFi: RIBA public   X #IHL24

Previous lectures

- **2023 –** Success from the South: the rotavirus vaccine story and its lessons
  Prof Gagandeep Kang, Director of Global Health at the Bill and Melinda Gates Foundation
- **2022** – Has traditional academic medicine had its day?
  Dr Victor J Dzau, President of the National Academy of Medicine (NAM)
- **2021 –** Global pandemic perspectives: public health, mental health and lessons for the future
  Prof George Gao, Prof Helen Herrman, Dr Matshidiso Rebecca Moeti
- **2020 –** Learning from crisis: building resilient systems to combat future pandemics
  Prof Gabriel Leung, Prof Robin Shattock, Prof Ilona Kickbusch
- **2019 –** Corruption in global health: the open secret
  Prof Patricia J García, Professor of the School of Public Health at Cayetano Heredia University (UPCH) in Lima-Peru

CLIMATE CRISIS, CITIES AND HEALTH

Mark Nieuwenhuijsen

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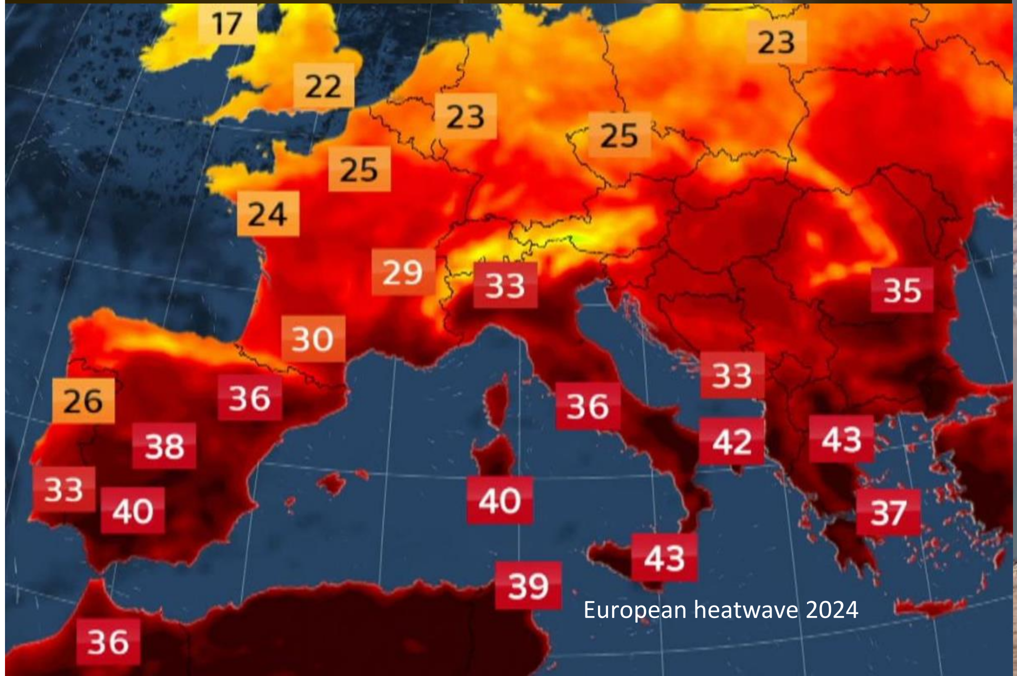
POLICY

CLIMATE CRISIS

The streets of St Pölten, Austria, are submerged in floodwater. Photograph: Christoph Reichwein/Avalon


Wildfires Portugal



European heatwave 2024


The usually submerged Sant Romà de Sau church on March 4, 2023 / Nia Escolà

Health

Heat deaths in Europe may triple by end of the century, study finds

Countries in south most at risk, with rise likely to outstrip fall in cold-related deaths if global heating hits 3C or 4C

Ajit Niranjan

Thu 22 Aug 2024 00.30 CEST

Share

Heat deaths in Europe could triple by the end of the century, with the numbers rising disproportionately in southern European countries such as Italy, Greece and Spain, a study has found.

Climate crisis

Global heating 'doubled' chance of extreme rain in Europe in September

Researchers find climate crisis aggravated the four days of heavy rainfall and deadly floods

- 'We're getting rid of everything': floods destroy homes and lives in Czech Republic

Ajit Niranjan
Europe environment correspondent

Wed 25 Sep 2024 05.00 CEST

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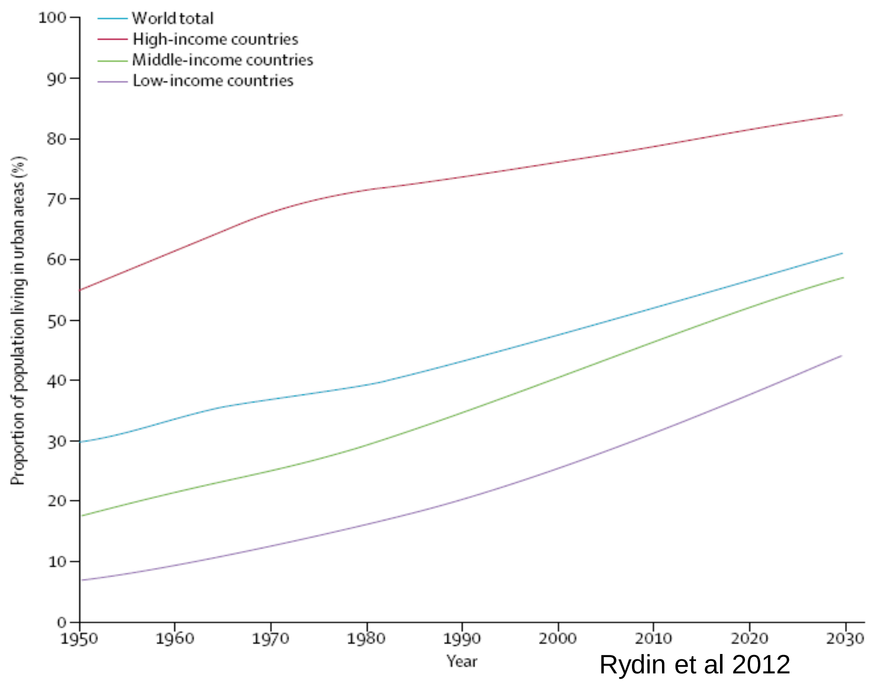
- More extreme weather events (heatwaves, cold spells, floods, droughts, storms/hurricanes), wildfires, migration, landscape changes are brought about by deforestation, deglaciation, river disappearance, desertification, water shortage, and biomass extinction, economic decline and social disruption, loss of urban forest, allergen increase
- Health effects including premature mortality, poor mental health (anxiety, stress, schizophrenia, mood disorder and depression, suicide, aggressive behaviors), cardiorespiratory disease (strokes..), respiratory disease (asthma…). infectious disease (…)
- Recent few years have been the hottest on record and high temperatures claimed over 60000 lives in Europe alone in 2022

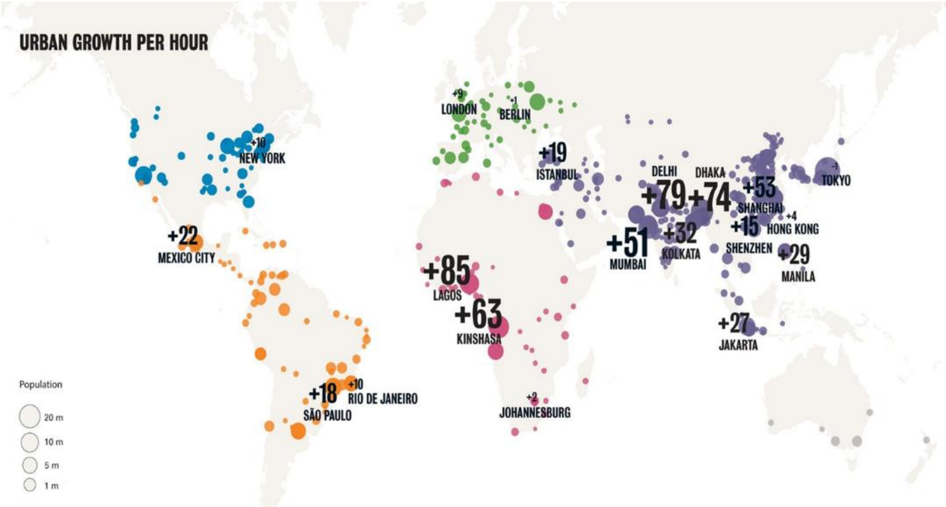
CLIMATE CRISIS

- The Conference of Parties (COP) had its first health day at COP28 (www.cop28.com) and over 120 countries have endorsed the COP28 UAE Declaration on Climate and Health.
- This historic event demonstrated that the climate crisis is also a health crisis and that we need to put health at the heart of climate action.
- The climate crisis leads already to large health impacts and health care costs, and therefore climate action is about saving more lives and preventing disease and reducing costs.

THE WORLD POPULATION LIVING IN URBAN AREAS



Rydin et al 2012



60 million new urban residents per year

“ Cities are the greatest achievement of humanity”

Glaeser 2011

“Cities have long been known to be society’s predominant engine of innovation and wealth creation, yet they are also its main source of crime, pollution, and disease”

Bettencourt et 2007

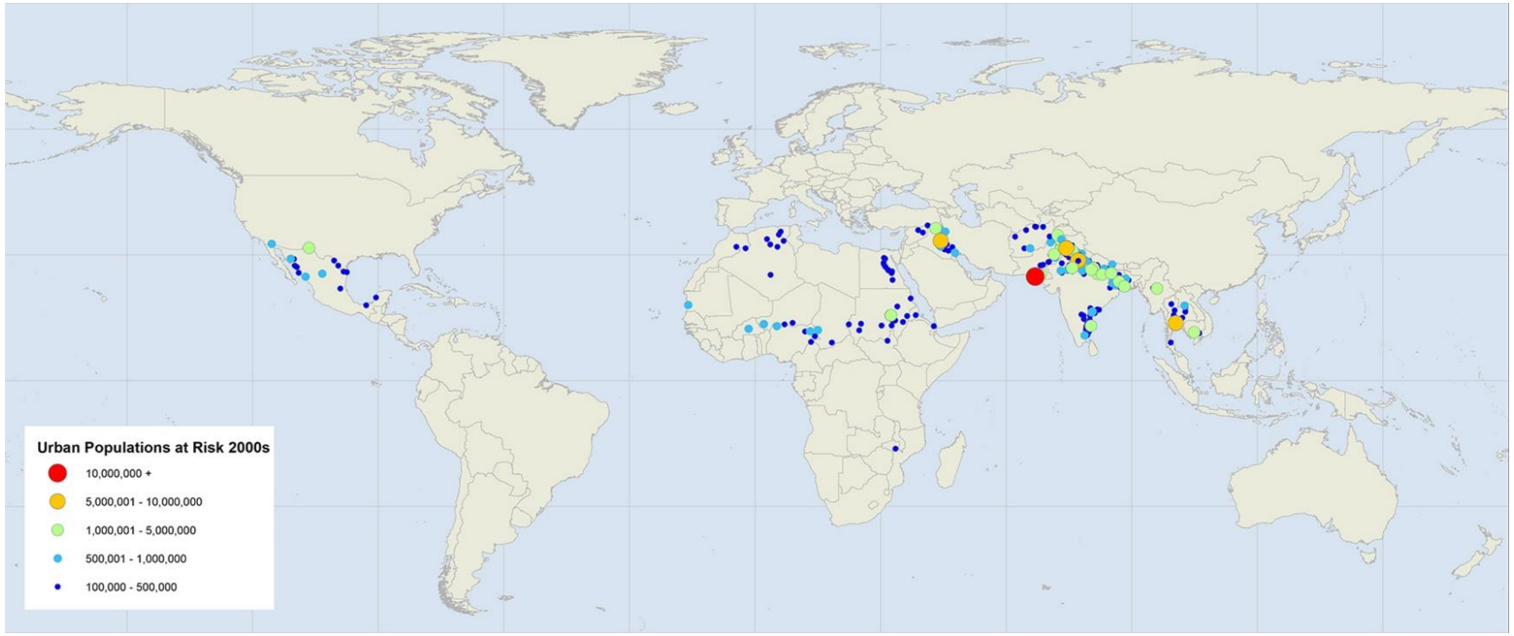
“ Ongoing urbanisation increasingly contributes to the human pressure on planetary boundaries and negatively affects planetary health”

Kronenberg et al 2024

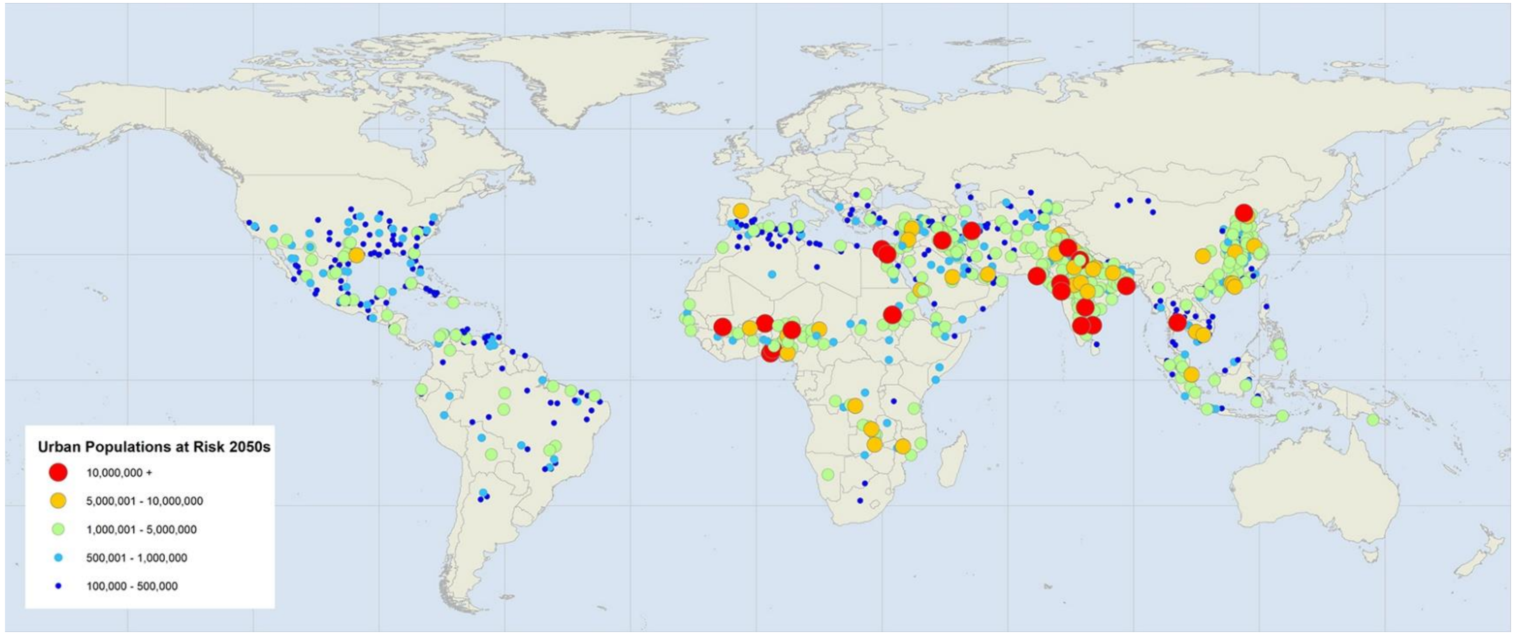
More than half of the world’s population is urban, and increasing to 68%.

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 and are a major contributor to biodiversity loss.

Cities are a problem, but also the solution. Solutions are here.



Today, around 200 million city-dwellers in over 350 cities live with summer temperature highs of over 35° C (95° F)



By 2050 around 970 cities will be at least this hot, with much higher exposure in Asia, Africa and North America

Average high temperatures of 35° C (95° F) will mean that heatwaves will become far more intense. Today, Egypt's capital Cairo, for example, has summertime average high temperatures of 34˚C (93˚F). There, temperatures have reached as high as 48˚C (118˚F) during heatwaves; by 2050 this will be a lot more common across the world.

https://www.c40.org/what-we-do/scaling-up-climate-action/adaptation-water/the-future-we-dont-want/heat-extremes/

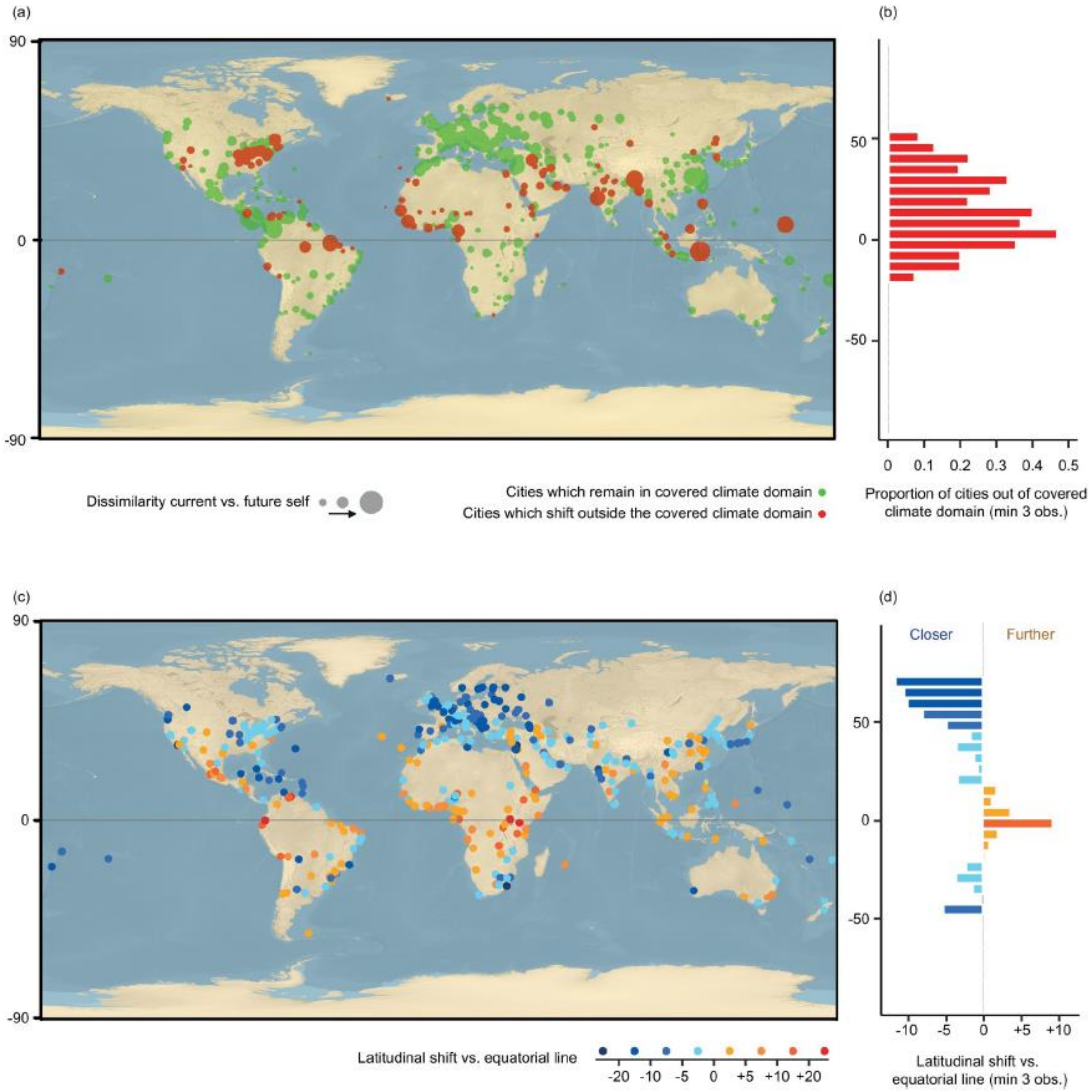


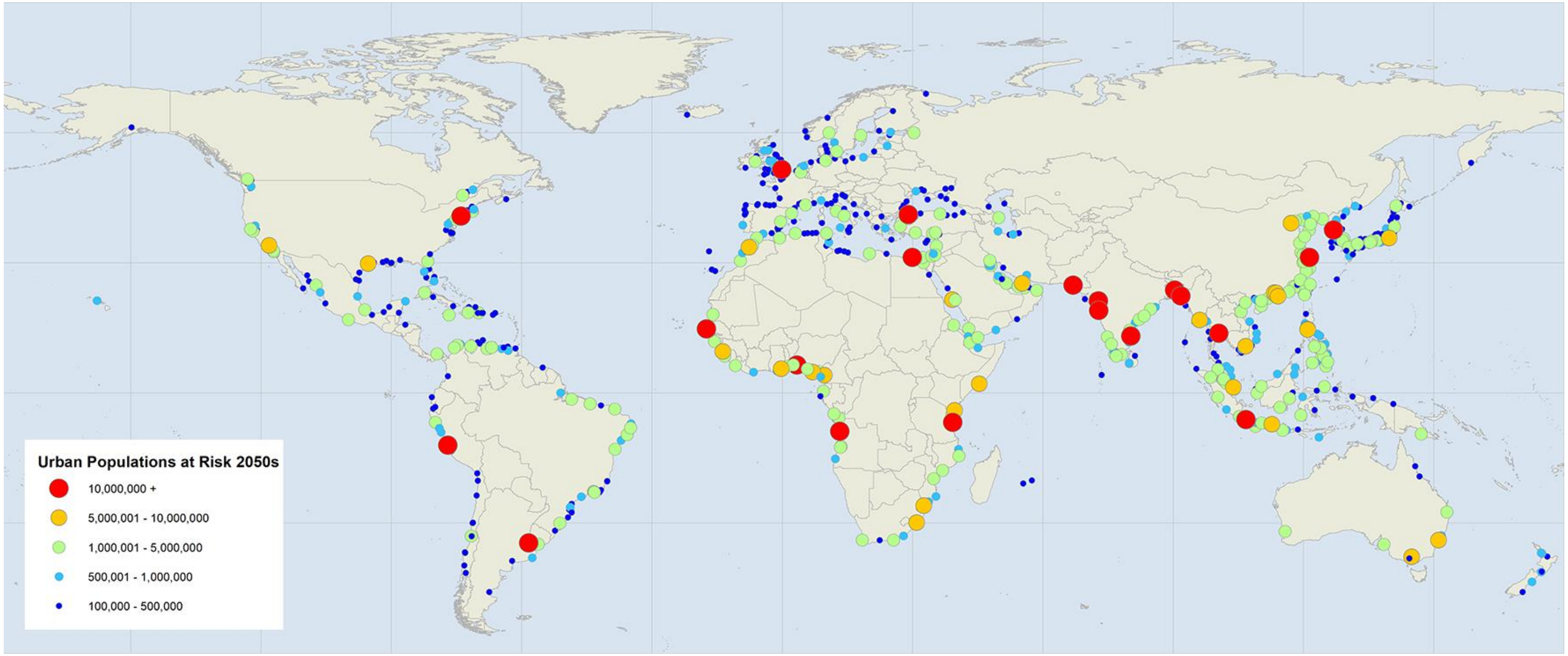
Fig 2. Extent of climate changes in major cities of the world by 2050. a, b, the extent of change in climate conditions. Cities predicted to have climates that no major city has experienced before are colored in red (mostly within the tropics). Cities for which future climate conditions reflect current conditions in other major cities of the world are shown in green. The size of the dots represents the magnitude of change between current and future climate conditions. **b,** The proportion of cities shifting away from the covered climate domain (concentrated in the tropics). **c,d,** The extent of latitudinal shifts in relation to the equatorial line. Cities shifting towards the equator are colored with a blue gradient (mostly outside the tropics), while cities shifting away from the equator are colored with a yellow to red gradient (mostly within the tropics). **d,** A summary of the shift by latitude is illustrated in a barchart, with shifts averaged by bins of 5 degrees. The background of the maps are a combination rasters available in the public domain, i.e. of USGS shaded relief only and hydro cached.

https://doi.org/10.1371/journal.pone.0217592.g002

As a general trend, they found that all the cities tend to shift towards the sub-tropics, with cities from the Northern hemisphere shifting to warmer conditions, on average ~1000 km south (velocity ~20 km.year-1), and cities from the tropics shifting to drier conditions (N=520).

They predict that Madrid's climate in 2050 will resemble Marrakech's climate today, Stockholm will resemble Budapest, London to Barcelona, Moscow to Sofia, Seattle to San Francisco, Tokyo to Changsha.

Bastin et al 2019



Cities a risk from sea level rise of 0.5 metres by 2050s [*Cities projected to receive at least 0.5 metres of sea level rise by the 2050s under RCP8.5.*]

The total urban population at risk from sea level rise, if emissions don't go down, could number over 800 million people, living in 570 cities, by 2050

https://www.c40.org/what-we-do/scaling-up-climate-action/adaptation-water/the-future-we-dont-want/sea-level-rise/

WORLD RESOURCES INSTITUTE

TECHNICAL NOTE

City-scale, city-relevant climate hazard indicators under 1.5°C, 2.0°C, and 3.0°C of global warming

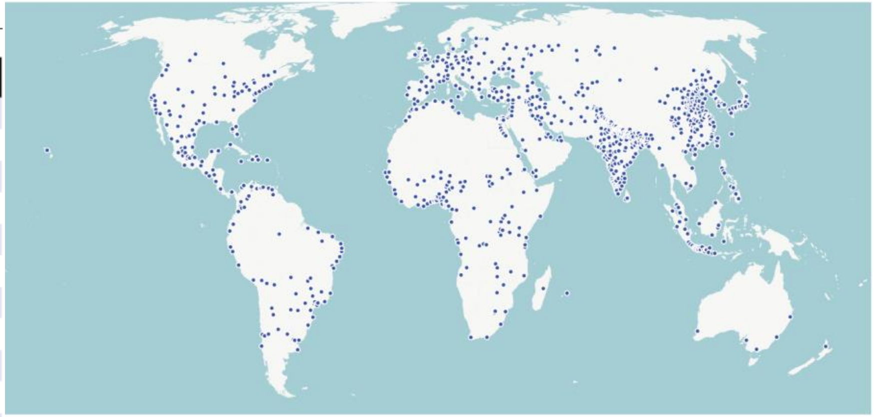
Theodore Wong and Eric Mackres

Table 6 | Population-weighted mean values of city-average climate hazard indicator values

	RECENT HISTORICAL	+1.5°C	+2.0°C	+3.0°C
Tmax_highest	0.50	0.54	0.53	0.60
Tmax95pctl_days	7.62	9.18	11.78	12.70
Tmax40_days	2.55	2.64	3.27	3.59
Tmax35_days	3.71	4.86	5.33	6.50
CDD21	40.09	51.78	52.36	56.19
Twb31_days	9.30	71.62	71.85	72.28
heatwave_duration	6.14	8.41	11.08	11.84
heatwave_count	0.77	0.88	1.00	1.12
malaria_days	7.63	8.86	9.20	10.04
arbovirus_days	7.82	9.06	10.12	10.83
pr_highest	6.57	7.03	7.12	7.07
pr90pctl_days	5.29	5.92	5.96	6.54
drought_days	15.98	17.33	17.34	18.87
landsliderisk_days	4.05	4.08	4.42	4.24

Notes: For each city, we calculated indicators using the three best NEX-GDDP-CMIP6 models based on minimizing RMSD with ERA5. Variation among the results from the three models can be characterized by a standard deviation. This table reports the average across all 996 cities of these standard deviations. The three best models differ from city to city. Larger values reflect greater among-model variation. Recent historical values are averages from the 1995–2014 reference period.

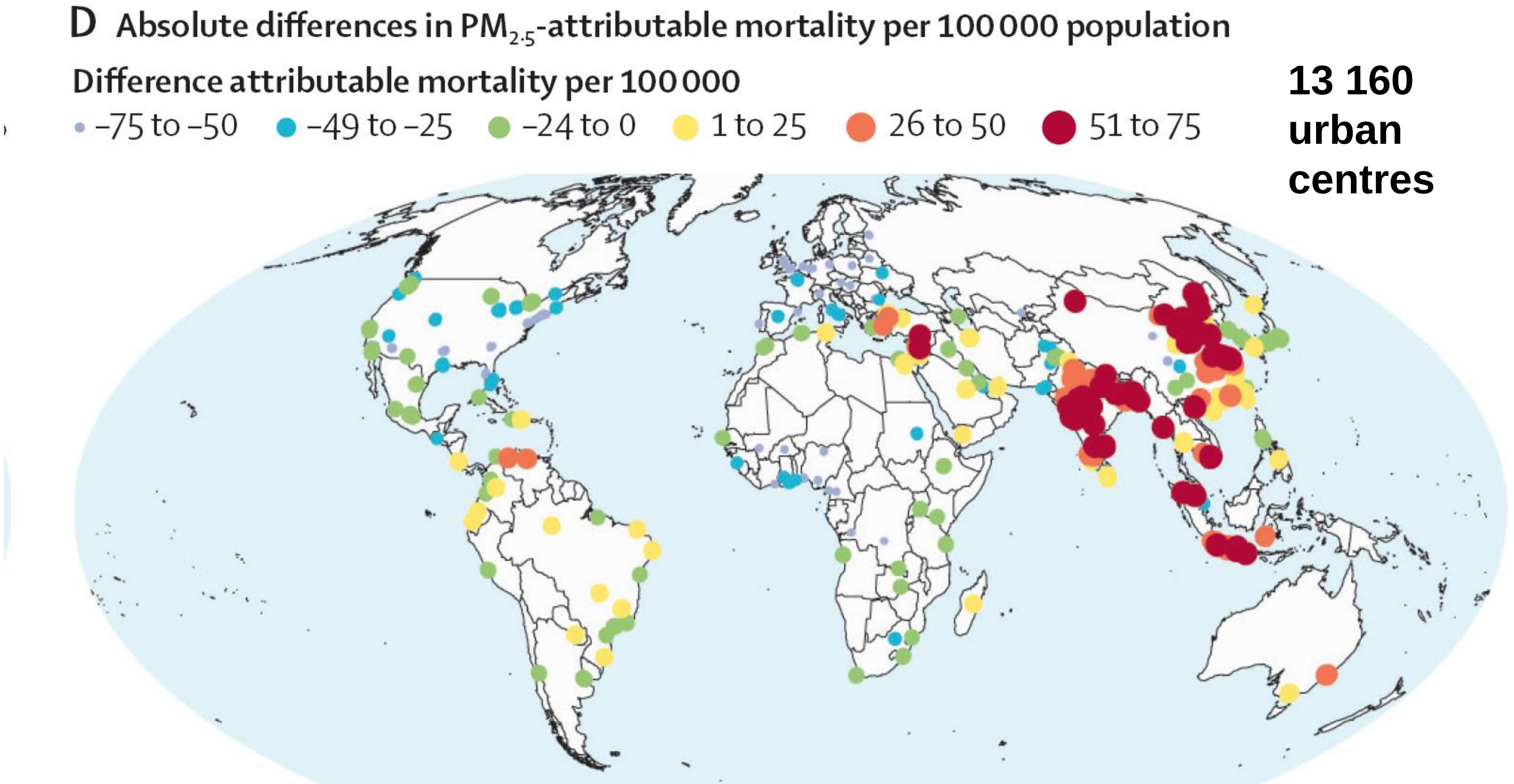
Source: WRI Authors.



e: For the study, 996 cities were chosen for having populations larger than 500,000 in 2015, according to the Global Human Settlement Layer Urban Centre Database.

rce: Florczyk et al. 2019.

Suggested Citation: Wong, T. and E. Mackres. 2024 "City-scale, city-relevant climate hazard indicators under 1.5°C, 2.0°C, and 3.0°C of global warming." Technical Note. Washington, DC: World Resources Institute. Available online at: doi.org/10.46830/writn.23.00154.



13 160 urban centres

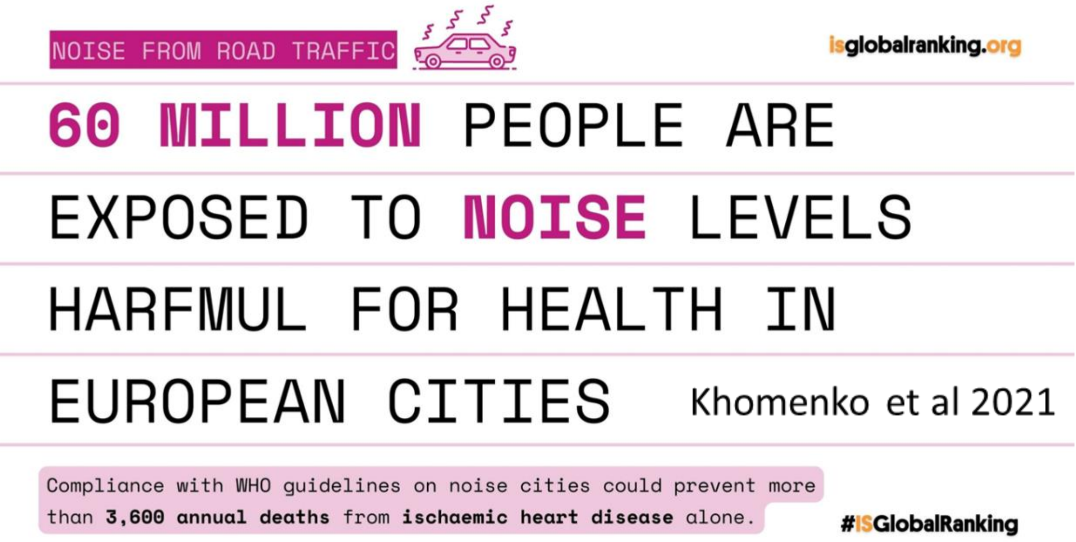
An excess of 1·8 million (95% CI 1·34 million–2·3 million) deaths in 2019

Range –73 to 29

But also causes lung and cardiovascular disease, cancer, affects brain function and foetus

Regional averages of PM2·5-attributable deaths increased in all regions except for Europe and the Americas, driven by changes in population numbers, age structures, and disease rates

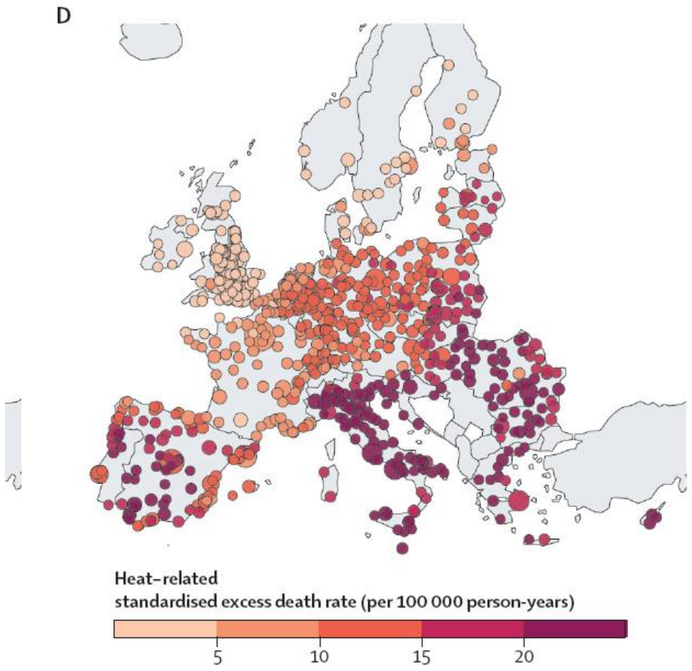
Southerland et al 2022



200K+ deaths due to air pollution

Khomenko et al 2021

Pereira Barboza et al 2021



Masselot et al 2023

20173 (17 261–22 934) attributed to heat

ISGlobal

ESTIMATES FROM NEARLY A 1000 CITIES IN EUROPE

https://isglobalranking.org/

Cities, CO_2 emissions and trade offs?

Does Size Matter? Scaling of CO_2 Emissions and U.S. Urban Areas

Michail Fragkias[1]*, José Lobo[2], Deborah Strumsky[3], Karen C. Seto[4]

1 Department of Economics, Boise State University, Boise, Idaho, United States of America, 2 School of Sustainability, Arizona State University, Tempe, Arizona, United States of America, 3 Department of Geography & Earth Sciences, University of North Carolina-Charlotte, Charlotte, North Carolina, United States of America, 4 Yale School of Forestry & Environmental Studies, Yale University, New Haven, Connecticut, United States of America

Abstract

Urban areas consume more than 66% of the world's energy and generate more than 70% of global greenhouse gas emissions. With the world's population expected to reach 10 billion by 2100, nearly 90% of whom will live in urban areas, a critical question for planetary sustainability is how the size of cities affects energy use and carbon dioxide (CO_2) emissions. Are larger cities more energy and emissions efficient than smaller ones? Do larger cities exhibit gains from economies of scale with regard to emissions? Here we examine the relationship between city size and CO_2 emissions for U.S. metropolitan areas using a production accounting allocation of emissions. We find that for the time period of 1999–2008, CO_2 emissions scale proportionally with urban population size. Contrary to theoretical expectations, larger cities are not more emissions efficient than smaller ones.

Citation: Fragkias M, Lobo J, Strumsky D, Seto KC (2013) Does Size Matter? Scaling of CO_2 Emissions and U.S. Urban Areas. PLoS ONE 8(6): e64727. doi:10.1371/journal.pone.0064727

ARTICLE OPEN

Check for updates

On the impact of urbanisation on CO_2 emissions

Muhammad Luqman[1,2], Peter J. Rayner[2,3] and Kevin R. Gurney[4]

We use a globally consistent, time-resolved data set of CO_2 emission proxies to quantify urban CO_2 emissions in 91 cities. We decompose emission trends into contributions from changes in urban extent, population density and per capita emission. We find that urban CO_2 emissions are increasing everywhere but that the dominant contributors differ according to development level. A cluster analysis of factors shows that developing countries were dominated by cities with the rapid area and per capita CO_2 emissions increases. Cities in the developed world, by contrast, show slow area and per capita CO_2 emissions growth. China is an important intermediate case with rapid urban area growth combined with slower per capita CO_2 emissions growth. Urban per capita emissions are often lower than their national average for many developed countries, suggesting that urbanisation may reduce overall emissions. However, trends in per capita urban emissions are higher than their national equivalent almost everywhere, suggesting that urbanisation will become a more serious problem in the future. An important exception is China, whose per capita urban emissions are growing more slowly than the national value. We also see a negative correlation between trends in population density and per capita CO_2 emissions, highlighting a strong role for densification as a tool to reduce CO_2 emissions.

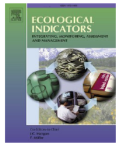
npj Urban Sustainability (2023)3:6 ; https://doi.org/10.1038/s42949-023-00084-2

Ecological Indicators 144 (2022) 109456

Contents lists available at ScienceDirect

Ecological Indicators

journal homepage: www.elsevier.com/locate/ecolind



ELSEVIER

Review

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Relationship between urban spatial structure and carbon emissions: A literature review

Hong Shunfa[a,b], Eddie Chi-man Hui[b], Lin Yaoyu[a,*]

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ARTICLE INFO

Keywords:
Urban agglomeration
Urban size
Urban compactness
Urban form
Urban spatial structure

ABSTRACT

Carbon emission reduction is one of the key factors in global climate change and should be an important component in urban planning and management. A full understanding of the relationship between carbon emissions and urban spatial structure is necessary. This paper presents the research on this relationship from the perspectives of urban agglomeration, urban size, urban compactness, and urban form. The results revealed that: (1) there is still a lack of research on the spatial structures of urban agglomerations and their relationship with carbon emissions, so it is urgent to conduct indicators system design and empirical research; (2) two-dimensional indicators have frequently been used to describe urban form and urban compactness, but three-dimensional indicators, such as volume ratio and floor height, are also important indicators for policymaking; (3) higher urban complexity, irregularity, and fragmentation were believed to contribute to urban carbon emissions because of the lack of continuity and connectivity. This paper also proposes a comprehensive analytical framework for examining urban spatial structures and carbon emissions. We position the research on the relationship between urban spatial structure and carbon emissions as a bridge between human ecosystems and natural ecosystems.

Environmental Research 257 (2024) 119324

Contents lists available at ScienceDirect

Environmental Research

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ELSEVIER

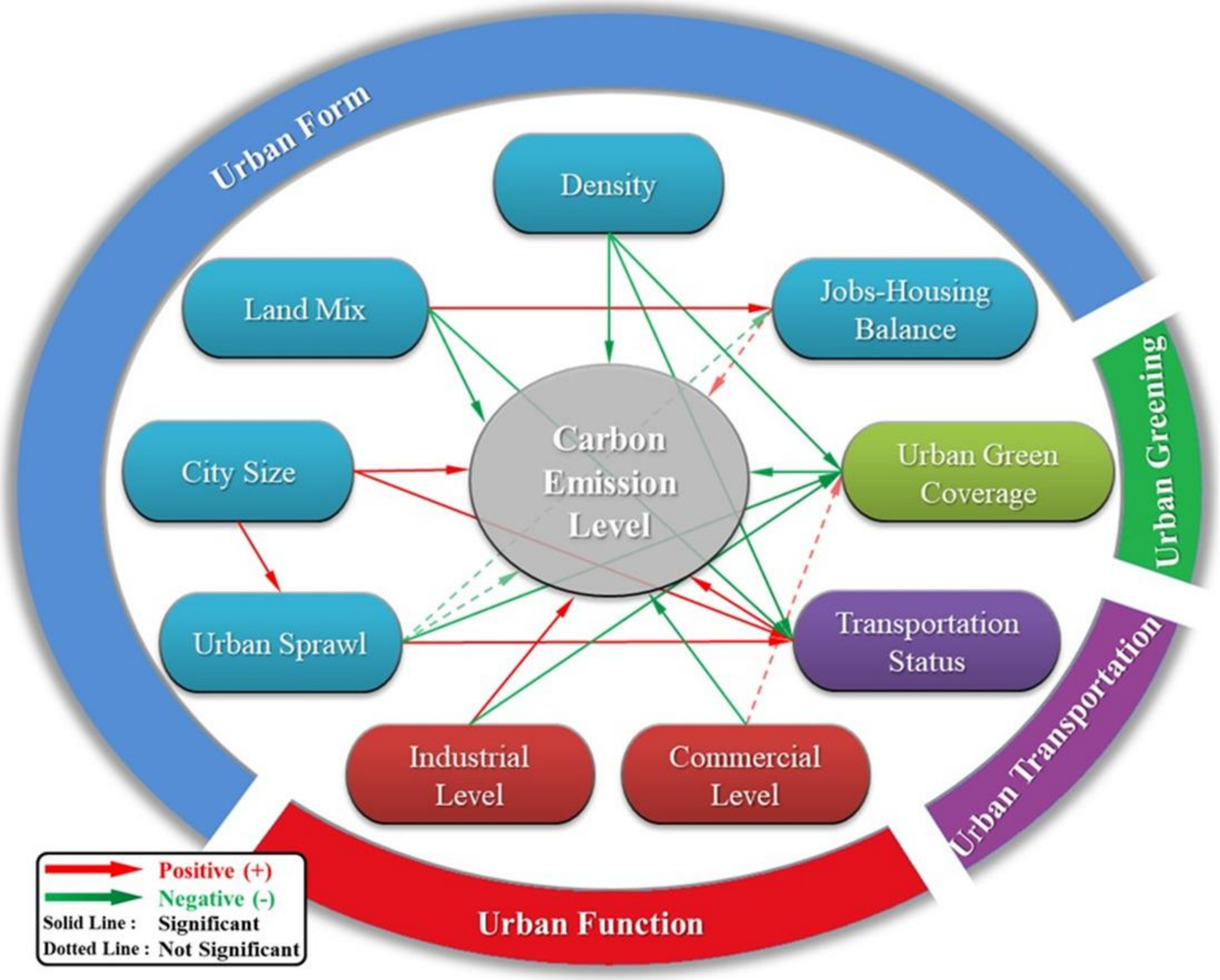
Review article

Check for updates

Exploring the nexus of urban form, transport, environment and health in large-scale urban studies: A state-of-the-art scoping review

Georgia M.C. Dyer[a,b,c], Sasha Khomenko[a,b,c], Deepti Adlakha[d], Susan Anenberg[e], Martin Behnisch[f], Geoff Boeing[g], Manuel Esperon-Rodriguez[h,i], Antonio Gasparrini[j], Haneen Khreis[k], Michelle C. Kondo[l], Pierre Masselot[j], Robert I. McDonald[m], Federica Montana[a,b,c], Rich Mitchell[n], Natalie Mueller[a,b,c], M. Omar Nawaz[e], Enrico Pisoni[o], Rafael Prieto-Curiel[p], Nazanin Rezaei[q], Hannes Taubenböck[r,s], Cathryn Tonne[a,b,c], Daniel Velázquez-Cortés[a,b,c], Mark Nieuwenhuijsen[a,b,c,*]

Background: As the world becomes increasingly urbanised, there is recognition that public and planetary health relies upon a ubiquitous transition to sustainable cities. Disentanglement of the complex pathways of urban design, environmental exposures, and health, and the magnitude of these associations, remains a challenge. A state-of-the-art account of large-scale urban health studies is required to shape future research priorities and equity- and evidence-informed policies.
Objectives: The purpose of this review was to synthesise evidence from large-scale urban studies focused on the interaction between urban form, transport, environmental exposures, and health. This review sought to determine common methodologies applied, limitations, and future opportunities for improved research practice.
Methods: Based on a literature search, 2958 articles were reviewed that covered three themes of: urban form; urban environmental health; and urban indicators. Studies were prioritised for inclusion that analysed at least 90 cities to ensure broad geographic representation and generalisability. Of the initially identified studies, following expert consultation and exclusion criteria, 66 were included.
Results: The complexity of the urban ecosystem on health was evidenced from the context dependent effects of urban form variables on environmental exposures and health. Compact city designs were generally advantageous for reducing harmful environmental exposure and promoting health, with some exceptions. Methodological heterogeneity was indicative of key urban research challenges; notable limitations included exposure and health data at varied spatial scales and resolutions, limited availability of local-level sociodemographic data, and the lack of consensus on robust methodologies that encompass best research practice.



This study used partial least squares (PLS) modeling and urban-scale data from nineteen counties in Taiwan to identify the crucial effects and pathways affecting carbon emissions

The results reveal that minimizing city size, urban sprawl, industrial level, and transportation status, and maximizing density, land mix, commercial levels, and urban green coverage could reduce carbon emissions.

Findings demonstrated that appropriate urban policies and planning, such as compact cities, green cities, or transit-oriented development, might lower carbon emissions and thus further serve as useful strategies for building low-carbon cities.

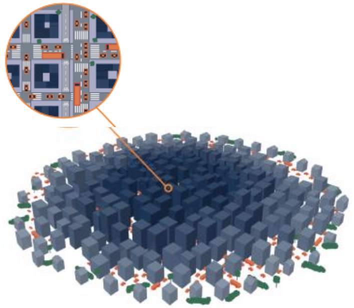
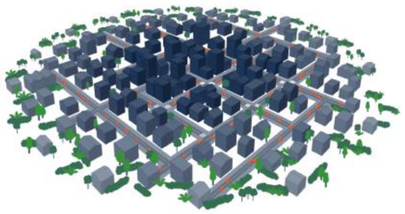
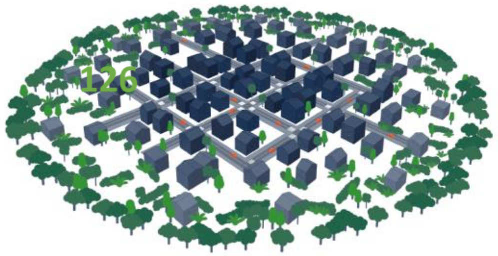
Shen et al 2022

The impact of urban configuration types on urban heat islands, air pollution, CO_2 emissions, and mortality in Europe: a data science approach

Tamara Iungman, Sasha Khomenko*, Evelise Pereira Barboza, Marta Cirach, Karen Gonçalves, Paula Petrone, Thilo Erbertseder, Hannes Taubenböck, Tirthankar Chakraborty, Mark Nieuwenhuijsen*

276,815	229,016	147,738	164,518

Average population


Model A Compact-High Density cities (n=246)	Model B Open Lowrise-Medium Density cities (n=245)	Model C Open Lowrise-Low Density cities (n=261)	Model D Green-Low Density cities (n=167)
126	128	148	206

Average area size (km2)

Analysis based on nearly 1000 European cities

Lancet Planet Health 2024; 8: e489–505

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

Iungman et al 2024
Nieuwenhuijsen 2024

2904 premature deaths (20%) annually in Barcelona due to suboptimal urban and transport planning

Mueller et al EHP 2017; 125: 89-96

	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

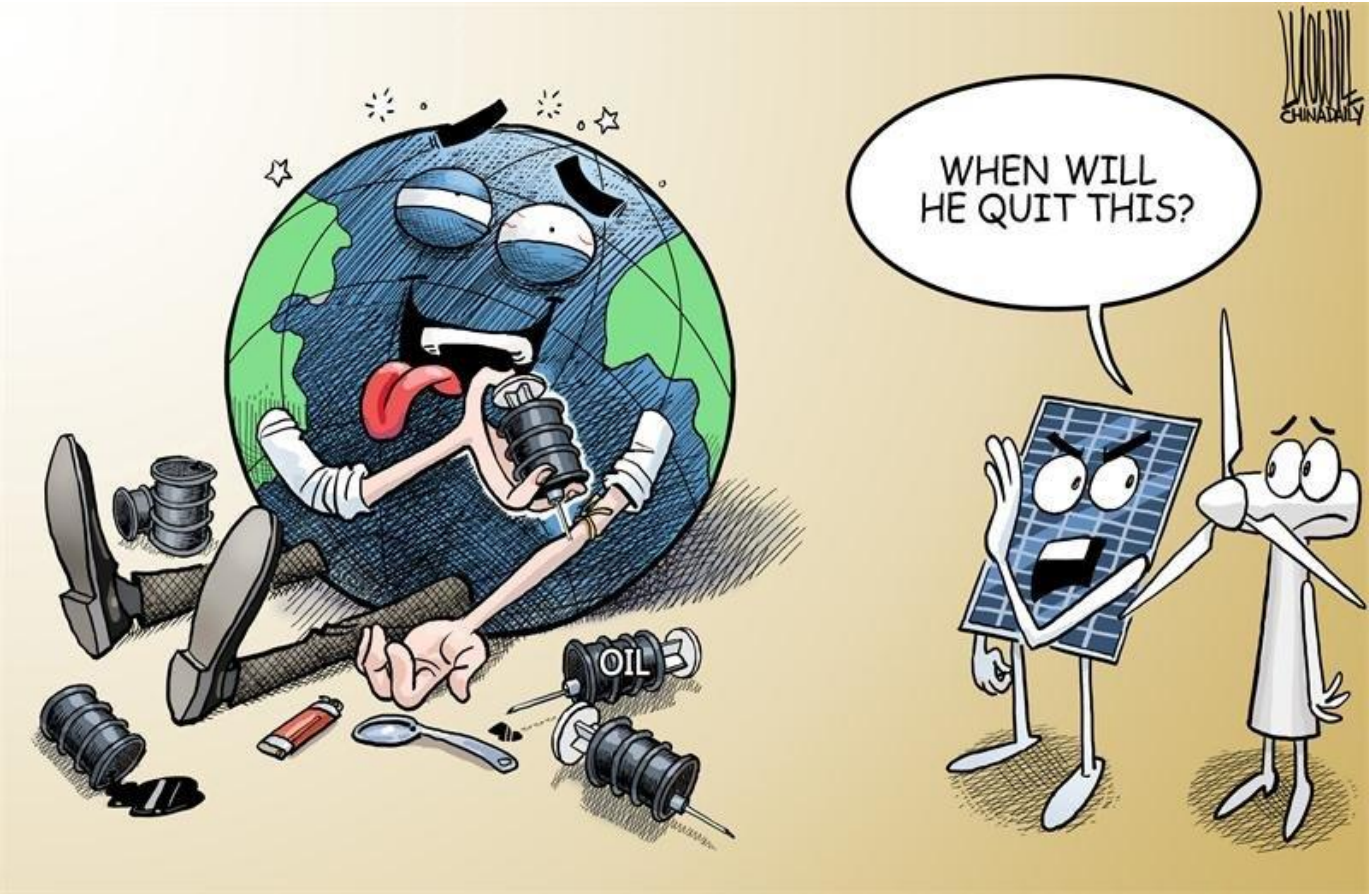
Barcelona has a mortality rate similar to the mean rate of the compact cities in the study (ie, 1124 deaths per 100 000 people) and much higher than the mortality rate in green low-density cities (ie, 1003 deaths per 100 000 people). The estimates are rough calculations that deduct the attributable mortality 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**

Nieuwenhuijsen 2024

Barcelona has a mortality rate similar to the average of the compact cities in the study (1124 deaths per 100,000 people) and much higher than the mortality rate in green low density cities (1003 deaths per 100,000 people). How can these higher mortality rates be reduced and brought closer to or lower than the green low density cities?

Decarbonisation



FOSSIL FUEL DEPENDENCY/ADDICTION LEADING TO CO2 EMISSIONS AND AIR POLLUTION

Air pollution deaths attributable to fossil fuels: observational and modelling study

Jos Lelieveld,[1,2] Andy Haines,[3] Richard Burnett,[4] Cathryn Tonne,[5,6] Klaus Klingmüller,[1] Thomas Münzel,[7] Andrea Pozzer[1,2]

ABSTRACT

OBJECTIVES

To estimate all cause and cause specific deaths that are attributable to fossil fuel related air pollution and to assess potential health benefits from policies that replace fossil fuels with clean, renewable energy sources.

DESIGN

Observational and modelling study.

CONCLUSION

Phasing out fossil fuels is deemed to be an effective intervention to improve health and save lives as part the United Nations' goal of climate neutrality by 2050. Ambient air pollution would no longer be a leading, environmental health risk factor if the use of fossil fuels were superseded by equitable access to clean sources of renewable energy.

Introduction

estimated 5.13 million (3.63 to 6.32) excess deaths per year globally are attributable to ambient air pollution from fossil fuel use and therefore could potentially be avoided by phasing out fossil fuels.

Cite this as: *BMJ* 2023;383:e077784
http://dx.doi.org/10.1136/bmj-2023-077784
Accepted: 23 November 2023

The age of extinction
Environment

Global spending on subsidies that harm environment rises to $2.6tn, report says

Exclusive: analysis finds $800bn increase in direct support for activities including deforestation and fossil fuel use

The age of extinction is supported by

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Patrick Greenfield

Wed 18 Sep 2024 01.01 CEST

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https://doi.org/10.1038/s41558-022-01356-y
nature climate change

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OPEN

Stranded fossil-fuel assets translate to major losses for investors in advanced economies

Gregor Semieniuk[1,2,3,11], Philip B. Holden[4,11], Jean-Francois Mercure[5,6,7], Pablo Salas[6,8], Hector Pollitt[6,7], Katharine Jobson[2,9], Pim Vercoulen[7], Unnada Chewpreecha[7], Neil R. Edwards[4,6] and Jorge E. Viñuales[6,10]

The distribution of ownership of transition risk associated with stranded fossil-fuel assets remains poorly understood. We calculate that global stranded assets as present value of future lost profits in the upstream oil and gas sector exceed US$1 trillion under plausible changes in expectations about the effects of climate policy. We trace the equity risk ownership from 43,439 oil and gas production assets through a global equity network of 1.8 million companies to their ultimate owners. Most of the market risk falls on private investors, overwhelmingly in OECD countries, including substantial exposure through pension funds and financial markets. The ownership distribution reveals an international net transfer of more than 15% of global stranded asset risk to OECD-based investors. Rich country stakeholders therefore have a major stake in how the transition in oil and gas production is managed, as ongoing supporters of the fossil-fuel economy and potentially exposed owners of stranded assets.

CLIMATE POLICY

Climate policies that achieved major emission reductions: Global evidence from two decades

Annika Stechemesser[1,2,3]*, Nicolas Koch[1,2,4]*, Ebba Mark[5,6,7], Elina Dilger[1], Patrick Klösel[1,2], Laura Menicacci[1], Daniel Nachtigall[8], Felix Pretis[5,9], Nolan Ritter[1,2], Moritz Schwarz[1,5,6,10], Helena Vossen[1], Anna Wenzel[1]

Meeting the Paris Agreement's climate targets necessitates better knowledge about which climate policies work in reducing emissions at the necessary scale. We provide a global, systematic ex post evaluation to identify policy combinations that have led to large emission reductions out of 1500 climate policies implemented between 1998 and 2022 across 41 countries from six continents. Our approach integrates a comprehensive climate policy database with a machine learning–based extension of the common difference-in-differences approach. We identified 63 successful policy interventions with total emission reductions between 0.6 billion and 1.8 billion metric tonnes CO_2. Our insights on effective but rarely studied policy combinations highlight the important role of price-based instruments in well-designed policy mixes and the policy efforts necessary for closing the emissions gap.

Climate crisis

Analysis

Hurricane Helene blows climate deniers Trump and Vance off course again

Oliver Milman

JD Vance had to cancel two events in Georgia on Thursday after the category 4 storm surged across the region

Fri 27 Sep 2024 12.00 CEST

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Pathways to a healthy net-zero future: report of the *Lancet* Pathfinder Commission

Sarah Whitmee, Rosemary Green, Kristine Belesova, Syreen Hassan, Soledad Cuevas, Peninah Murage, Roberto Picetti, Romain Clercq-Roques, Kris Murray, Jane Falconer, Blanca Anton, Tamzin Reynolds, Hugh Sharma Waddington, Robert C Hughes, Joseph Spadaro, Aimée Aguilar Jaber, Yamina Saheb, Diarmid Campbell-Lendrum, Maria Cortés-Puch, Kristie Ebi, Rachel Huxley, Mariana Mazzucato, Tolu Oni, Nicole de Paula, Gong Peng, Aromar Revi, Johan Rockström, Leena Srivastava, Lorraine Whitmarsh, Robert Zougmoré, Joy Phumaphi, Helen Clark, Andy Haines

The *Lancet* Pathfinder Commission was established to collate and assess the evidence on the nearterm health effects of greenhouse gas mitigation, including both modelling studies and evaluated implemented actions. The Commission's aim is to assess the potential and achieved magnitude of the benefits for health and climate of different mitigation actions and, where possible, the factors facilitating or impeding implementation.

Major benefits to health are delivered through reductions in air pollution, consumption of healthy sustainable diets, and the promotion of active travel and public transport. Clean cookstoves had the greatest estimated median health co-benefit (a reduction of 1279 YLL per 100 000 population per year, based on data from India), followed by dietary changes (306 YLL per 100 000 population per year). Actions in the transportation sector resulted in a median reduction of 60 YLL per 100 000 population per year. In the electricity generation sector, we estimated a median reduction of 11 YLL per 100 000 population per year, with some evidence for larger benefits in India (a reduction of 149 YLL per 100 000 population per year for the single reported study). Actions to decarbonise electricity generation generally had the greatest carbon mitigation intensity of actions in a single sector (a median estimated reduction of 171 kilotonnes of CO_2eq per 100 000 population per year). Multisectoral actions might achieve very high mitigation intensity, but their effects were highly variable, depending on the country context.

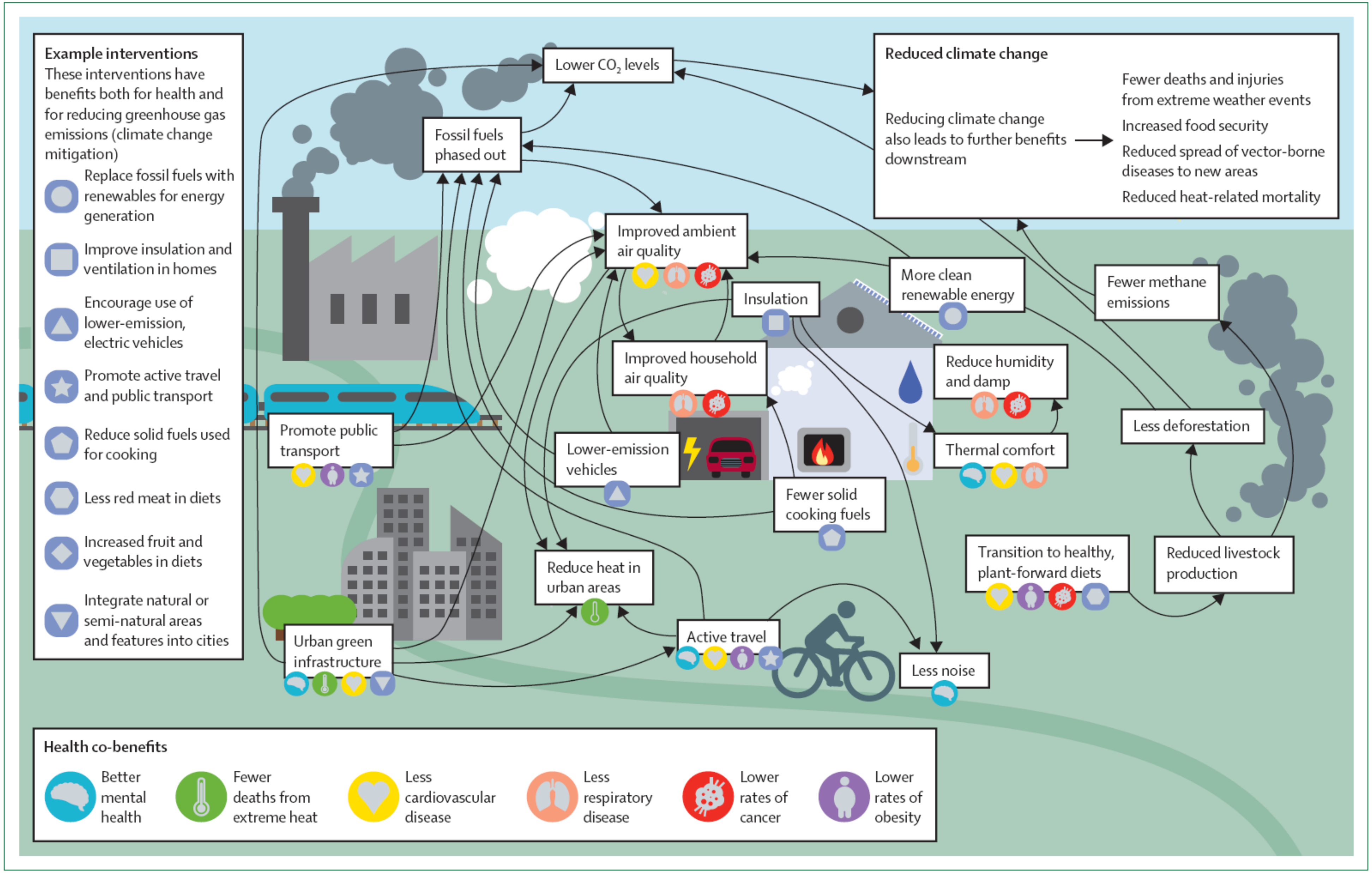


Figure 1: Key pathways and connections between climate mitigation actions and health

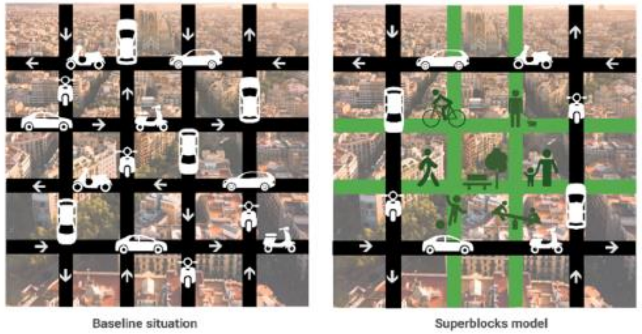
The Pathfinder report, Whitmee et al 2023

Solutions that address CO_2 emissions, environmental quality, liveability and health in cities

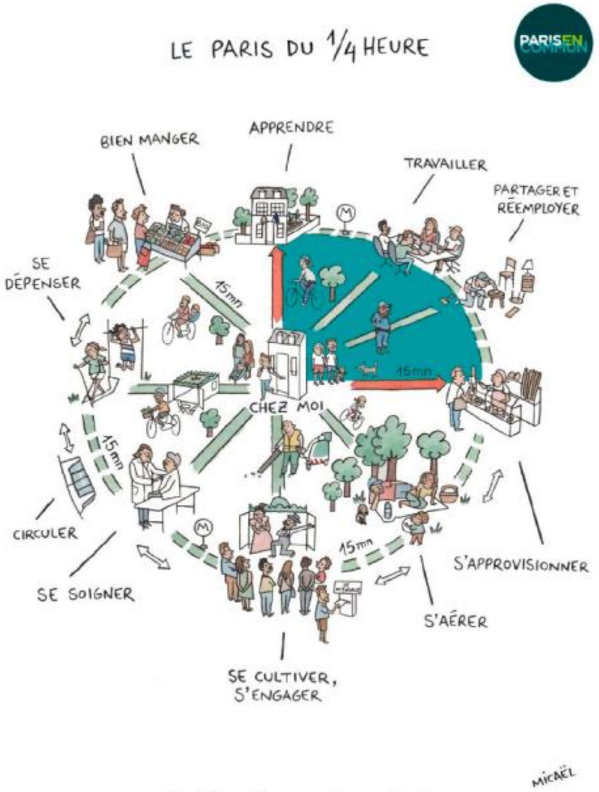
Land use

NEW URBAN MODELS

a) low traffic neighbourhood, London



b) Superblock, Barcelona



c) 15-minute city, Paris

d) Car free Vauban, Freiburg, Germany

Nieuwenhuijsen 2021

LOW TRAFFIC NEIGHBOURHOODS

Table 3
Changes in average traffic volume for each LTN situation pre and post LTN.

LTN (number of observations)		Average Traffic Volume		Change (%)
		Pre LTN	Post LTN	
St Peter's (42)	External	5573	5769	+196 (3.5 %)
	Boundary	8703	8344	−359 (−4.1 %)
	Internal	2175	868	−1307 (−60.1 %)
Canonbury East (38)	External	5735	5762	+27 (0.5 %)
	Boundary	11,931	9357	−2574 (−21.6 %)
	Internal	2317	606	−1711 (−73.8 %)
Clerkenwell (28)	External	6249	5748	−501 (−8.0 %)
	Boundary	4988	4104	−884 (−17.7 %)
	Internal	473	250	−223 (−47.1 %)

Table 2
Changes in average NO_2 for each LTN situation pre and post LTN.

LTN (number of observations)		Average NO_2		Change (%)
		Pre LTN	Post LTN	
St Peter's (129)	External	25.13	25.60	+0.47 (1.9 %)
	Boundary	27.60	26.80	−0.80 (−2.9 %)
	Internal	23.81	20.23	−3.58 (−15 %)
Canonbury East (59)	External	24.52	27.22	+2.70 (11 %)
	Boundary	34.06	35.11	+1.05 (3.1 %)
	Internal	24.25	23.03	−1.22 (−5%)
Clerkenwell (122)	External	24.41	28.20	+3.79 (15.5 %)
	Boundary	28.33	29.07	+0.74 (2.6 %)
	Internal	27.16	25.91	−1.25 (−5%)

Yang et al 2022

Table 3
Mean and median internal and boundary road traffic changes.

Internal Roads	**Medians (middle values)**	**Means (average of all values)**
Baseline	1220	1780
After Observed	662	930
Difference from Baseline	−363	−850
% difference from Baseline	−33.3%	−47.8%
After Predicted	1199	1745
Difference from Predicted	−321	−815
% difference from Predicted	−31.9%	−45.8
Boundary Roads	**Medians (middle values)**	**Means (average of all values)**
Baseline	11,034	11,706
After Observed	11,074	11,505
Difference from Baseline	106	−201
% difference from Baseline	1.2%	−1.7%
After Predicted	10,526	11,429
Difference from Predicted	242	77
% difference from Predicted	4.2%	0.7

Thomas and Aldred 2024

Journal of Transport & Health 35 (2024) 101771

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Journal of Transport & Health

journal homepage: www.elsevier.com/locate/jth

Check for updates

Impacts of active travel interventions on travel behaviour and health: Results from a five-year longitudinal travel survey in Outer London

Rachel Aldred[a,*], Anna Goodman[b], James Woodcock[c]

[a] *University of Westminster, School of Architecture and Cities, Marylebone Campus, 35 Marylebone Road, London, NW1 5LS, UK*
[b] *London School of Hygiene and Tropical Medicine, UK*
[c] *University of Cambridge, UK*

Conclusions: Active travel interventions provided high value for money when comparing health economic benefits from physical activity to costs of scheme implementation, particularly low traffic neighbourhoods.

Opinion
Transport policy

The Guardian view on low-traffic neighbourhoods: spread the word - these schemes work
Editorial

Sun 10 Mar 2024 19.25 CET

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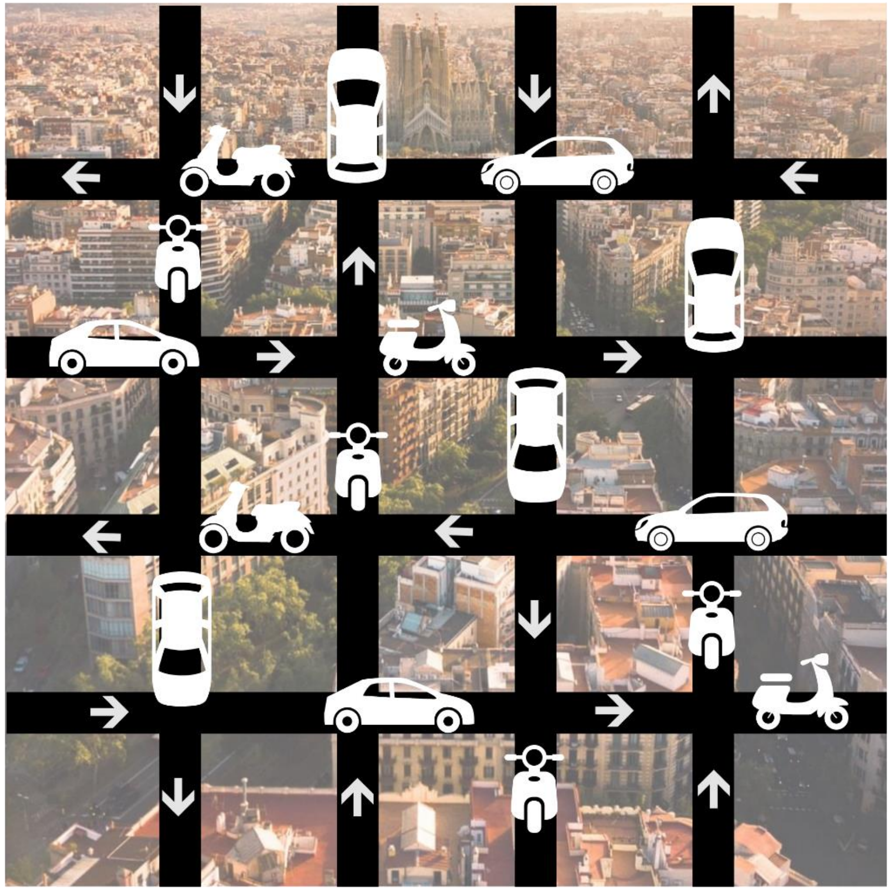
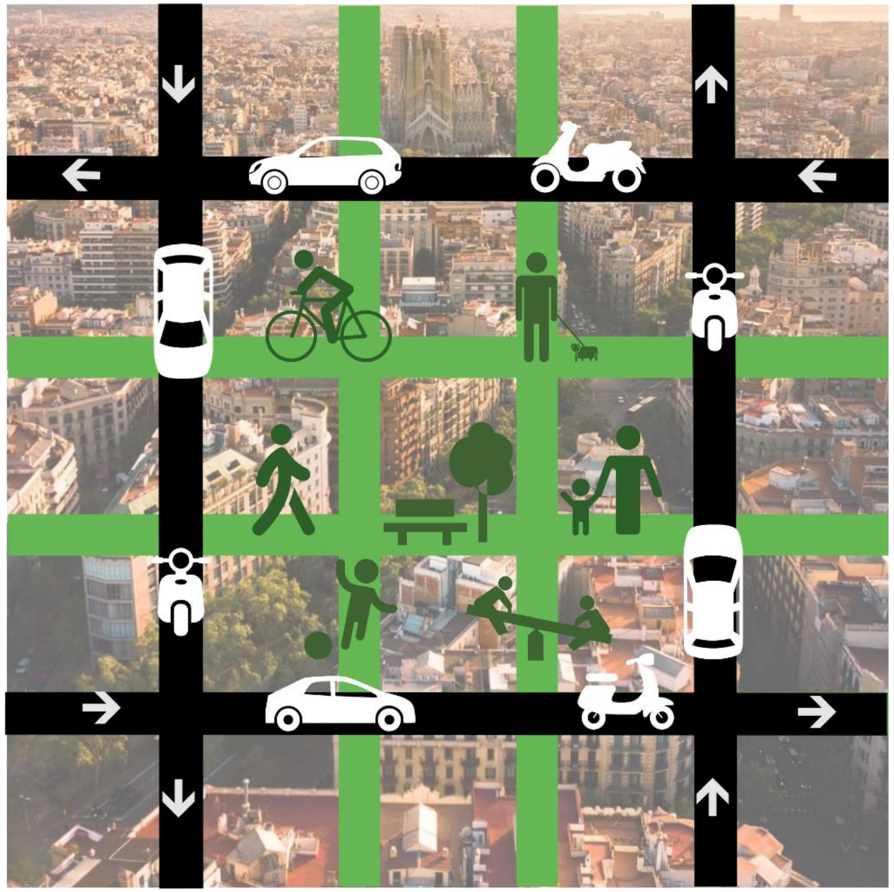
Rejecting green transport policies was a backwards step by Rishi Sunak. New research proves it

BARCELONA SUPER BLOCK MODEL



Baseline situation



Superblocks model

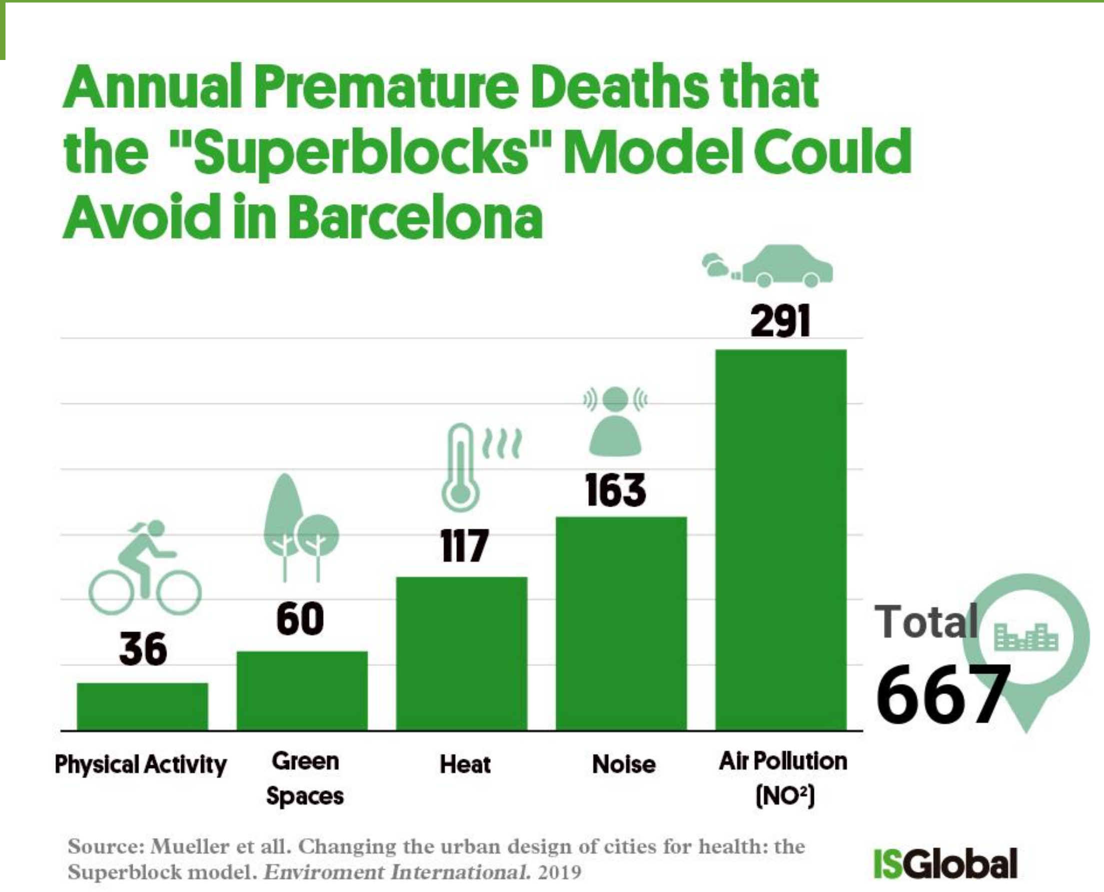
Mueller et al 2019, Env Int

Barcelona Superblock San Antoni

Before

After

BARCELONA SUPER BLOCKS



- **19.2% car reduction, 11.5 ug/ ... ce (6.5% to 19.6%), 20% Surface temperature reduction**

Mueller et al 2019, Env Int

The 15-minute city offers a new framework for sustainability, liveability, and health

In the countdown to The UN Climate Change Conference in Glasgow (COP26), two crucial reports, the Intergovernmental Panel on Climate Change 6th Assessment Report and the Nationally Determined Contributions synthesis report by the UN Framework Convention on Climate Change, have highlighted that global temperatures are poised to rise by 2·7°C by mid-century, substantially higher than the because changing the 78% of energy consumed by different sectors in cities would need to be achieved without compromising liveability. Urban liveability demands societal cohesion and bonding, which is present and higher in human-scale cities (a city designed optimally for human use) compared with contemporary cities. This demand is shown by the latest ranking on the Urban Liveability Index 2021,[5] where cities that

www.thelancet.com/planetary-health Vol 6 March 2022

Bloomberg CityLab

CITYLAB

Paris Mayor: It's Time for a '15-Minute City'

In her re-election campaign, Mayor Anne Hidalgo says that every Paris resident should be able to meet their essential needs within a short walk or bike ride.

By Feargus O'Sullivan

18 de febrero de 2020 14:40 CET

CITYLAB Take the survey

nature cities

Article https://doi.org/10.1038/s44284-024-00119-4

A universal framework for inclusive 15-minute cities

Received: 6 February 2024

Accepted: 2 August 2024

Published online: 16 September 2024

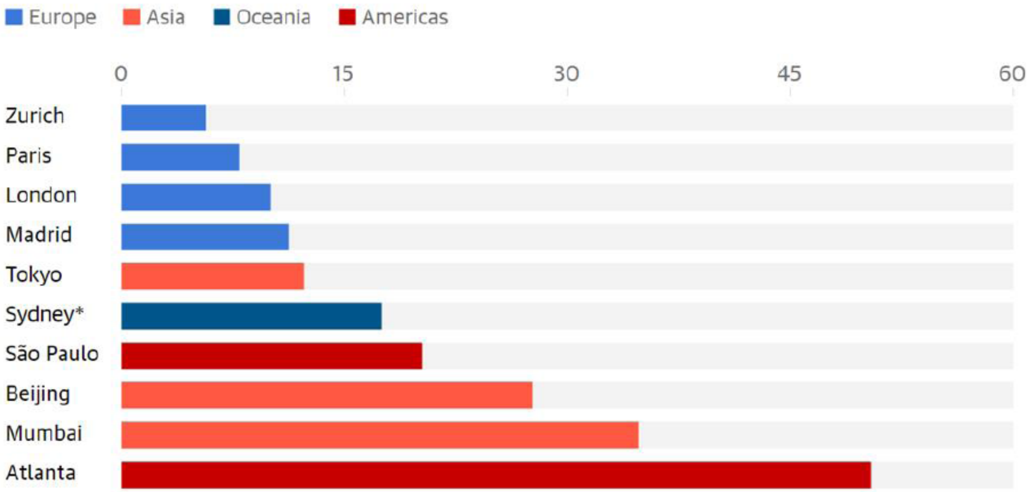
Check for updates

Matteo Bruno[1,2], Hygor Piaget Monteiro Melo[1,2,3], Bruno Campanelli[1,2,4] & Vittorio Loreto[1,2,4,5]

Proximity-based cities have attracted much attention in recent years. The '15-minute city', in particular, heralded a new vision for cities where essential services must be easily accessible. Despite its undoubted merit in stimulating discussion on new organization of cities, the 15-minute city cannot be applicable everywhere, and its very definition raises a few concerns. Here we tackle the feasibility and practicability of the 15-minute city model in many cities worldwide. We provide a worldwide quantification

European cities tend to have amenities that are closer to residents

Average proximity time on foot to key services and amenities, minutes

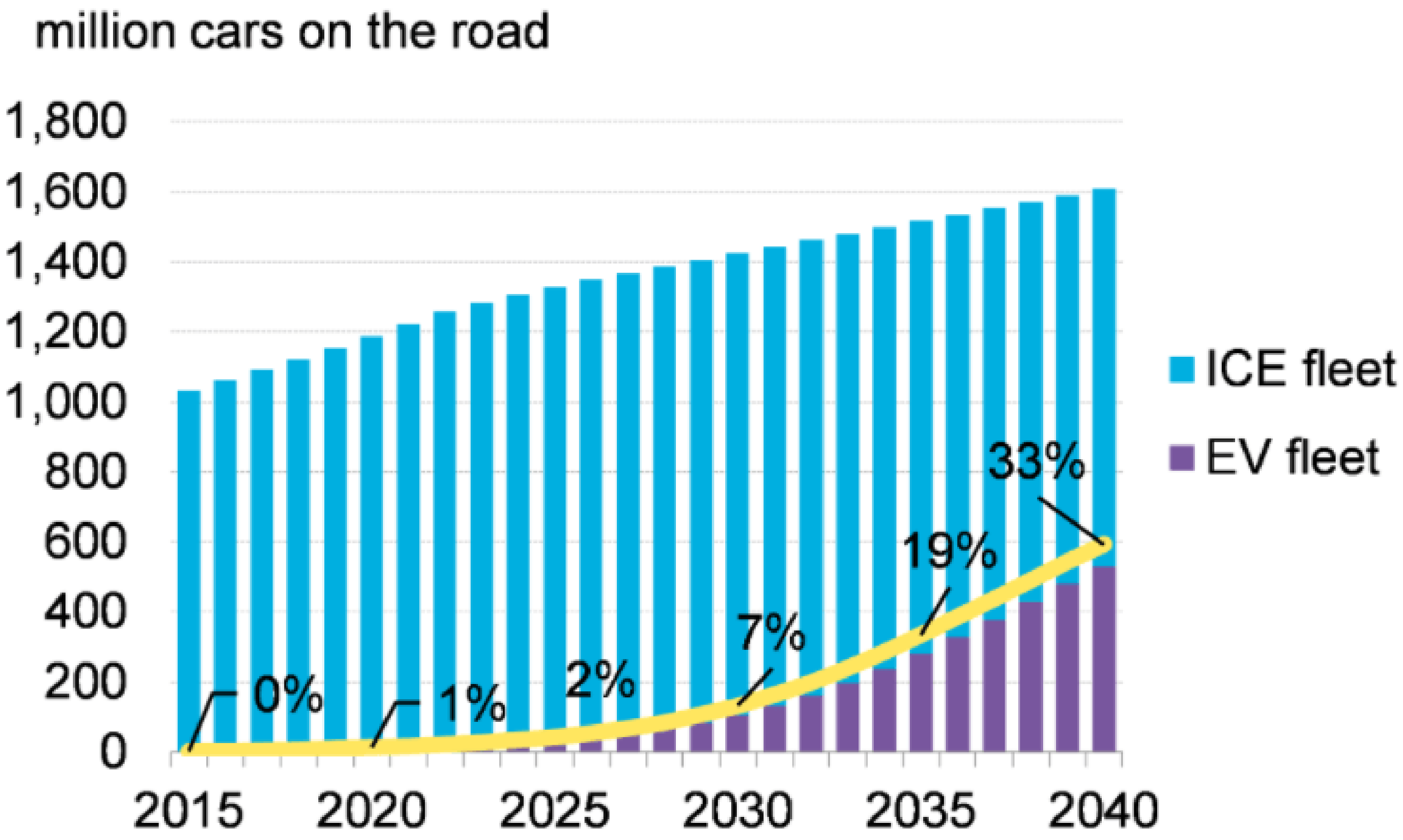



Vauban, Freiburg

Mobility

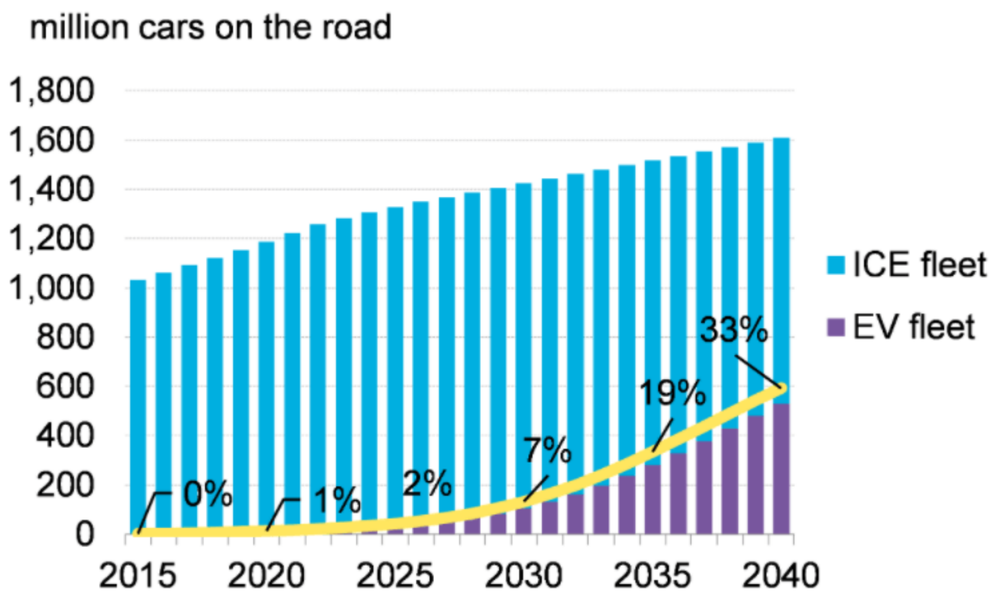
ELECTRIC CARS

PREDICTIONS FOR CARS

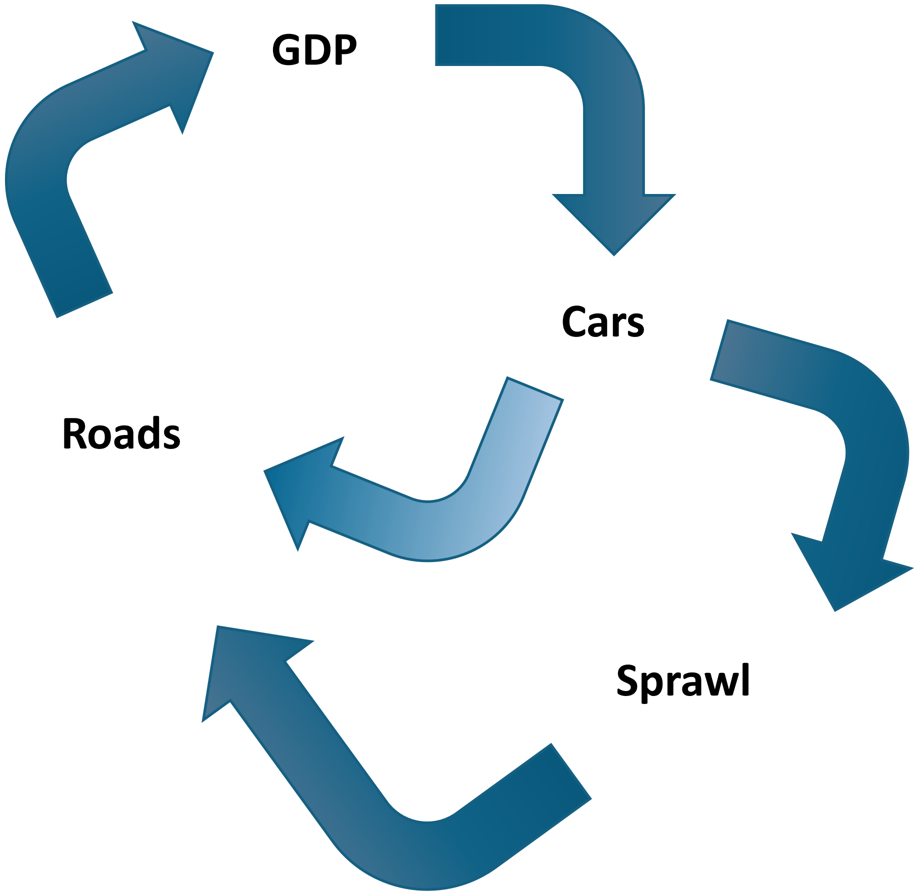


Bloomberg New Energy
Finance (BNEF)

PREDICTIONS FOR CARS

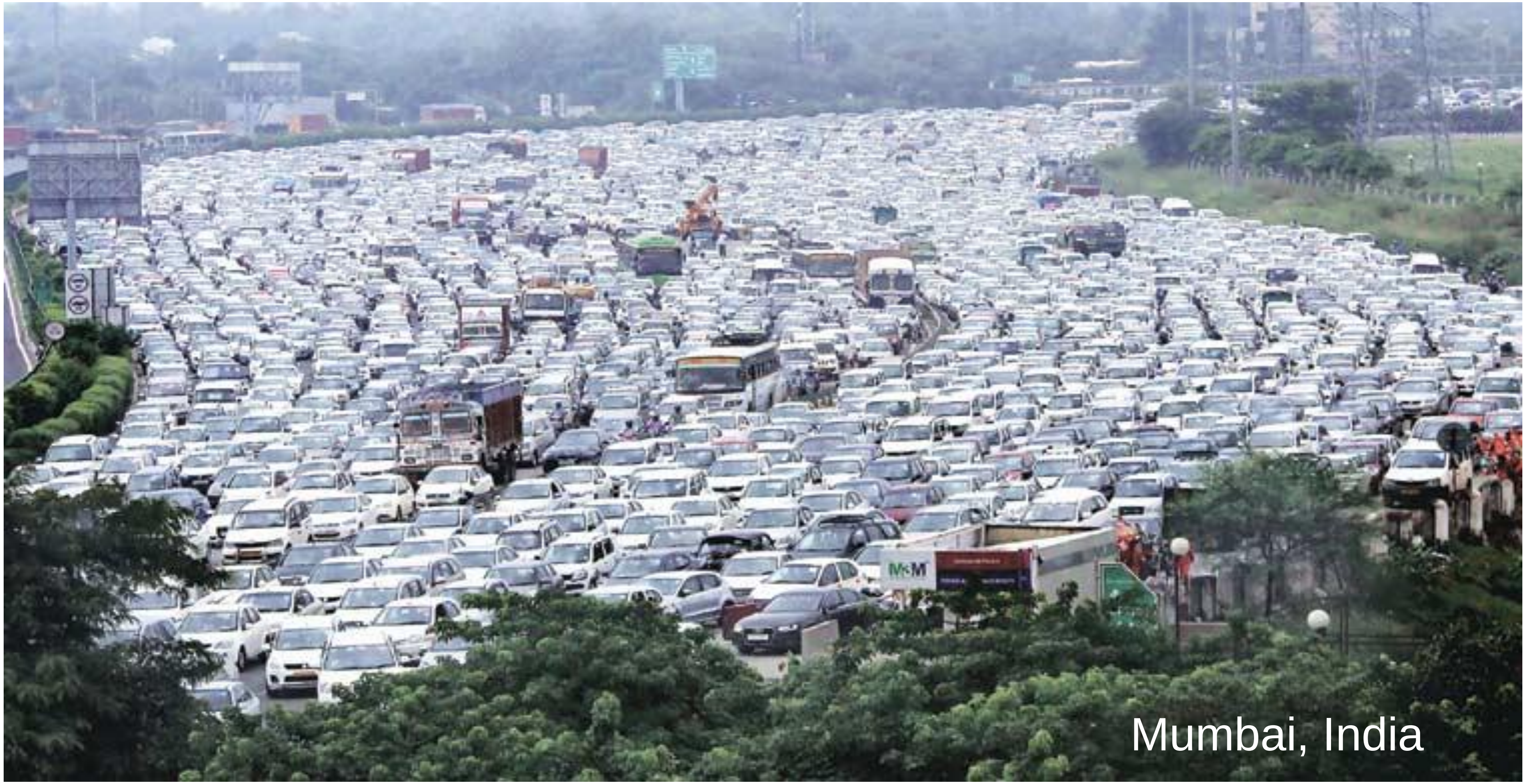


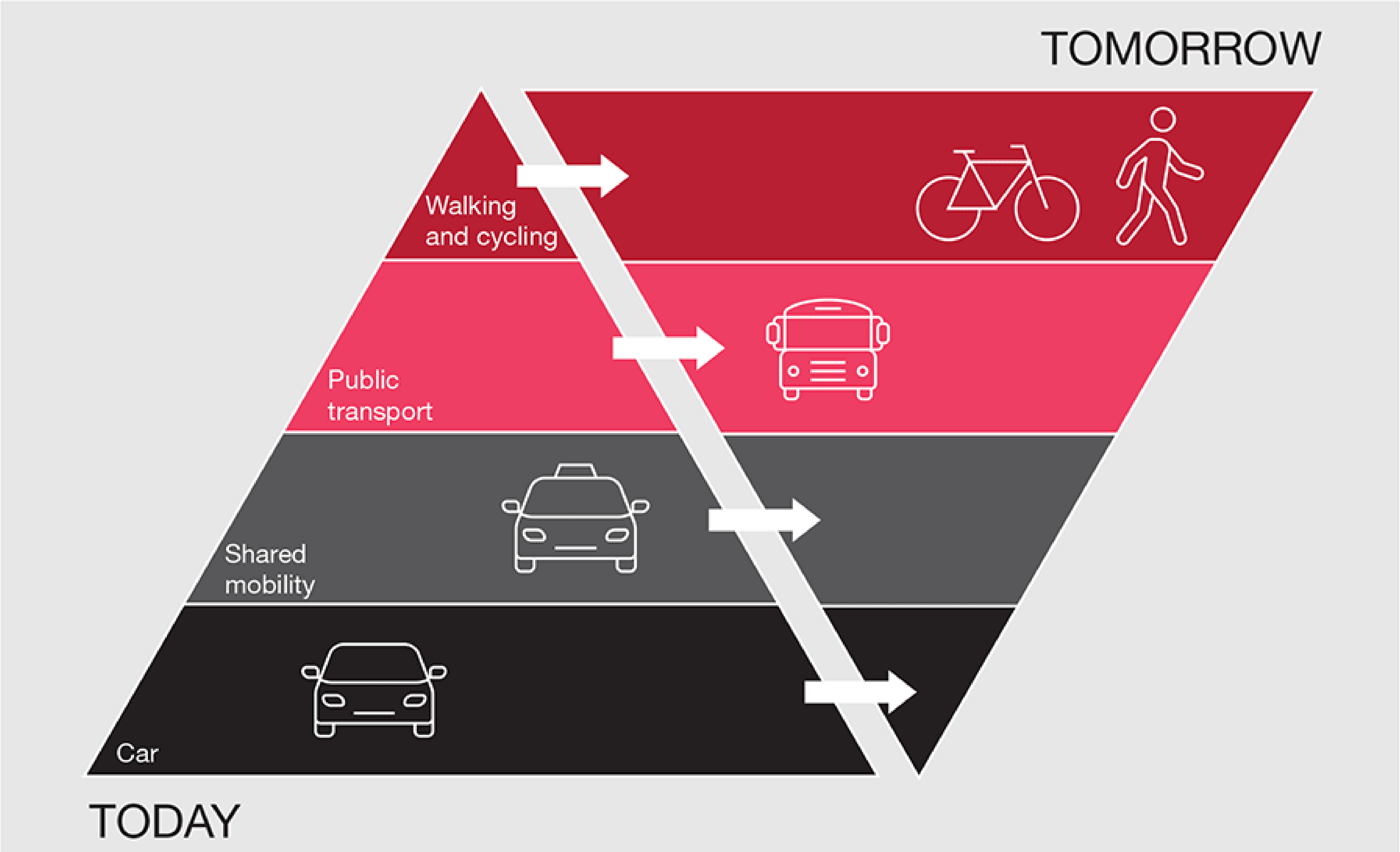
Bloomberg New Energy Finance (BNEF)



Replace
Predict and provide → Car dependency
With
Decide and provide

Mobility paradigm should be: Avoid, shift, improve


Mumbai, India


TOMORROW
Walking and cycling
Public transport
Shared mobility
Car
TODAY

50% of car trips < 5 km

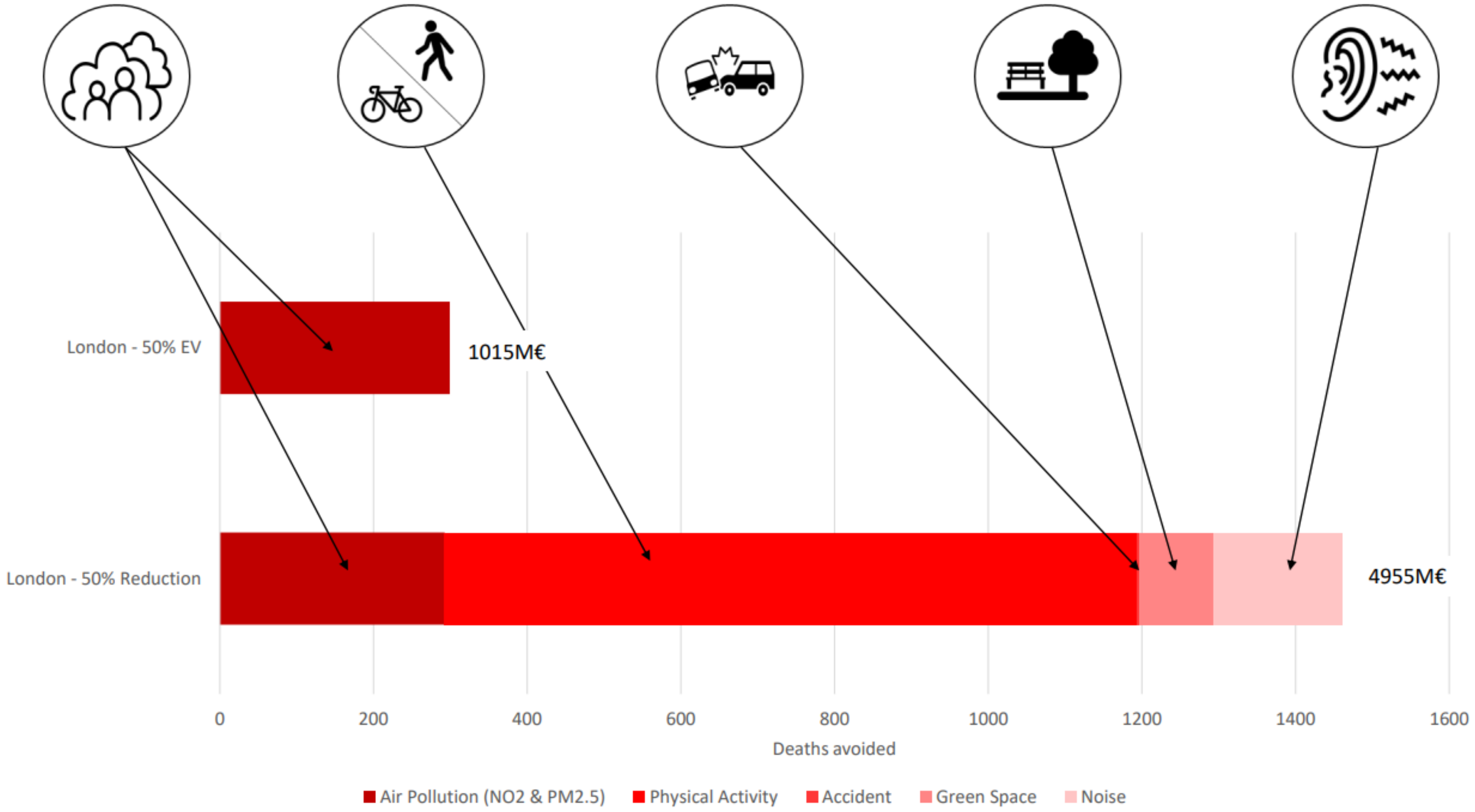
Health benefits (deaths avoided) of converting 50% of car travel in London

Replaced with

Electric Vehicles

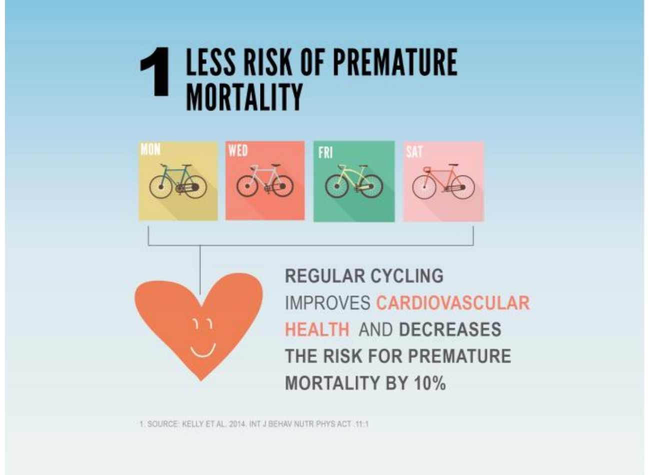
Walking, cy

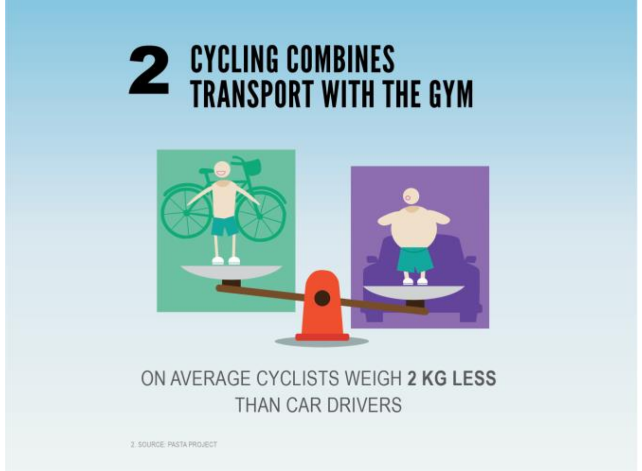
public transport

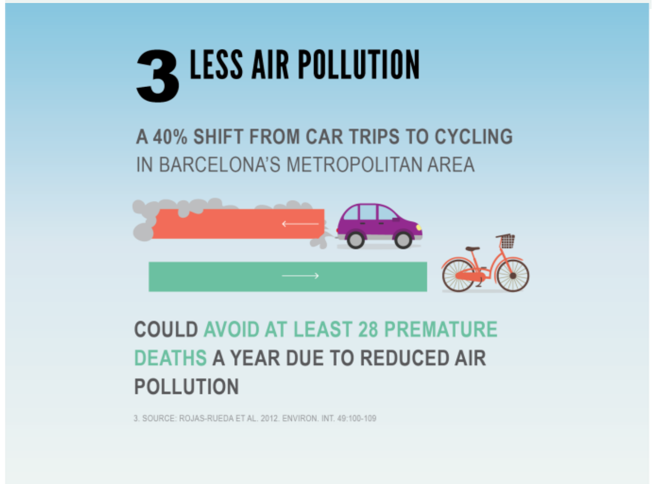


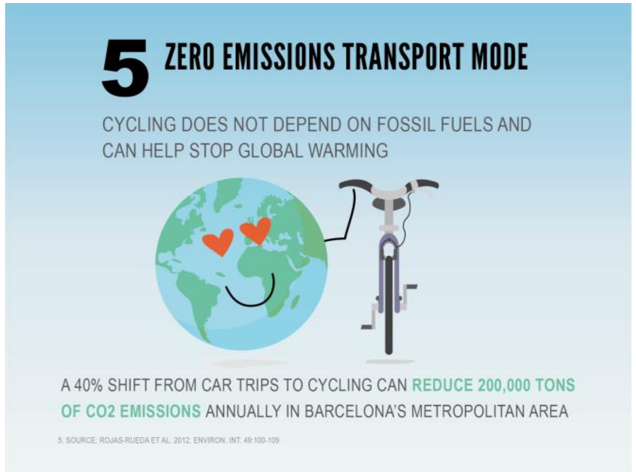
Tanguy Wasson
+ Livio Caputo

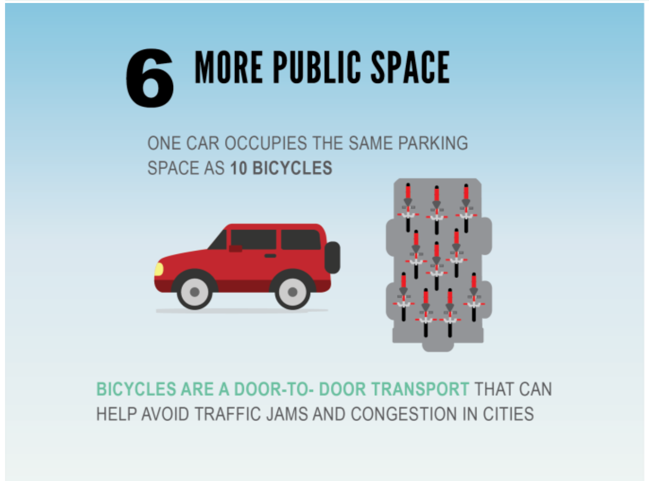
Ongoing work Audrey de Nazelle, Imperial College London











Benefits of physical activity well outweight the risks of air pollution and accidents for cyclists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de Bijenkorf
KLOEK
KLOEK
Utrecht, NL

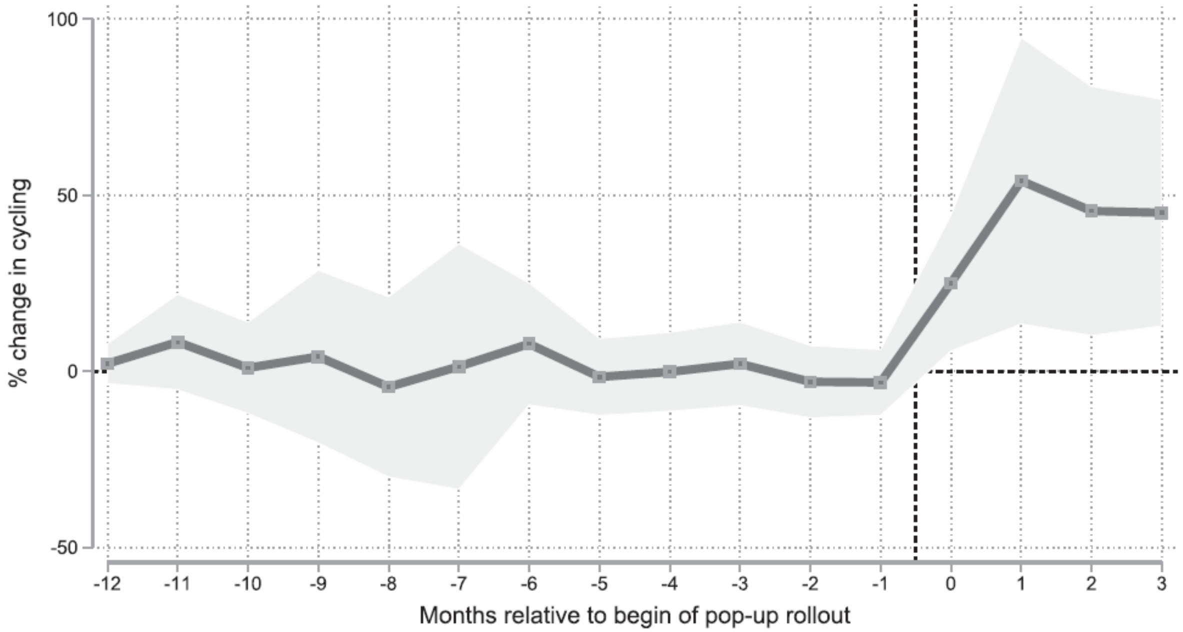


Fig. 2. Treatment effect (difference between treated and control cities) in months before and after the beginning of the pop-up bike lane policy. Observations are binned into months. Treatment for this plot is hard coded to March 2020 and the baseline category and the beginning of the sample are set to February 2019. Estimates are from Poisson regressions that include city and country–day fixed effects (*SI Appendix*, Eq. **S1**). The shaded area shows the 95% confidence interval. Data for the outcome variable are from the European Cyclists' Federation (3) and data for the treatment variable are from municipal bike counters (*Materials and Methods*).

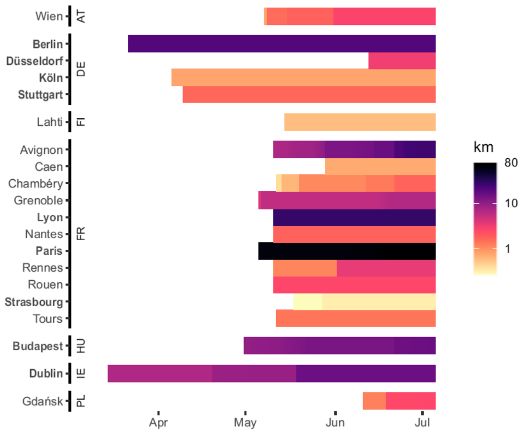
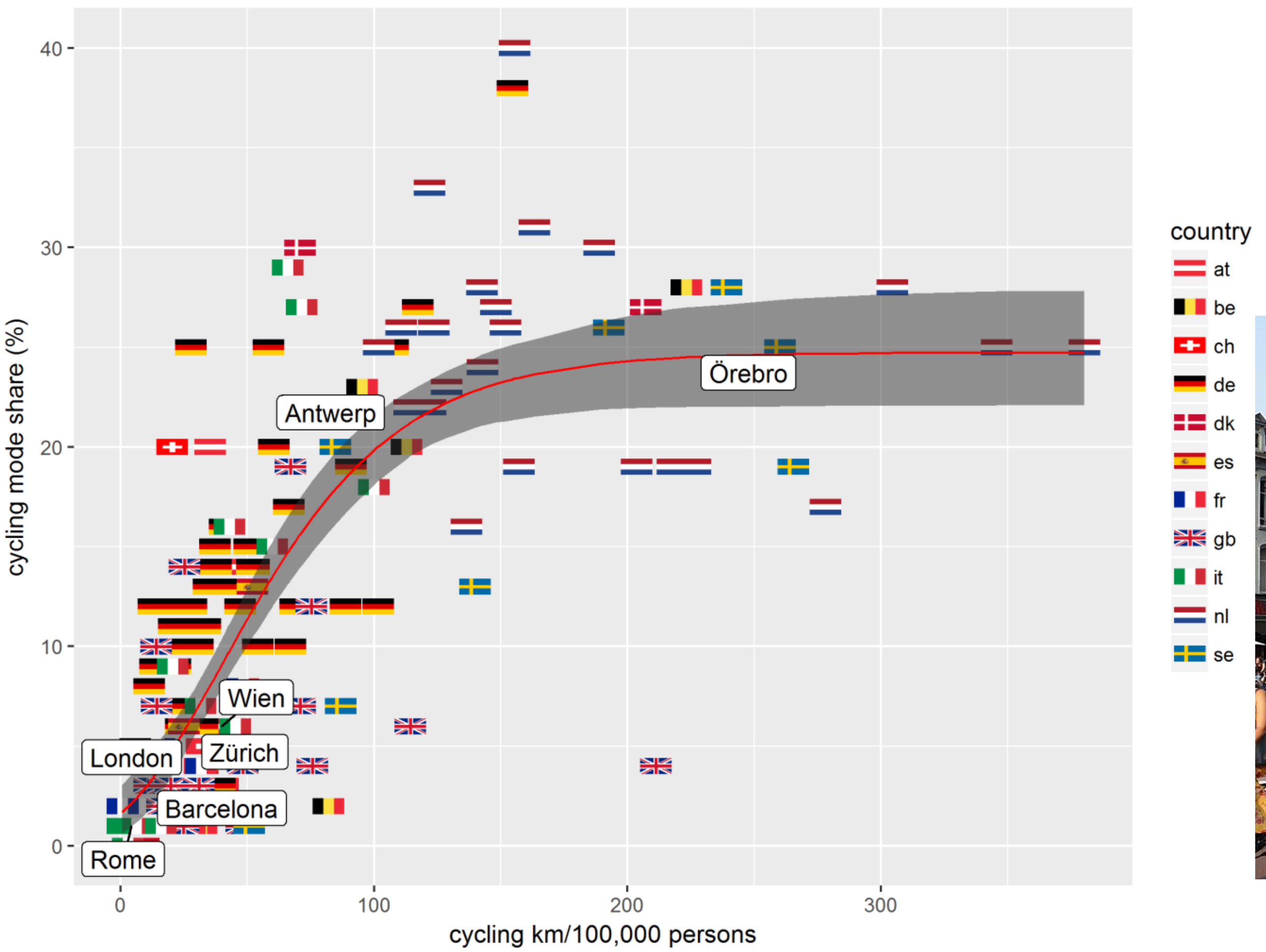


Fig. 1. Treated cities and their treatment intensities in terms of implemented kilometers of public bike lanes in service (cumulative) on a given day between March and July 2020. Cities used in the estimation sample for Fig. 3 are marked in boldface type. Control cities are plotted in *SI Appendix*, Fig. S2. London, Milan, Rome, and Lisbon are missing from the sample due to a lack of daily bicycle counter data. Data are from the European Cyclists' Federation (3).

Within 4 months, an average of 11.5 km of provisional pop-up bike lanes have been built per city and the policy has increased cycling between 11 and 48% on average.

Kraus and Koch 2021



- **10,091 premature deaths prevented annually in 167 European cities (75M people) if the mode share of cycling went up to 24.7%**

Mueller et al 2018, Prev Med

Transportation Research Part D 93 (2021) 102764

Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd

The climate change mitigation effects of daily active travel in cities

Christian Brand [a,b,*], Evi Dons [c,d], Esther Anaya-Boig [e], Ione Avila-Palencia [f,g], Anna Clark [h], Audrey de Nazelle [e], Mireia Gascon [f,i,j], Mailin Gaupp-Berghausen [k], Regine Gerike [l], Thomas Götschi [m], Francesco Iacorossi [n], Sonja Kahlmeier [o,p], Michelle Laeremans [c,t], Mark J Nieuwenhuijsen [f,i,j], Juan Pablo Orjuela [a,e], Francesca Racioppi [q], Elisabeth Raser [u], David Rojas-Rueda [f,s], Arnout Standaert [c], Erik Stigell [h], Simona Sulikova [a], Sandra Wegener [r], Luc Int Panis [c,d,t]

Daily mobility-related life cycle CO2 emissions were 3.2 kg CO2 per person, with car travel contributing 70% and cycling 1%. Cyclists had 84% lower life cycle CO2 emissions than non-cyclists. Life cycle CO2 emissions decreased by -14% per *additional* cycling trip and decreased by -62% for each *avoided* car trip. An average person who 'shifted travel modes' from car to bike decreased life cycle CO2 emissions by 3.2 kgCO2/day.

Global Environmental Change 67 (2021) 102224

Contents lists available at ScienceDirect

Global Environmental Change

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The climate change mitigation impacts of active travel: Evidence from a longitudinal panel study in seven European cities

Christian Brand [a,*], Thomas Götschi [b], Evi Dons [c,d], Regine Gerike [e], Esther Anaya-Boig [f], Ione Avila-Palencia [g,h], Audrey de Nazelle [f], Mireia Gascon [g,i,j], Mailin Gaupp-Berghausen [k], Francesco Iacorossi [l], Sonja Kahlmeier [m,n], Luc Int Panis [c,d,s], Francesca Racioppi [o], David Rojas-Rueda [g,q], Arnout Standaert [c], Erik Stigell [r], Simona Sulikova [a], Sandra Wegener [p], Mark J. Nieuwenhuijsen [g,i,j]

We found that changes in active travel have significant lifecycle carbon emissions benefits, even in European urban contexts with already high walking and cycling shares. An increase in cycling or walking consistently and independently decreased mobility-related lifecycle CO2 emissions, suggesting that active travel substituted for motorized travel – i.e. the increase was not just additional (induced) travel over and above motorized travel. To illustrate this, an average person cycling 1 trip/day more and driving 1 trip/day less for 200 days a year would decrease mobility-related lifecycle CO2 emissions by about 0.5 tonnes over a year, representing a substantial share of average per capita CO2 emissions from transport. The largest benefits from shifts from car to active travel were for business purposes, followed by social and recreational trips, and commuting to work or place of edu-cation. Changes to commuting emissions were more pronounced for those who were younger, lived closer to work and further to a public transport station.

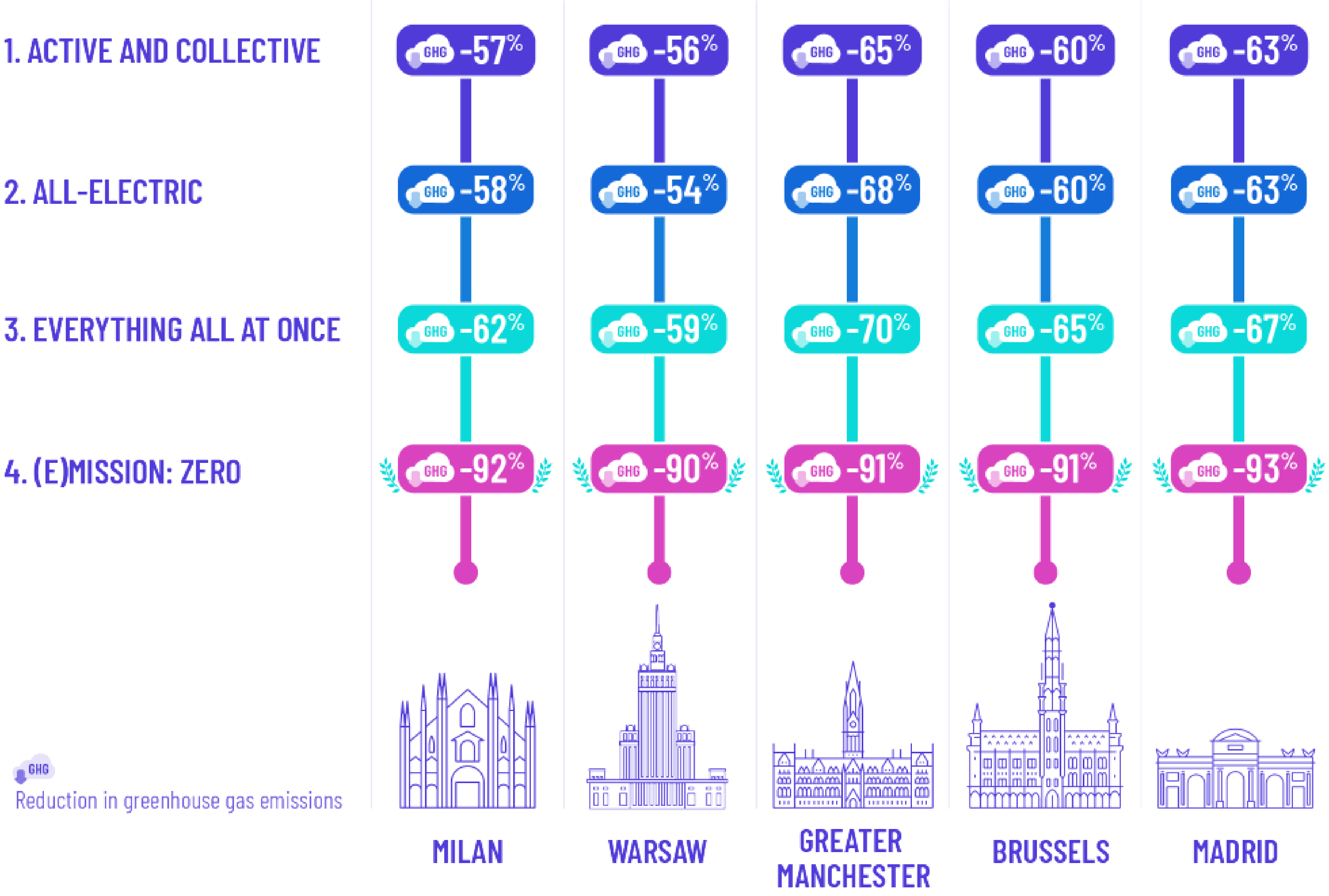
Table 2 - Implemented policies by scenario. Source: TRT

Group	Policy	S01	S02	S03	S04
Vehicle fleet and charging infrastructure	Electric vehicle (EV) uptake		✓	✓	✓
	EV charging infrastructure		✓	✓	✓
	Green public transport fleet	✓	✓	✓	✓
	Green logistics fleet		✓	✓	✓
	Cooperative ITS		✓	✓	✓
Innovative and shared mobility services	Bike sharing	✓		✓	✓
	Car sharing	✓		✓	✓
	Moped sharing	✓		✓	✓
	E-scooter sharing	✓		✓	✓
	Moblity-as-a-Service (MaaS)	✓		✓	✓
	Demand-responsive transport (DRT)	✓		✓	✓
Transport infrastructure	Cycling network expansion	✓		✓	✓
	Bus network expansion	✓		✓	✓
	Tram network expansion	✓		✓	✓
	Metro network expansion	✓		✓	✓
	Park & Ride	✓		✓	✓

Group	Policy	S01	S02	S03	S04
Traffic management and control	Prioritizing public transport	✓		✓	✓
	Limited traffic zones (LTZ)	✓		✓	✓
	Low-emission zones (LEZ)	✓	✓	✓	✓
	Traffic calming	✓		✓	✓
	Pedestrian areas	✓		✓	✓
Transport avoidance	Working from home	✓	✓	✓	✓
	Car-free days	✓		✓	✓
Pricing schemes	Parking pricing	✓	✓	✓	✓
	Public transport fare reduction	✓		✓	✓
Urban logistics	Urban delivery centers	✓		✓	✓
	Delivery and servicing plan	✓		✓	✓
	Cargo bikes	✓		✓	✓

(E)Mission zero: towards zero emission Mobility in European cities briefing. Clean Cities Campaign 2024

Figure 9 - Per capita GHG emissions (Tank-to-Wheel) from urban transport by city and scenario



(E)Mission zero: towards zero emission Mobility in European cities briefing. Clean Cities Campaign 2024

Health effects of low emission and congestion charging zones: a systematic review

Rosemary C Chamberlain, Daniela Fecht, Bethan Davies, Anthony A Laverty

Low emission zones (LEZs) and congestion charging zones (CCZs) have been implemented in several cities globally. We systematically reviewed the evidence on the effects of these air pollution and congestion reduction schemes on a range of physical health outcomes. We searched MEDLINE, Embase, Web of Science, IDEAS, Greenfile, and Transport Research International Documentation databases from database inception to Jan 4, 2023. We included studies that evaluated the effect of implementation of a LEZ or CCZ on air pollution-related health outcomes (cardiovascular and respiratory diseases, birth outcomes, dementia, lung cancer, diabetes, and all-cause) or road traffic injuries (RTIs) using longitudinal study designs and empirical health data. Two authors independently assessed papers for inclusion. Results were narratively synthesised and visualised using harvest plots. Risk of bias was assessed using the Graphic Appraisal Tool for Epidemiological studies. The protocol was registered with PROSPERO (CRD42022311453). Of 2279 studies screened, 16 were included, of which eight assessed LEZs and eight assessed CCZs. Several LEZ studies identified positive effects on air pollution-related outcomes, with reductions in some cardiovascular disease subcategories found in five of six studies investigating this outcome, although results for other health outcomes were less consistent. Six of seven studies on the London CCZ reported reductions in total or car RTIs, although one study reported an increase in cyclist and motorcyclist injuries and one reported an increase in serious or fatal injuries. Current evidence suggests LEZs can reduce air pollution-related health outcomes, with the most consistent effect on cardiovascular disease. Evidence on CCZs is mainly limited to London but suggests that they reduce overall RTIs. Ongoing evaluation of these interventions is necessary to understand longer term health effects.

Case Studies on Transport Policy 10 (2022) 1494–1513

Contents lists available at ScienceDirect

Case Studies on Transport Policy

journal homepage: www.elsevier.com/locate/cstp

A dozen effective interventions to reduce car use in European cities: Lessons learned from a meta-analysis and transition management

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ARTICLE INFO

Keywords:
Transport transition
Car use reduction
Transport intervention
Urban mobility
Urban transition experiments
Climate mitigation

ABSTRACT

Transitioning to fossil-free transport and reducing car use are necessary to meet European and national climate goals. Cities are promising leverage points to facilitate system transitions by promoting local innovation and policy experimentation. Building on transition management, we developed a knowledge base for the implementation of transition experiments to reduce city-level car use. From screening nearly 800 peer-reviewed studies and case studies, including in-depth analysis of 24 documents that met quality criteria and quantitatively estimated car use reduction, we identify 12 intervention types combining different measures and policy instruments that were effective in reducing car use in European cities. The most effective at reducing overall car use were the Congestion Charge, Parking & Traffic Congrol, and Limited Traffic Zone. Most interventions were led by local government, planned and decided in collaboration with different urban stakeholders. We evaluated the potential of the identified intervention types to be implemented in a pilot study of Lund, Sweden, using three criteria from Transition Management of novelty, feasibility, and suitability, as assessed by interviews with local experts. We recommend three transition experiments to reduce local car use in Lund: Parking and Traffic Control, Workplace Parking Charge, and Mobility Services for Commuters. We suggest practitioners follow our method to identify effective and locally suitable interventions to reduce car use, and future research quantify the effectiveness of interventions to reduce car use using the standardised outcome measure of daily passenger kilometres travelled by car.

Environment International 172 (2023) 107805

Contents lists available at ScienceDirect

Environment International

journal homepage: www.elsevier.com/locate/envint

Systematic Evidence Map

Urban policy interventions to reduce traffic-related emissions and air pollution: A systematic evidence map

Haneen Khreis [a,*], Kristen A. Sanchez [b,c], Margaret Foster [d], Jacob Burns [e], Mark J. Nieuwenhuijsen [f,g,h], Rohit Jaikumar [b], Tara Ramani [b], Josias Zietsman [b]

ABSTRACT

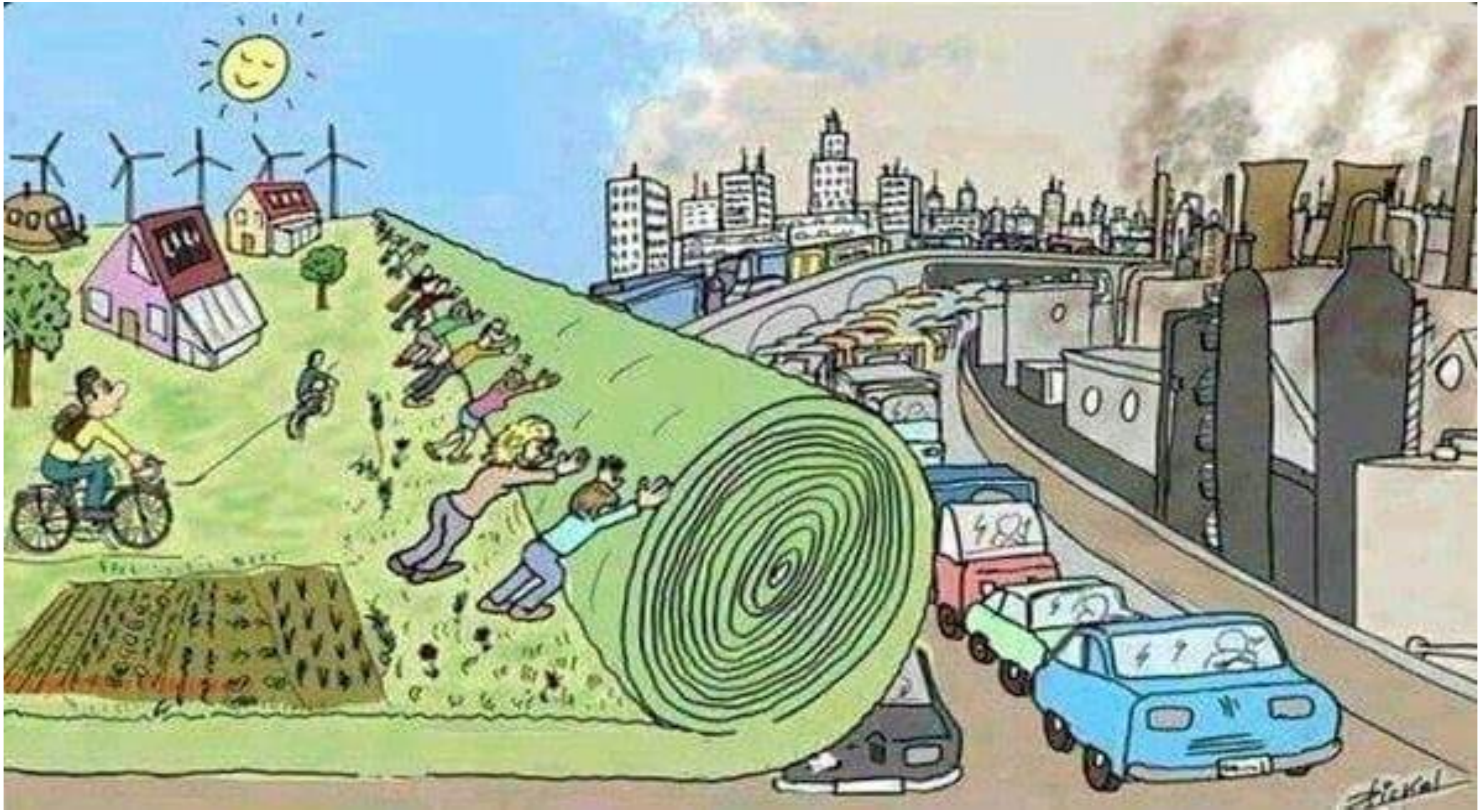
Background: Urban areas are hot spots for human exposure to air pollution, which originates in large part from traffic. As the urban population continues to grow, a greater number of people risk exposure to traffic-related air pollution (TRAP) and its adverse, costly health effects. In many cities, there is a need and scope for air quality improvements through targeted policy interventions, which continue to grow including rapidly changing technologies.

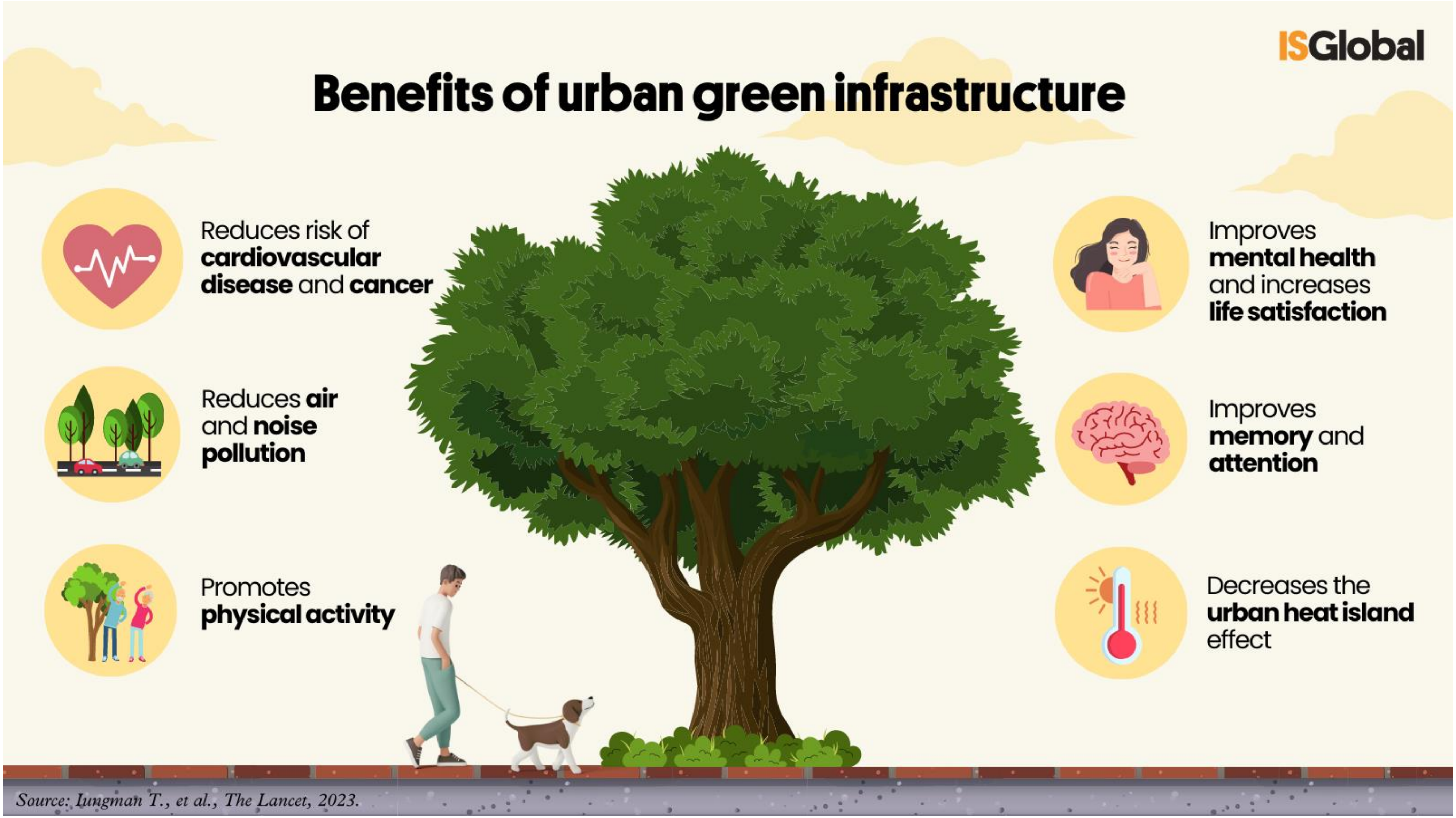
Objective: This systematic evidence map (SEM) examines and characterizes peer-reviewed evidence on urban-level policy interventions aimed at reducing traffic emissions and/or TRAP from on-road mobile sources, thus potentially reducing human exposures and adverse health effects and producing various co-benefits.

Methods: This SEM follows a previously peer-reviewed and published protocol with minor deviations, explicitly outlined here. Articles indexed in Public Affairs Index, TRID, Medline and Embase were searched, limited to English, published between January 1, 2000, and June 1, 2020. Covidence was used to screen articles based on previously developed eligibility criteria. Data for included articles was extracted and manually documented into an Excel database. Data visualizations were created in Tableau.

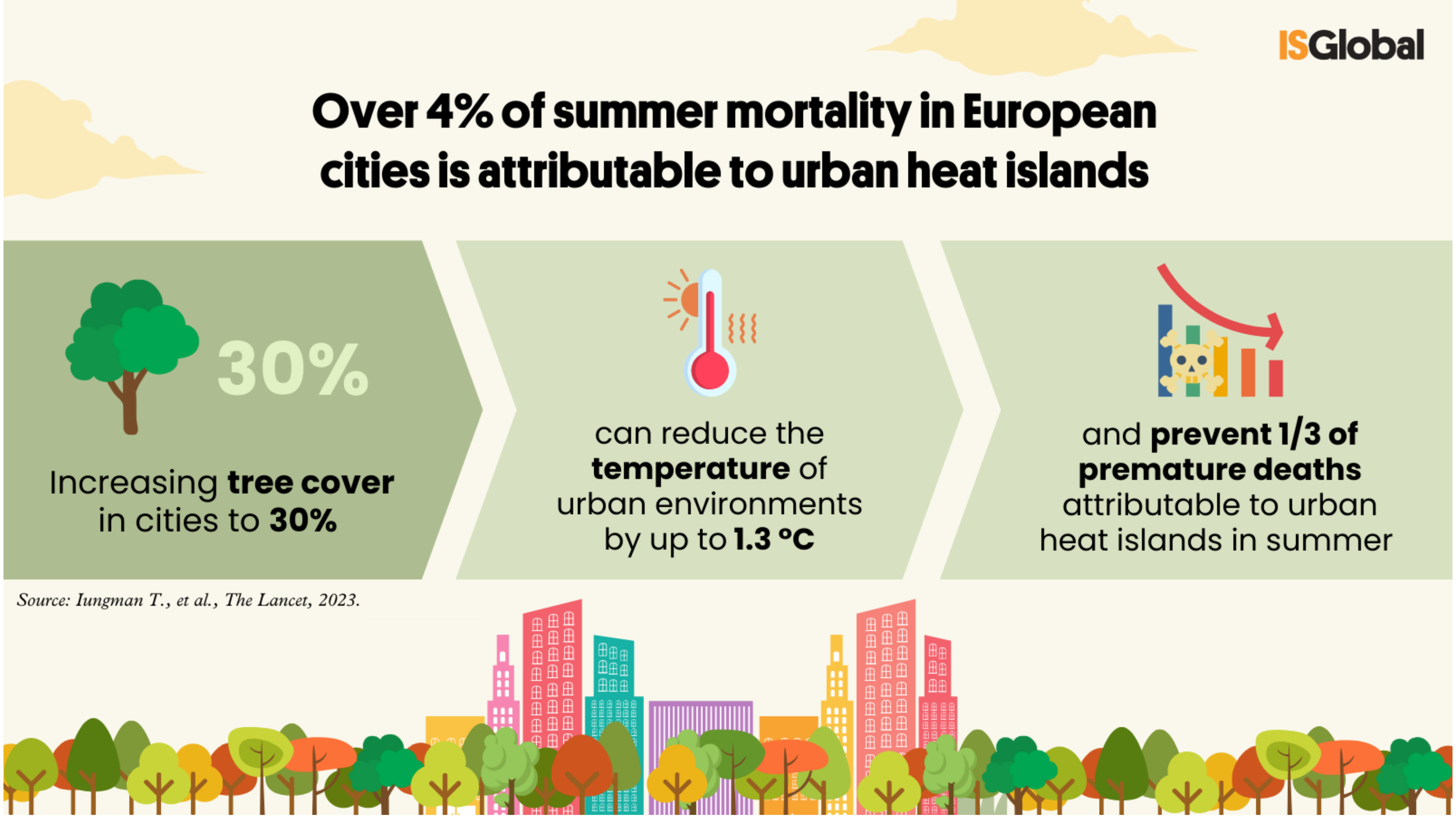
Results: We identified 7528 unique articles from database searches and included 376 unique articles in the final SEM. There were 58 unique policy interventions, and a total of 1,139 unique policy scenarios, comprising these

Greening





REDUCED PREMATURE MORTALITY


ISGlobal
Over 4% of summer mortality in European cities is attributable to urban heat islands
30%
Increasing tree cover in cities to 30%
can reduce the temperature of urban environments by up to 1.3 °C
and prevent 1/3 of premature deaths attributable to urban heat islands in summer
Source: Iungman T., et al., The Lancet, 2023.

nature climate change

Analysis

https://doi.org/10.1038/s41558-023-01737-x

Contribution of prioritized urban nature-based solutions allocation to carbon neutrality

Received: 20 December 2022

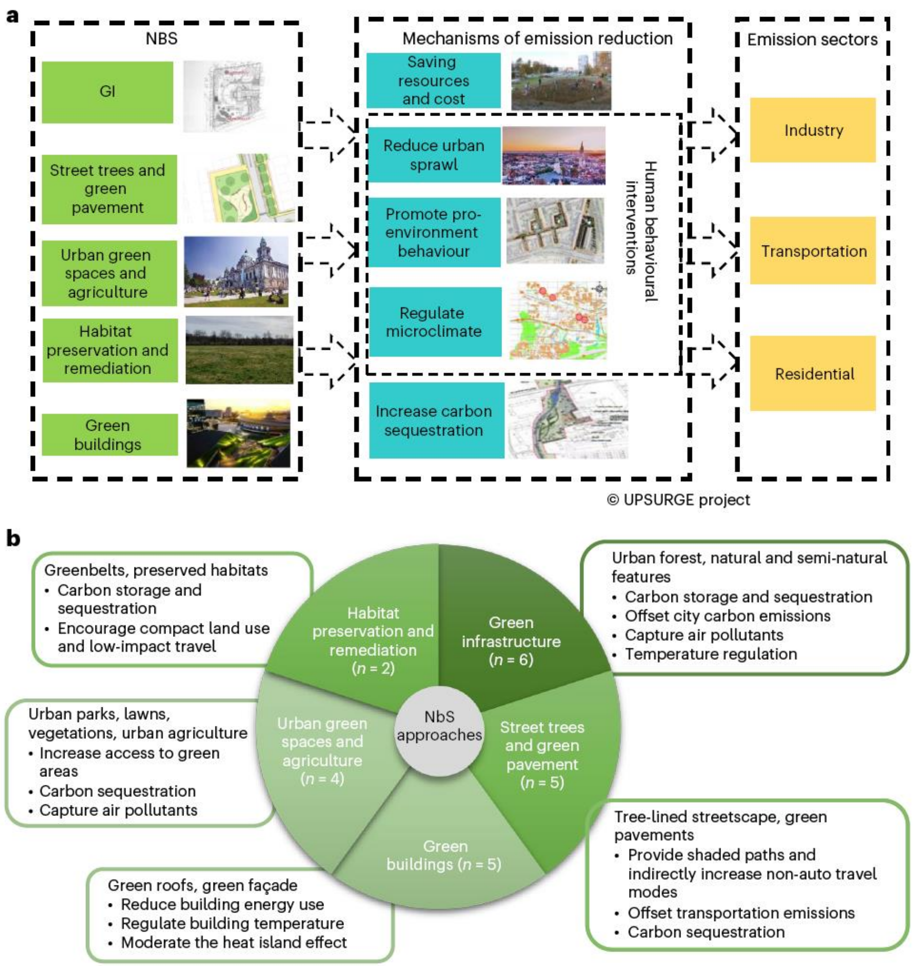
Accepted: 20 June 2023

Published online: 20 July 2023

Check for updates

Haozhi Pan[1,9], Jessica Page[2,9], Rui Shi[1,9], Cong Cong[3], Zipan Cai[4], Stephan Barthel[5,6], Patrik Thollander[5,7], Johan Colding[5,8] & Zahra Kalantari[4]

Nature-based solutions (NBS) are essential for carbon-neutral cities, yet how to effectively allocate them remains a question. Carbon neutrality requires city-led climate action plans that incorporate both indirect and direct contributions of NBS. Here we assessed the carbon emissions mitigation potential of NBS in European cities, focusing particularly on commonly overlooked indirect pathways, for example, human behavioural interventions and resource savings. Assuming maximum theoretical implementation, NBS in the residential, transport and industrial sectors could reduce urban carbon emissions by up to 25%. Spatially prioritizing different types of NBS in 54 major European Union cities could reduce anthropogenic carbon emissions by on average 17.4%. Coupling NBS with other existing measures in Representative Concentration Pathway scenarios could reduce total carbon emissions by 57.3% in 2030, with both indirect pathways and sequestration. Our results indicate that carbon neutrality will be near for some pioneering cities by 2030, while three can achieve it completely.



Pan et al 2023

Table 1 | Main NBS types and carbon emission reduction effects of highlighted cities. Carbon emissions levels according to Global Carbon Grid data and the main NBS type that should be prioritized in different sectors in 15 typical European cities to maximize emissions reduction potential

City	Residential emissions share	Industrial emissions share	Transport emissions share	Total emissions per capita (tons per year)	Emissions reduction rate (resident)	Emissions reduction rate (industry)	Emissions reduction rate (transport)	Emissions reduction through carbon sequestration	Main NBS type
Paris	53%	30%	17%	7.34	6%	26%	15%	1%	GI and green buildings
Madrid	28%	35%	36%	5.06	7%	18%	15%	2%	Habitat and GI
Berlin	38%	30%	33%	7.55	6%	13%	14%	4%	Urban green spaces and green buildings
Milan	40%	39%	21%	7.12	12%	14%	15%	0%	GI and green buildings
Rome	36%	30%	34%	6.07	5%	8%	12%	2%	Urban green spaces and green buildings
Warsaw	35%	30%	35%	5.31	5%	5%	14%	3%	Urban green spaces and green buildings
Athens	38%	28%	34%	3.98	3%	3%	14%	4%	Urban green spaces and green buildings
Vienna	23%	21%	56%	5.92	9%	10%	13%	13%	Urban green spaces and habitat
Stockholm	20%	18%	62%	1.7	4%	5%	12%	55%	Street trees and urban green spaces
Budapest	32%	33%	36%	5.61	8%	8%	13%	2%	GI and green buildings
Brussels	42%	29%	29%	10.66	10%	13%	14%	1%	Urban green spaces and habitat
Amsterdam	27%	35%	37%	6.69	10%	11%	8%	1%	Urban green spaces and green buildings
Prague	25%	30%	45%	5.74	7%	11%	11%	5%	Preserved habitat
Lisbon	28%	25%	47%	3.58	2%	7%	6%	2%	Street trees
Bucharest	33%	36%	31%	3.27	4%	5%	11%	0%	GI

Pan et al 2023

3-30-300 GREEN SPACE RULE

Konijnendijk 2021

Few people (6%) achieved the 3-30-300 green space in Barcelona. Meeting the rule was associated with a 23-76% reduction in mental health indicators (poor mental, medication use and psychologist/psychiatrist visits

Nieuwenhuijsen et al 2022

Housing

PLOS SUSTAINABILITY AND TRANSFORMATION

This study presents the degree of urban sprawl on the planet at multiple spatial scales (continents, UN regions, countries, subnational units, and a regular grid) for the period 1990–2014. Urban sprawl increased by 95% in 24 years, almost 4% per year, with built-up areas growing by almost 28 km2 per day, or 1.16 km2 per hour.

Check for updates

RESEARCH ARTICLE

Rapid rise in urban sprawl: Global hotspots and trends since 1990

Martin Behnisch[1☯]*, **Tobias Krüger**[1☯], **Jochen A. G. Jaeger**[2☯]

1 Leibniz Institute of Ecological Urban and Regional Development (IOER), Dresden, Germany,
2 Department of Geography, Planning and Environment, Concordia University Montreal, Montréal, Québec, Canada

☯ These authors contributed equally to this work.
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Abstract

Dispersed low-density development–"urban sprawl"–has many detrimental environmental, economic, and social consequences. Sprawl leads to higher greenhouse-gas emissions

The results demonstrate that Europe has been the most sprawled and also the most rapidly sprawling continent, by 51% since 1990. At the scale of UN regions, the highest relative increases in urban sprawl were observed in East Asia, Western Africa, and Southeast Asia. Urban sprawl per capita has been highest in Oceania and North America, exhibiting a minor decline since 1990, while it has been increasing rapidly in Europe, by almost 47% since 1990.


Carrer de París
Carrer d'Aribau
Carrer de Còrsega
Carrer d'Enric Granados
Carrer de Muntaner
Carrer de Còrsega
Carrer del Rosselló
Carrer d'Aribau
Carrer del Rosselló
Carrer de Muntaner
Carrer del Rosselló
Carrer de Provença
Carrer d'Aribau

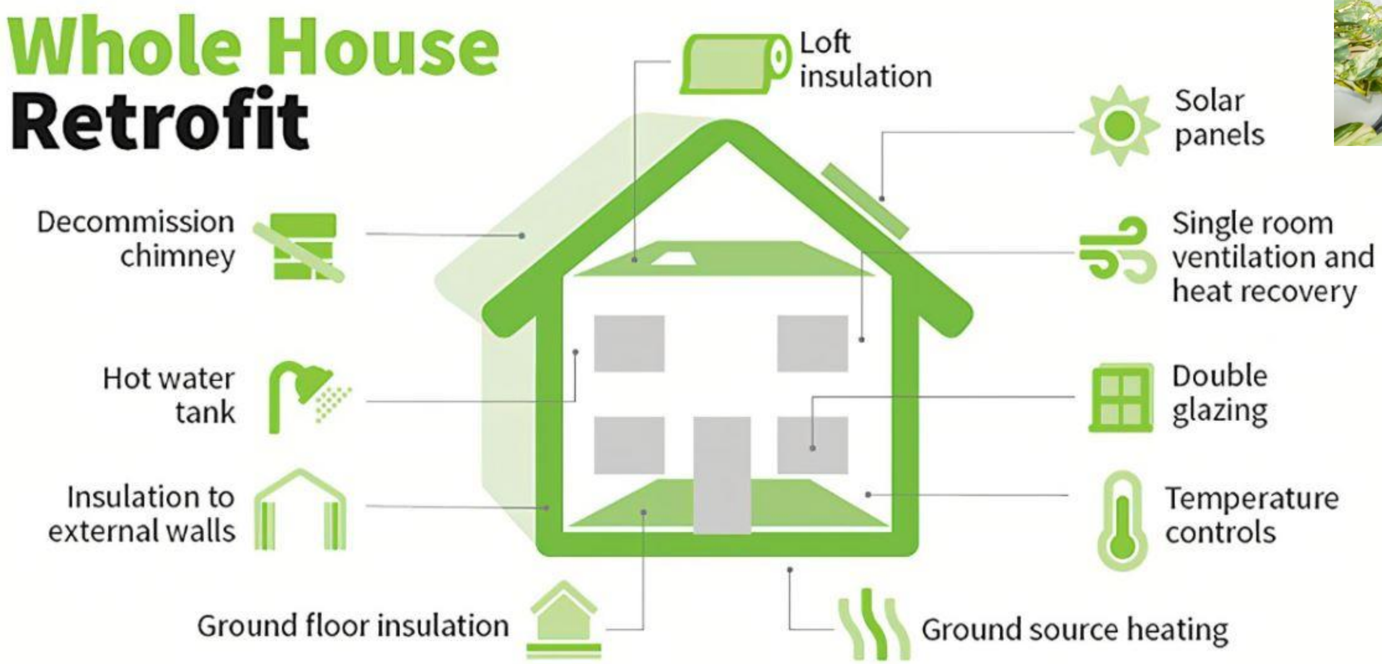
SUSTAINABLE HOUSING

https://www.alvarezdiazvillalon.com/blog/13-sustainable-affordable-housing-ideas

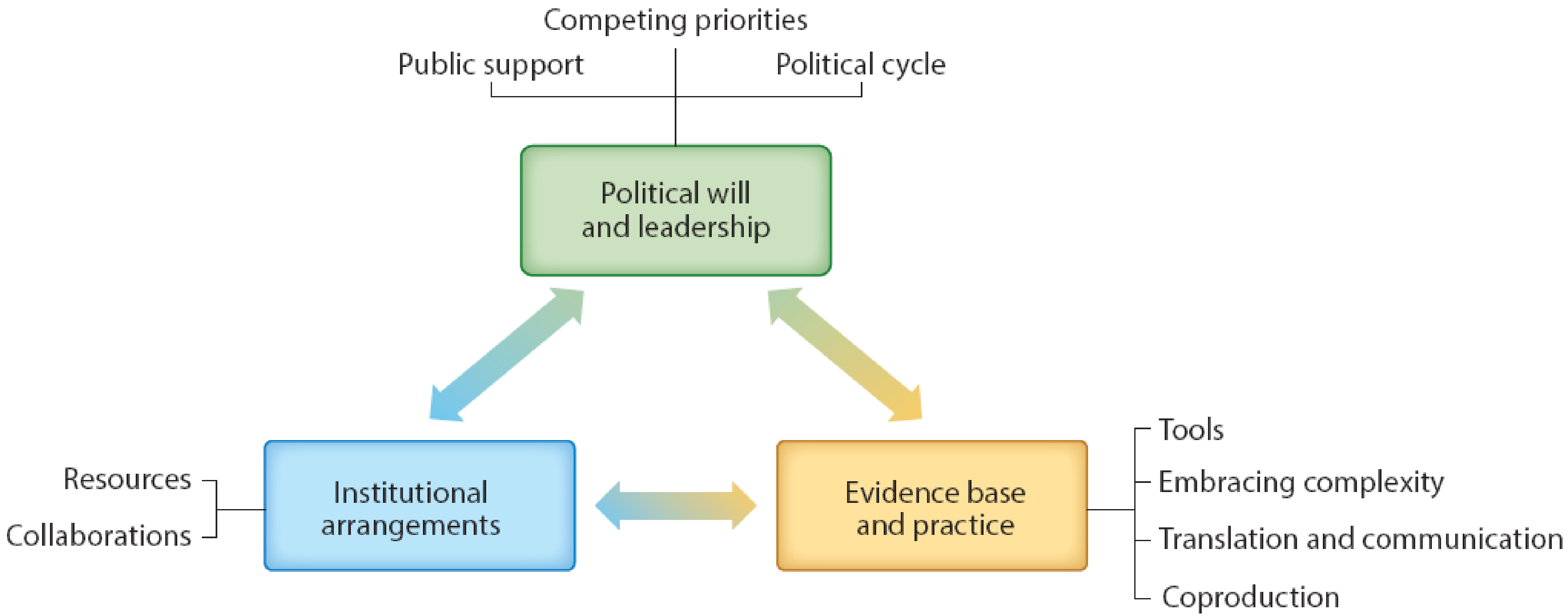
https://blog.mipimworld.com/guide-green-real-estate/green-real-estate-sustainable-living-urban-spaces-modern-development/

https://www.scottishhousingnews.com/articles/artisan-commits-to-new-design-standards-for-sustainable-housing-development

heatpomps


Whole House
Retrofit
Loft insulation
Solar panels
Decommission chimney
Single room ventilation and heat recovery
Hot water tank
Double glazing
Insulation to external walls
Temperature controls
Ground floor insulation
Ground source heating

Barriers and facilitators



Barriers to and enablers for integrating health as a cobenefit in urban climate policy. Political will and leadership, evidence base and practice, and institutional arrangements were the three key domains identified in our systematic review of reviews. These domains and their subdomains represent important leverage points to overcome fundamental hurdles to health-promoting climate change policy making.

Struggles for power and influence, resistance of vested interest and lobbying and short-term election cycles make long term transitional policy making challenging and burn political capital.

Negev et al 2022

Multisectorial approach

Multi sectorial and systemic approaches are needed to address current problems and find solutions

ISUH International Society for Urban Health

Courtesy of Jo Ivey Boufford

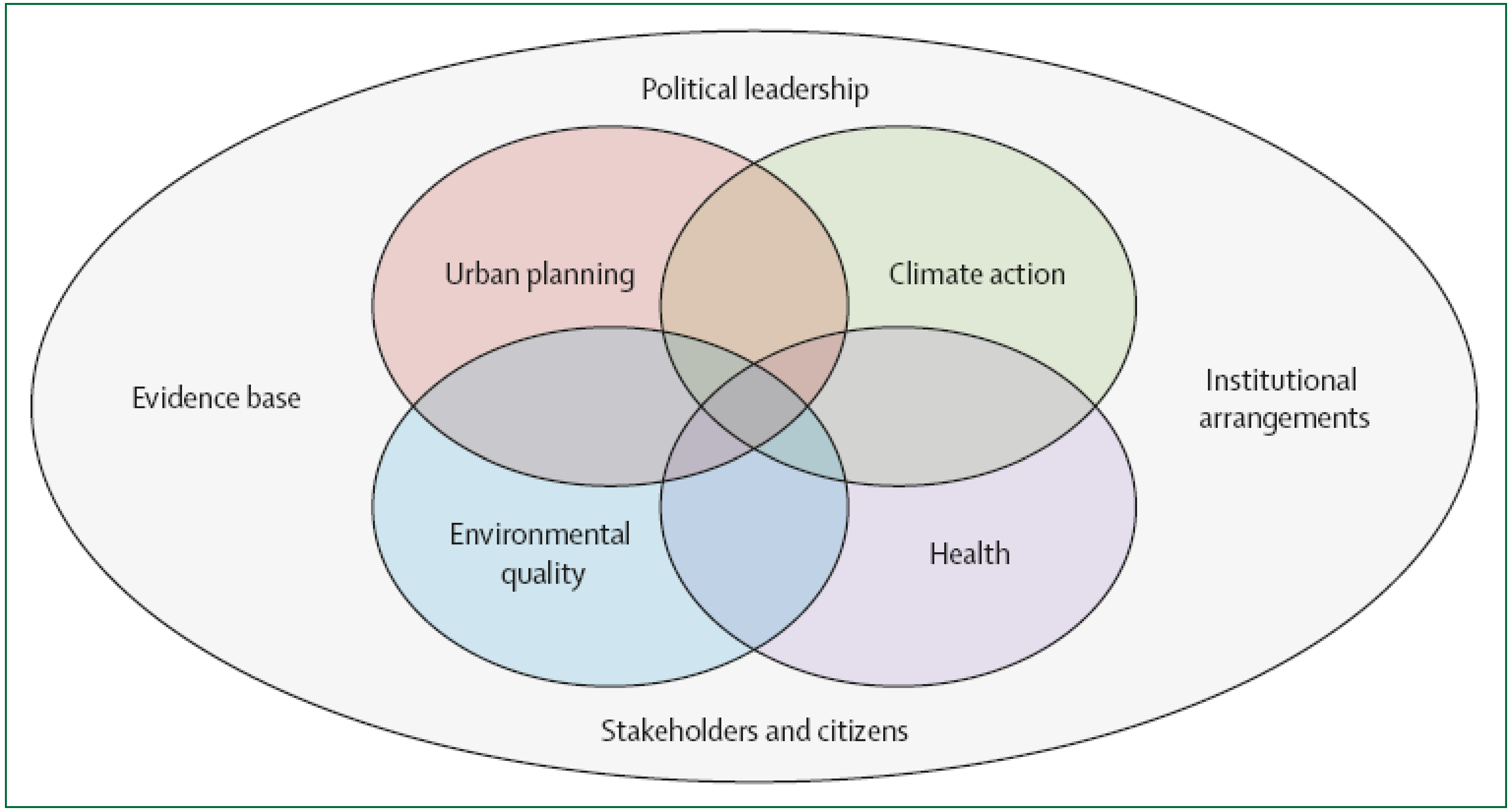
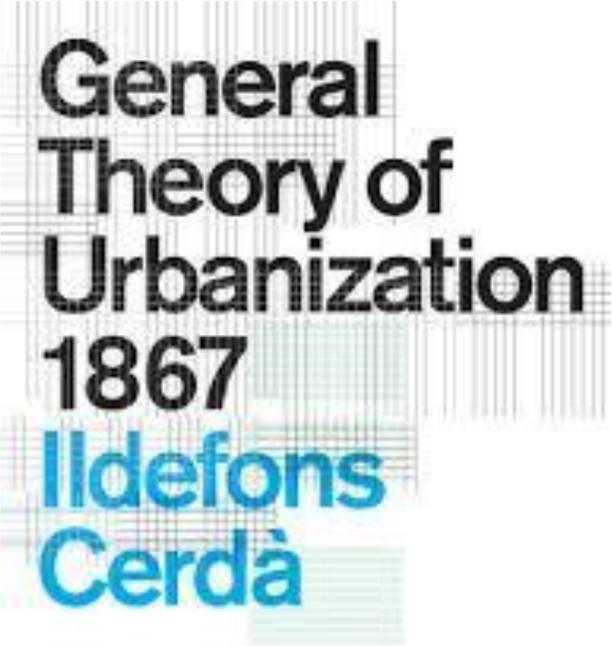


Figure 3: **Close collaboration between urban planning, environment, climate action, and health is essential for a transitional and healthy change**

Nieuwenhuijsen 2024


General
Theory of
Urbanization
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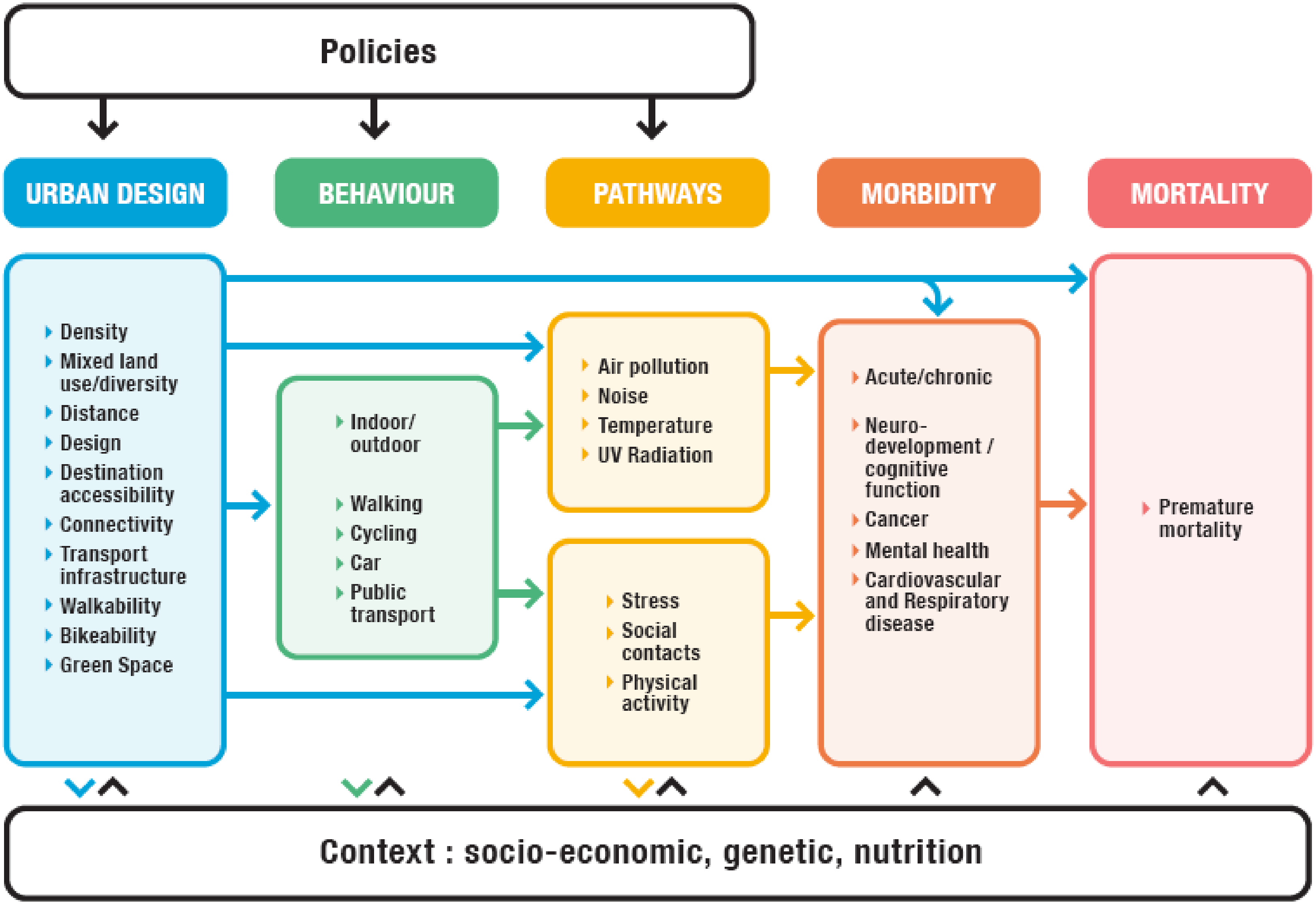
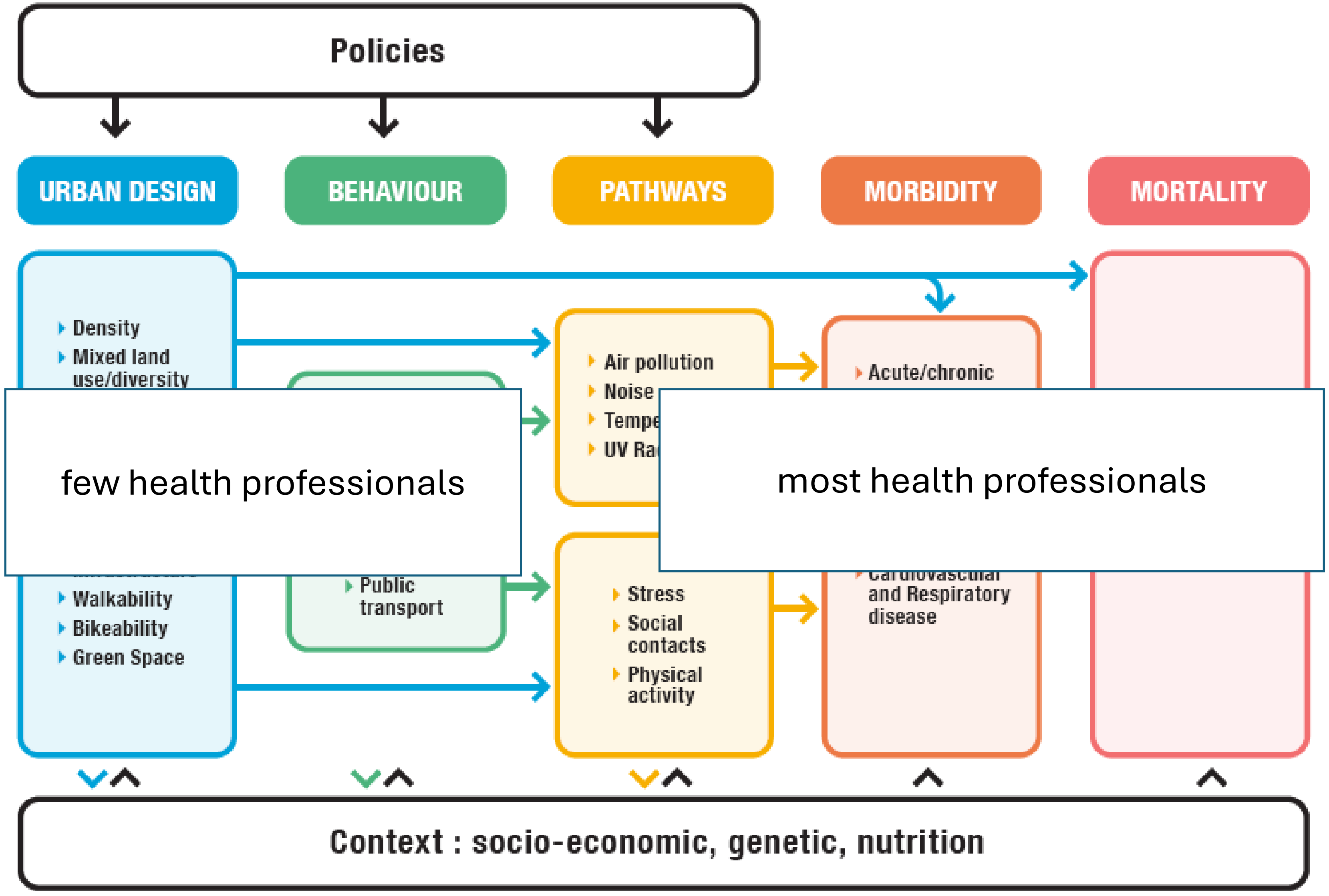


Nieuwenhuijsen 2016 and 2018
2020, 2021

Holistic and systematic approach

ISGlobal



Nieuwenhuijsen 2016 and 2018
2020, 2021

Holistic and systematic approach

CHANGES ARE POSSIBLE

Seoul, Korea

Greening cities


DÜSSELDORF, ALEMANHA
1990
2019


1971
Amsterdam
Archives


2020
schlijper.nl
today

Poblenou, Barcelona

FUTURE SCENARIOS

CITY VISION

- Climate action is essential and good for health
- Turn cities that are detrimental to health to cities that promote health
- Innovative measures in our streets, neighbourhoods and cities needed to improve the health of citizens.
- Multi stakeholder approach with equitable power with more involvement of health professionals in urban and transport planning

Carbon neutral, liveable and healthy (High Climate Action and Success) **Scenario 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. **Key Characteristics**: **Sustainable Infrastructure**: Extensive use of green building materials, renewable energy, and resilient infrastructure. Public transit is fully electric, and streets are designed and prioritized 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)** **Scenario Overview**: Cities that take moderate climate action face mixed outcomes. While some initiatives succeed, others fall short due to financial, political, or technical barriers. These cities manage to survive but with significant challenges. **Key Characteristics**: **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 neighborhoods have access to parks and green infrastructure, while others, particularly low-income areas, lack 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 partially offset by gains in green sectors. **Ongoing Climate Risks**: The city faces recurring climate-related challenges like flooding, heatwaves, and air pollution, leading to periodic disruptions and health issues
Climate Resilience at a Cost (Delayed Climate Action with Reactive Measures) **Scenario 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. **Key Characteristics**: **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)** **Scenario Overview**: Cities that fail to take meaningful climate action will experience severe degradation. These cities face environmental, social, and economic collapse, becoming increasingly uninhabitable. **Key Characteristics**: **Infrastructure Collapse**: Aging 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 neighborhoods, and increased crime. **Economic and Social Breakdown**: The city faces 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. The city becomes a symbol of climate failure.

Thank you!

This project has received funding from the European Union's, Horizon Europe Framework Programme (HORIZON) under GA No 101094639 - THE URBAN BURDEN OF DISEASE ESTIMATION FOR POLICY MAKING (UBDPolicy)

ISGlobal

mark.nieuwenhuijsen@isglobal.org

Big thanks to the whole team!

Questions?

www.isglobal.org

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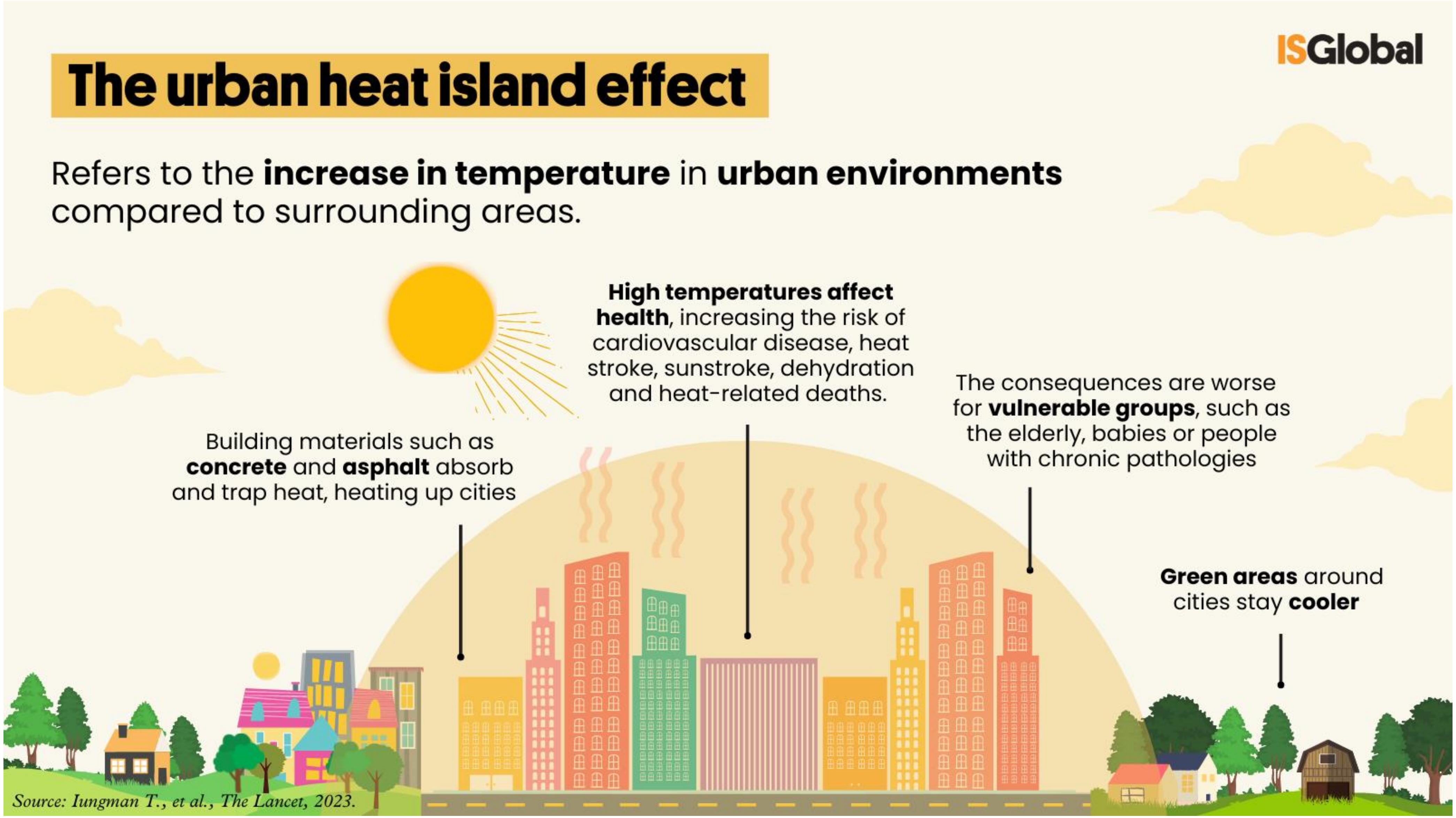
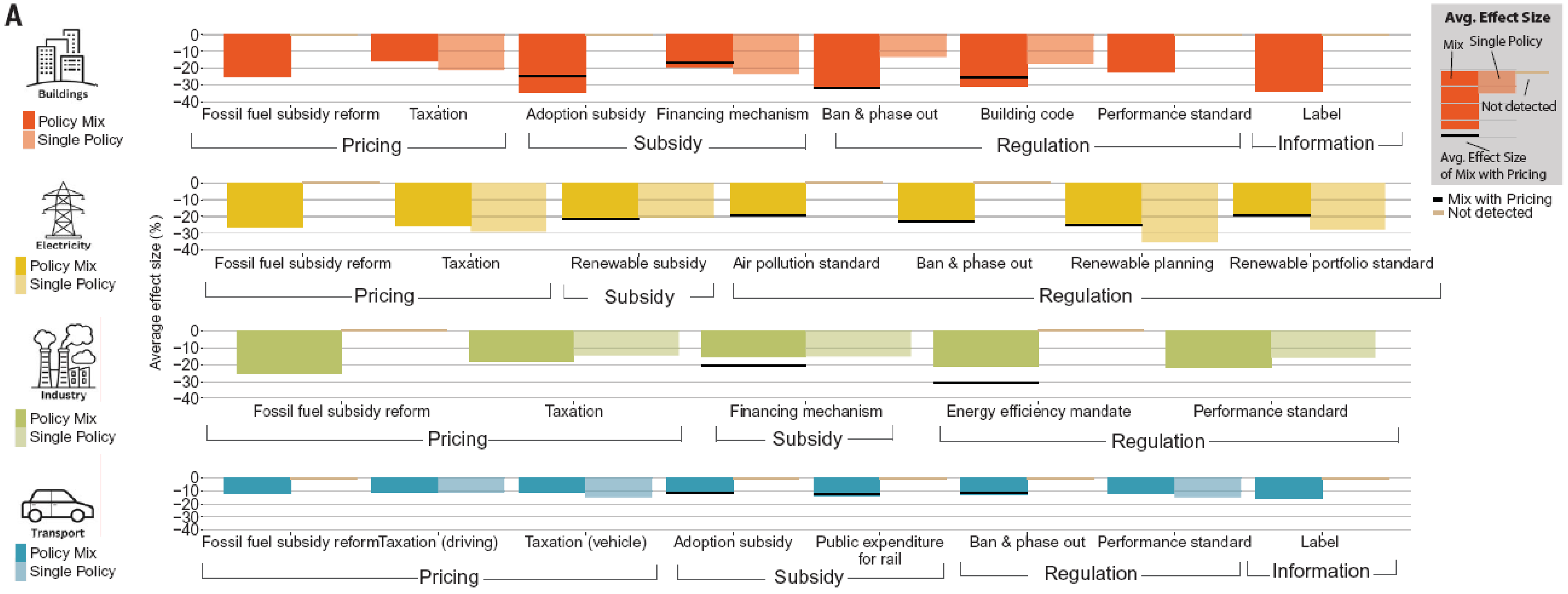

ISGlobal
The urban heat island effect
Refers to the increase in temperature in urban environments compared to surrounding areas.
High temperatures affect health, increasing the risk of cardiovascular disease, heat stroke, sunstroke, dehydration and heat-related deaths.
The consequences are worse for vulnerable groups, such as the elderly, babies or people with chronic pathologies
Building materials such as concrete and asphalt absorb and trap heat, heating up cities
Green areas around cities stay cooler
Source: Iungman T., et al., The Lancet, 2023.

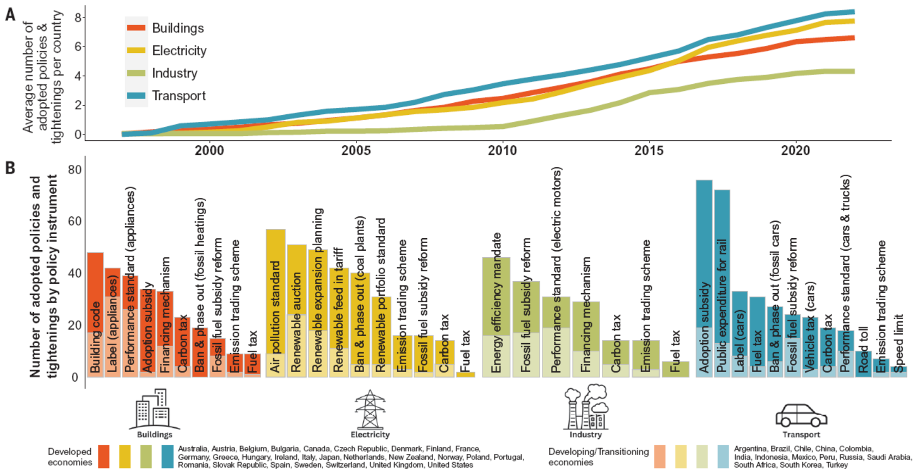


CLIMATE POLICY

Climate policies that achieved major emission reductions: Global evidence from two decades

Annika Stechemesser[1,2,3]*, Nicolas Koch[1,2,4]*, Ebba Mark[5,6,7], Elina Dilger[1], Patrick Klösel[1,2], Laura Menicacci[1], Daniel Nachtigall[8], Felix Pretis[5,9], Nolan Ritter[1,2], Moritz Schwarz[1,5,6,10], Helena Vossen[1], Anna Wenzel[1]

Meeting the Paris Agreement's climate targets necessitates better knowledge about which climate policies work in reducing emissions at the necessary scale. We provide a global, systematic ex post evaluation to identify policy combinations that have led to large emission reductions out of 1500 climate policies implemented between 1998 and 2022 across 41 countries from six continents. Our approach integrates a comprehensive climate policy database with a machine learning–based extension of the common difference-in-differences approach. We identified 63 successful policy interventions with total emission reductions between 0.6 billion and 1.8 billion metric tonnes CO_2. Our insights on effective but rarely studied policy combinations highlight the important role of price-based instruments in well-designed policy mixes and the policy efforts necessary for closing the emissions gap.



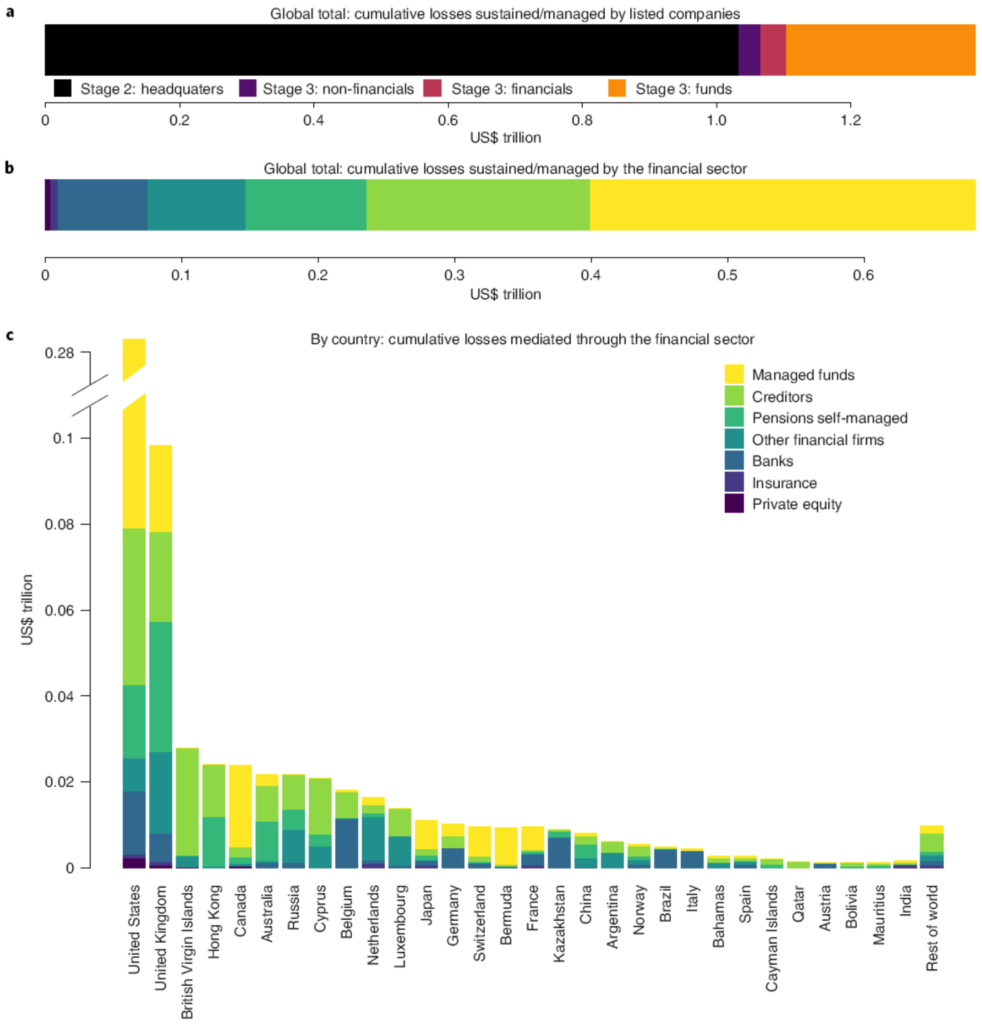


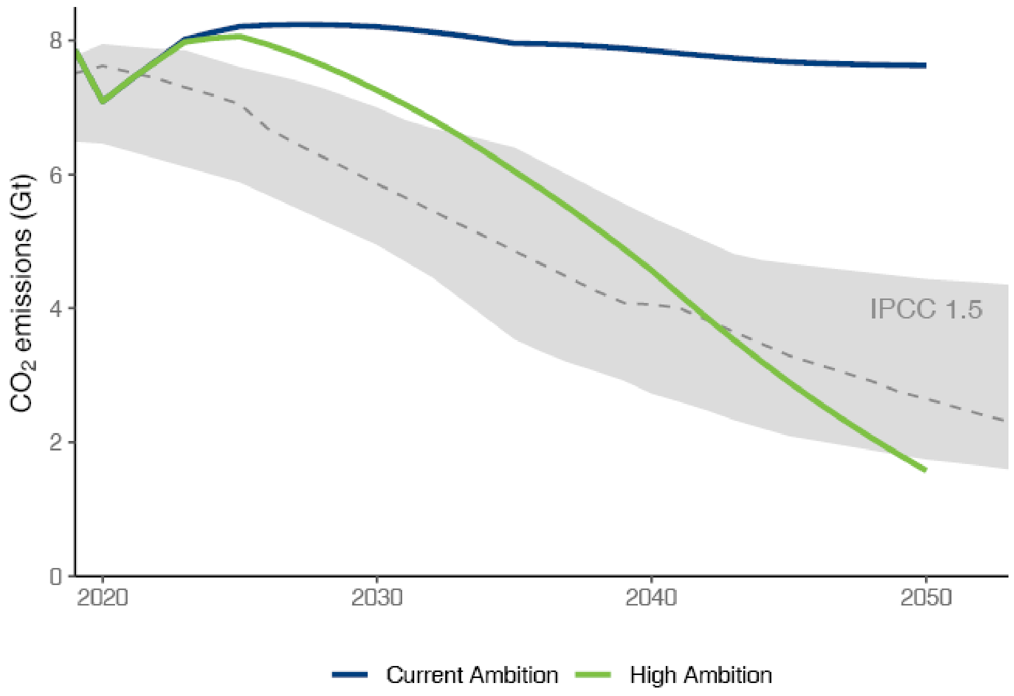
Fig. 4 | Cumulative losses by listed companies and in financial markets. a, Global losses affecting stock-market-listed fossil-fuel headquarters, intermediate and ultimate corporate owners, and listed fund managers in the medium realignment. **b**, Same as in **a**, but for all financial institutions. for legend. Creditors equal negative equity, reducing creditors' collateral. **c**, Same as in **b**, but split by country. The *y* axis is compressed between US and US$0.28 trillion.

Stranded fossil-fuel assets translate to major losses for investors in advanced economies

Gregor Semieniuk[1,2,3,11] ✉, Philip B. Holden[4,11], Jean-Francois Mercure[5,6,7], Pablo Salas[6,8], Hector Pollitt[6,7], Katharine Jobson[2,9], Pim Vercoulen[7], Unnada Chewpreecha[7], Neil R. Edwards[4,6] and Jorge E. Viñuales[6,10]

The distribution of ownership of transition risk associated with stranded fossil-fuel assets remains poorly understood. We calculate that global stranded assets as present value of future lost profits in the upstream oil and gas sector exceed US$1 trillion under plausible changes in expectations about the effects of climate policy. We trace the equity risk ownership from 43,439 oil and gas production assets through a global equity network of 1.8 million companies to their ultimate owners. Most of the market risk falls on private investors, overwhelmingly in OECD countries, including substantial exposure through pension funds and financial markets. The ownership distribution reveals an international net transfer of more than 15% of global stranded asset risk to OECD-based investors. Rich country stakeholders therefore have a major stake in how the transition in oil and gas production is managed, as ongoing supporters of the fossil-fuel economy and potentially exposed owners of stranded assets.

Figure 1.4. Carbon dioxide emissions under the Current Ambition and High Ambition scenarios



Note: Current Ambition (CA) and High Ambition (HA) refer to the two main policy scenarios modelled, which represent two levels of ambition for decarbonising transport. IPCC 1.5˚C represents the emission levels needed to limit warming to 1.5˚C as introduced by the Intergovernmental Panel on Climate Change. The levels were calculated based on data sourced from the International Assessment Modelling Consortium.
Sources: (IAMC, 2019[62]); IPCC (2018[63]).

https://stat.link/owi68q

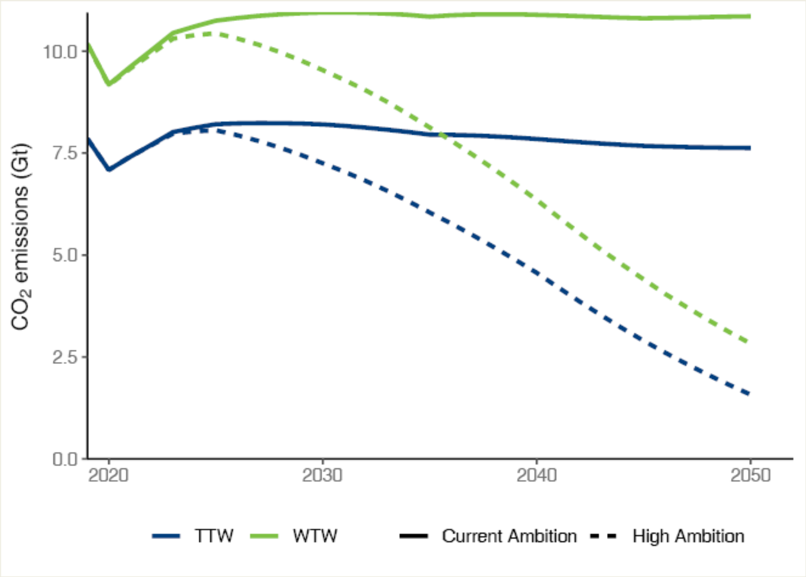
Key takeaways

- The transport sector's recovery following the pandemic has been faster than expected but significant challenges remain.
- Turmoil in energy markets and cost-of-living crises complicate efforts to decarbonise transport.
- Despite some progress, transport emissions will not fall fast enough in the coming years to meet international climate objectives.
- Mechanisms exist to advance decarbonisation goals but they need to become more ambitious.
- Governments face the challenge of balancing multiple priorities while meeting climate commitments.

Box 1.1. Accounting for all of the transport sector's emissions

The modelling in this report refers to tank-to-wheel (TTW) emissions, defined as any emissions due solely to the energy used during a trip. However, there are also upstream emissions associated with transport activity. The emissions inherent in the production of the energy or fuel source used in the vehicle fleets are referred to as well-to-tank (WTT) emissions. Well-to-wheel (WTW) emissions include both TTW and WTT emissions and represent the total emissions associated with a vehicle's activity.

Figure 1.5. Well-to-wheel and tank-to-wheel emissions under the Current Ambition and High Ambition scenarios



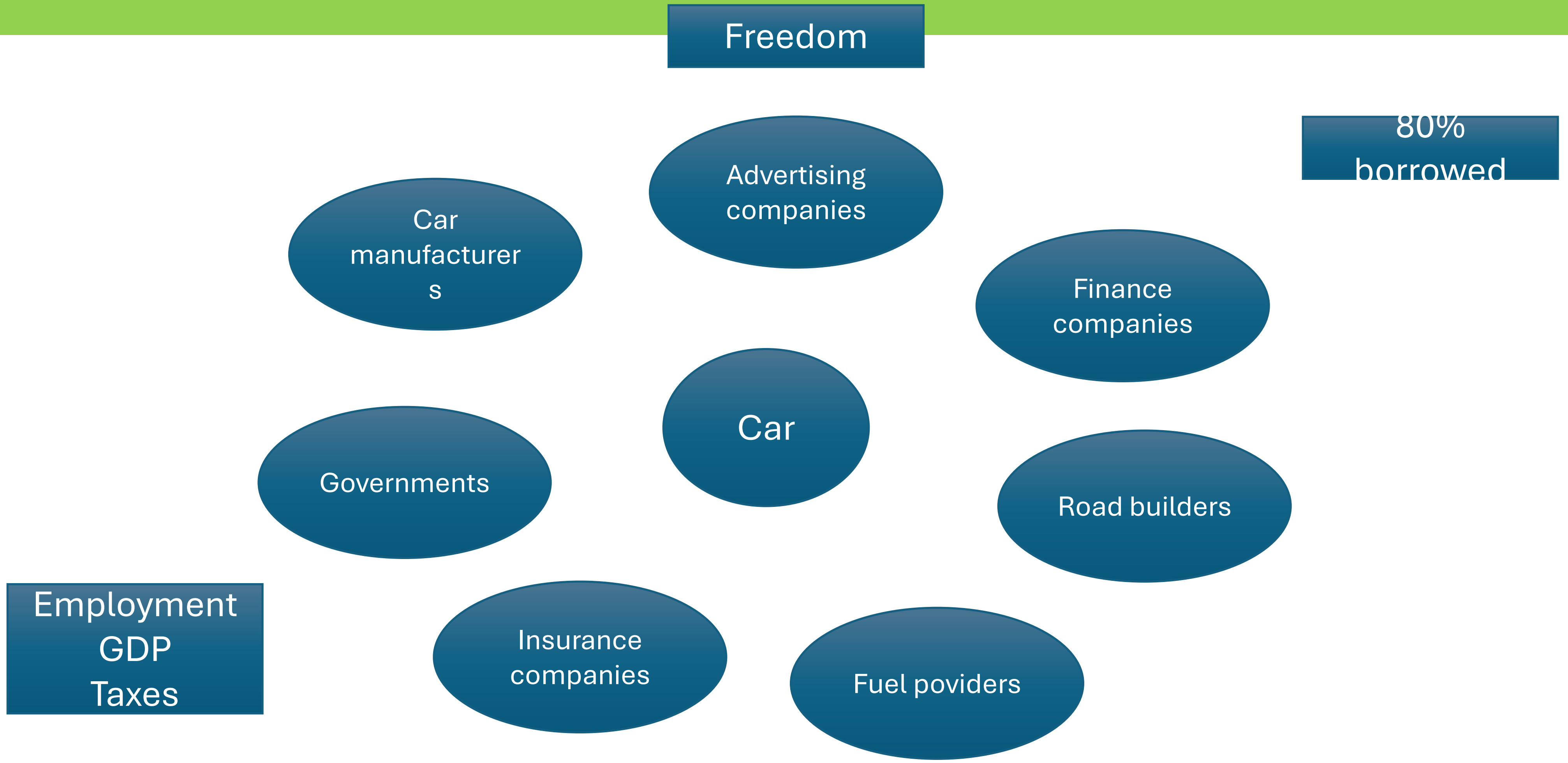
Note: Figure depicts ITF modelled estimates. Current Ambition (CA) and High Ambition (HA) refer to the two main policy scenarios modelled, representing two levels of ambition for decarbonising transport. Tank-to-wheel (TTW) emissions (or tailpipe emissions) are generated from the use of transport vehicles. This excludes well-to-tank emissions, which make up part of the total well-to-wheel (WTW) emission pathway.

StatLink https://stat.link/vupyw5

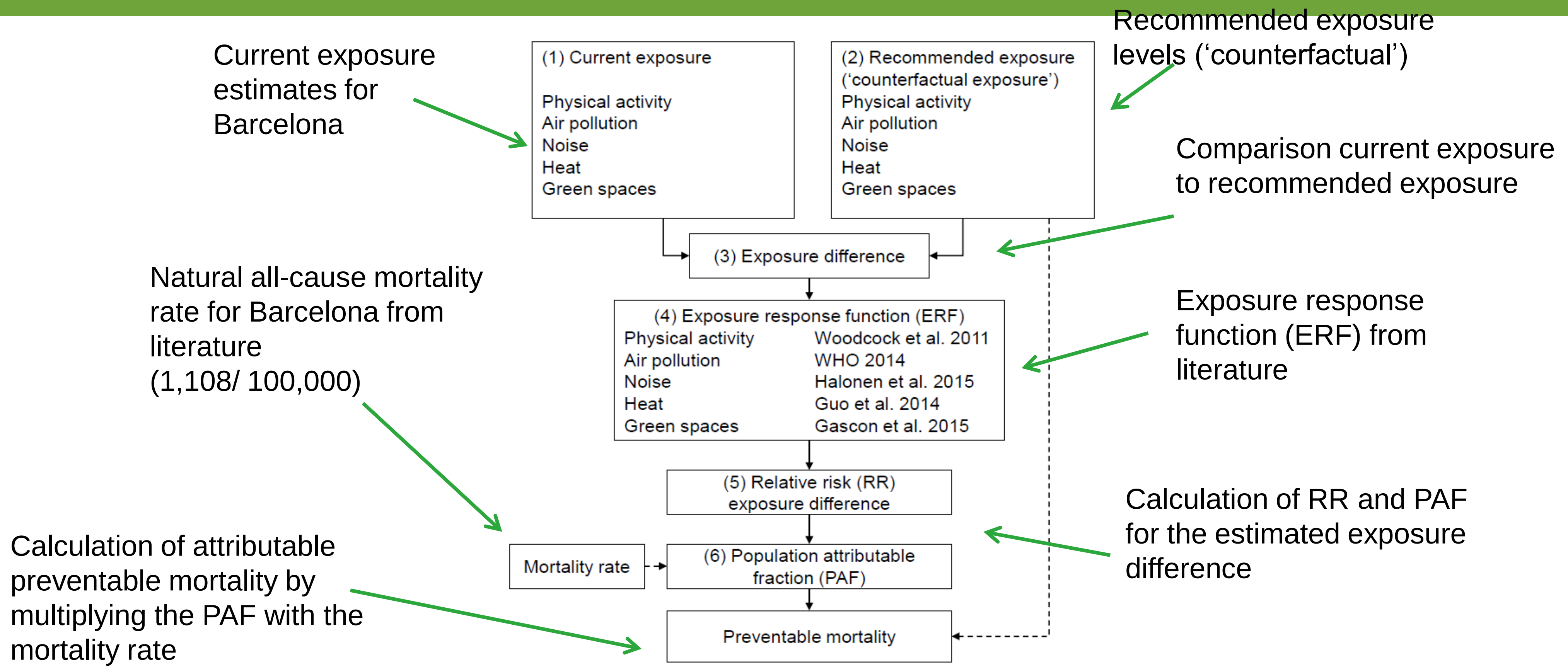
As shown in Figure 1.5, global WTW emissions were 30% higher than TTW emissions in 2019. As vehicle fleets become more efficient, WTT emissions will make up a larger share of total transport emissions than TTW emissions. The *ITF Transport Outlook* focuses on TTW emissions to identify specific policies that will speed up decarbonisation in the transport sector. However, greater collaboration with the energy sector to decarbonise fuel and energy production and distribution remains critical to achieving global climate goals.

Source: ITF (2021[9]).

The car ecosystem



Urban and TranspOrt Planning Health Impact Assessment tool (UTOPHIA)



Mueller et al EHP 2017; 125: 89-96

Cities at the heart of the climate action and public health agenda

On December 3, 2023, the Conference of Parties (COP) had its inaugural health day at COP28. Over 120 countries have endorsed the COP28 United Arab Emirates Declaration on Climate and Health. This historic declaration stated that the climate crisis is also a health crisis, and that we need to put health at the heart of climate action. The climate crisis already leads to substantial premature mortality, disease, and health-care costs. Climate action is about reducing premature mortality, preventing disease, and reducing these costs, but with many additional health co-benefits. The recent few years have been the hottest on record and heatwaves have claimed over 60 000 lives in Europe alone in 2022, with cities being the most affected.[1]

Cities play an important role in climate action, as they house over half the world's population and are responsible for more than 75% of CO_2 emissions, determined by factors such as size, urban form, and density and transport systems.[2] Because of the higher population density, cities have many advantages for their residents, such as shorter travelling times; promoted at COP28 seeks to reduce emission sources. An estimated 5 million premature deaths each year are attributable to burning of fossil fuels.[6]

Electric cars have often been proposed as the panacea, but only partly reduce air pollution and noise, still use a large amount of public space, and provide no change in physical activity.[7] A shift to carbon-neutral and healthier urban and transport planning is essential. For example, this shift could include building denser, carbon neutral, three-storey or four-storey, well insulated apartment blocks with solar power and heat pumps,[8] shifting from private car use to electric public transport and active transport, and greening cities. Innovative urban models that prioritise people over cars, such as the Paris 15-minute city, Barcelona's superblocks, London's low-traffic neighbourhoods, or the Vauban Freiburg car-free neighbourhood, should be urgently implemented, as these can reduce private car use, lower air pollution concentrations, increase green space, lower urban heat island effects, and increase physical activity, all which can contribute to better health.[7]

Lancet Public Health 2023

Published **Online** December 15, 2023
https://doi.org/10.1016/S2468-2667(23)00305-5

For more on **COP28** see www.cop28.com


BEIRUTOPIA

Figure 1. Visualisations for a typical urban terraced street. The four figures are taken from the visualisations used in the Visions 2030 Walking and Cycling Project http://www.visions2030.org.uk/. Each vision represents four different possibilities for urban transport in 2030 in the UK. These visualisations are of a 'typical' Victorian terraced street. Visualisations created by the School of Computing at the University of East Anglia.
doi:10.1371/journal.pone.0051462.g001

Woodcock et al 2013, PLoS ONE

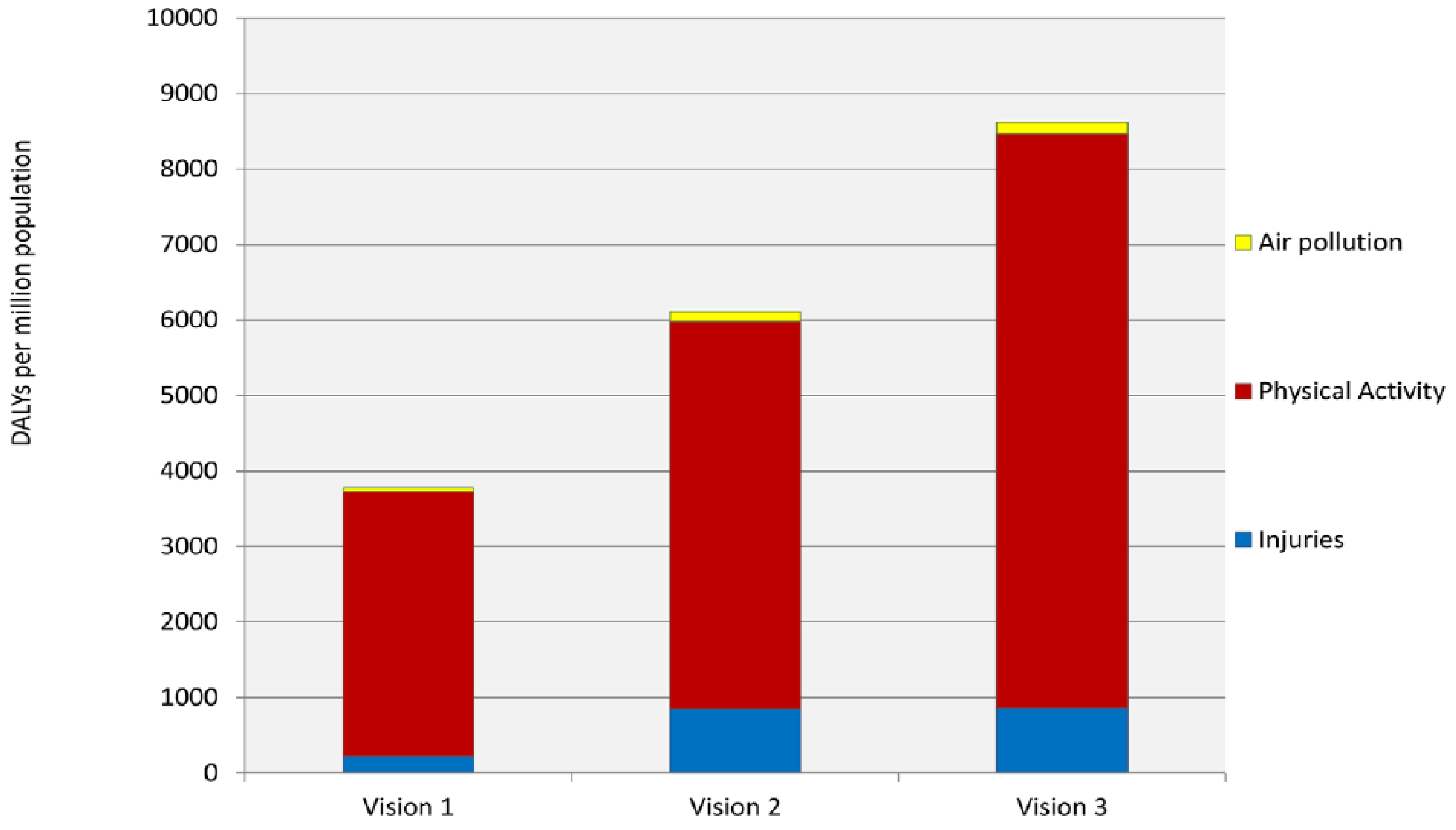


Figure 3. Health gains by Vision and risk factor. Disability Adjusted Life Years gained per million population under each of the three visions, broken down into the proportions attributable to improvements from air quality, increased physical activity and decreased road injuries. See Table 7 for full results.
doi:10.1371/journal.pone.0051462.g003

Woodcock et al 2013, PLoS ONE

Big oil uncovered
Donald Trump

Trump continues to deny climate crisis as he visits hurricane-ravaged Georgia

Ex-president refers to climate crisis as 'one of the great scams' and plans to attend two fundraisers in oil-rich Texas

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Tue 1 Oct 2024 21.49 CEST

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https://www.scottishhousingnews.com/articles/artisan-commits-to-new-design-standards-for-sustainable-housing-development

New York affected by Canadian wildfires


Mumbai, India

SHENZHEN, CHINA

LA, USA

Paris, France


BUENOS AIRES, ARGENTINA

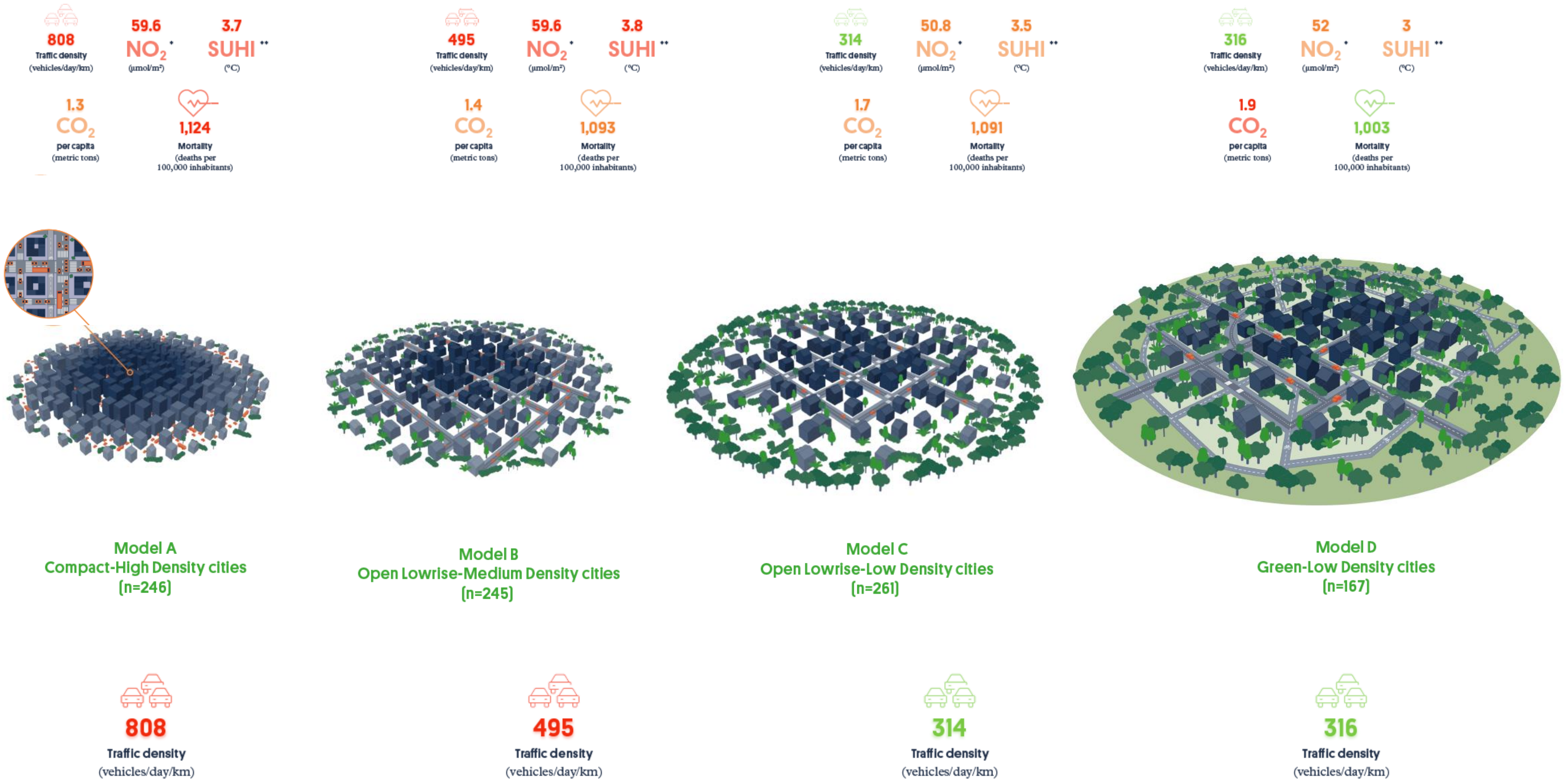

Mumbai, India

Johannesburg,
South Africa

Tehran, Iran, 15 November 2016. Habib Kashani, a member of Tehran's municipal council, said on Tuesday that pollution in Tehran had led to the death of 412 citizens in the past 23 days, according to the state news agency, Irna. City authorities announced that all schools would be closed on Wednesday. The concentration of ultra-fine airborne particles (known as PM2.5) reached more than 150 this week, setting a new record. These particles of less than 2.5 micrometres in diameter can penetrate the lungs and pass into the bloodstream and have been linked to increased rates of chronic bronchitis, lung cancer and heart disease. (Guardian newspaper)

The impact of urban configuration types on urban heat islands, air pollution, CO_2 emissions, and mortality in Europe: a data science approach

Tamara Iungman, Sasha Khomenko*, Evelise Pereira Barboza, Marta Cirach, Karen Gonçalves, Paula Petrone, Thilo Erbertseder, Hannes Taubenböck, Tirthankar Chakraborty, Mark Nieuwenhuijsen*



Lancet Planet Health 2024;
8: e489–505

https://redrawingbarcelona.isglobal.org/

30
km/hr
city

Grote steden willen wegen snel naar 30 km/uur: ‘Veel minder verkeersdoden’

https://www.ad.nl/auto/grote-steden-willen-wegen-snel-naar-30-km-uur-veel-minder-verkeersdoden~aa76773e/

AD dec 1, 2021

CLIMATE CRISIS

- More extreme weather events (heatwaves, cold spells, floods, droughts), wildfires, migration, landscape changes are brought about by deforestation, deglaciation, river disappearance, desertification, water shortage, and biomass extinction, economic decline and social disruption, loss of urban forest, allergen increase
- Health effects including premature mortality, poor mental health (anxiety, stress, schizophrenia, mood disorder and depression, suicide, aggressive behaviors), cardiorespiratory disease (strokes..), respiratory disease (asthma…). infectious disease (…)
- Recent few years have been the hottest on record and high temperatures claimed over 60000 lives in Europe alone in 2022

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CRISES

CLIMATE CRISIS
HOUSING CRISIS
COST OF LIVING CRISIS
IMMIGRATION CRISIS
AGEING POPULATION
BIODIVERSITY LOSS

POPULISM
LACK OF PA

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.

Panel remarks

- **Dr Marina Romanello,** Executive Director of the *Lancet* Countdown: tracking progress on health and climate change

- **Dr Maria Neira,** Director, Department of Environment, Climate Change and Health, World Health Organisation

- **Professor Niheer Dasandi,** Professor of Global Politics and Sustainable Development, University of Birmingham

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Q&A discussion

Thank you

- Lancet article published today:
  Mark J Nieuwenhuijsen: Climate crisis, cities, and health

- Please send feedback or queries to international@acmedsci.ac.uk