The 2026 Europe Cities Report of the *Lancet* Countdown on health and climate change: cities at the forefront of climate change action

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Executive summary

Cities are hubs for innovation, economic activity, and socioeconomic development, concentrating not only population, assets, and infrastructure, but also health risks of climate hazards. Cities have a central role in addressing climate change by implementing adaptation and mitigation solutions that deliver resilient and low-carbon communities, boost local economies, and improve citizens' health.

In this *Lancet* Countdown Report, we present for the first time a systematic, policy-relevant set of climate change and health indicators for European cities. Developed by 58 researchers from 31 academic institutions, a set of 28 indicators track trends in climate change and health across five domains.

Urban residents are increasingly at risk from growing climate change-related hazards

The increase over time in wildfire danger (indicator 1.2.1) and heat-related mortality (indicator 1.1.2) was highest in southern European cities (ie, an increase of 7% from 2003 to 2023, and of 160·6% from 1991–2000 to 2015–24, respectively), whereas the increase in climate suitability to dengue was largest in eastern Europe (ie, a 369·3% increase from 1982–2010 to 2015–24; indicator 1.3.2). Concentrations of allergenic pollen more than doubled in southern and eastern European cities from 1991–2000 to 2015–24 (indicator 1.4.1), increasing exposure and morbidity of patients with allergic rhinitis.

Adaptation measures are being implemented, but are not sufficient

Signs of city-level nature-based adaptation are evident across European subregions; however, much remains to be done to adequately protect Europe's urban dwellers from growing climate hazards. During summer months, an increase in absolute leaf area coverage was related to a reduction in surface temperature in 88% of European cities (indicator 2.2.2). Tree cover gains from 2000 to 2020 (indicator 2.2.4) were largest in eastern and northern Europe (21·8% and 24·5%, respectively). However, shaded cycling infrastructure (indicator 2.2.5) was low across European cities, and particularly low in cities in Türkiye and Cyprus (6·6% in 2018–20).

Low-carbon cities in northern Europe lead the way

While progress on mitigation is being made across European cities, much remains to be done to deliver health co-benefits from mitigation actions, including reduced air pollution, healthier diets, and equitable transport systems that promote physical activity. Cities in northern Europe had the largest decreases in emissions derived from local fossil fuel burning (indicator 3.1.1) and $PM_{2.5}$-attributable mortality (indicator 3.2.1) compared with cities in other European subregions. However, northern European cities had higher emissions related to food demand in 2020 compared with other regions (indicator 3.4.1). Death rates attributable to unhealthy diets (4·5 per 100 000 people; indicator 3.4.2) and associated health costs per person (€526; indicator 4.1.2) were largest in eastern European cities in 2020. Western Asian cities in Cyprus and Türkiye were behind in most indicators. The residential sector was the dominant contributor to $PM_{2.5}$-attributable mortality across most European cities, accounting for 38% of total urban $PM_{2.5}$-attributable mortality in 2023. Particularly in eastern Europe, the use of solid fuels led to a $PM_{2.5}$-related all-cause mortality rate more than three times that of northern cities in 2023 (indicator 3.2.1). Accessibility to sustainable transport, including walking, cycling, and public transportation stops was highest in northern and western European cities in 2022 (indicator 3.3.1), essential enablers to reduce air pollution, including transport-related greenhouse gas (GHG) emissions, and increase physical activity.

Tackling climate change at the city level requires adequate financing and tools

In 2024, cities across Europe reported requiring additional funds for climate-related projects on transport (16·4%), buildings (14·3%), and renewable energies (13·6%). Only 0·5% of adaptation and mitigation projects reported by the cities directly addressed health systems and services. Financial and technical constraints pose

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For the French translation of the abstract see Online for appendix 1

For the Spanish translation of the abstract see Online for appendix 2

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considerable barriers to implement climate change adaptation and mitigation measures for nearly a third of surveyed cities (indicator 4.2.1).

Low engagement with the intersection of climate change and health in cities

While political engagement with climate and health in cities remained low from 2020 to 2024 (indicator 5.2.1), climate change and health received more engagement from the media: nearly a quarter of newspaper articles on climate change addressed health issues at the urban level between 2023 and 2025 (indicator 5.4.1).

Prioritising city-level climate change action

The indicators from this Report inform priority actions to protect the health of European urban dwellers in the face of climate change. First, European cities experiencing heat risks would benefit from strengthening and evaluating heat-health early warning systems and heat-health adaptation plans to keep city residents informed, safe, and healthy as heat exposure increases. These adaptation strategies (ie, early warnings and heat-health planning) are important as European cities are highly susceptible to heat due to large populations, high population density, at-risk groups, and heat island effects.

Second, intersectoral urban planning in cities is crucial to reduce climate change impacts. Healthy actions include increased urban green spaces (especially tree canopy), the use of less heat-absorbent building materials, de-sealing impermeable surfaces, and the promotion of active and public transport. Compact urban forms that also include urban green spaces can effectively support active travel while offsetting negative trade-offs related to the urban heat island effect.

Third, accelerating the reduction of GHG emissions across sectors (particularly energy, transport, and food) can lead to immediate health gains from reduced air pollution and a reduction of non-communicable diseases due to improved diets.

Targeted strategies should be considered to ensure small cities are not excluded from the transition to low-carbon economies. With robust evidence, multilevel governance, and adequate financing and implementation tools, cities can lead the green transition towards a healthier and more equitable Europe.

Introduction

Cities are central to addressing climate change as catalysts of innovation, economic activity, and socioeconomic transformation.[1–3] At the same time, cities are responsible for 80% of the primary energy use and for around 70% of consumption-based GHG emissions in the EU.[1,4,5] Cities concentrate people, assets, and infrastructure, but also the health risks of climate hazards, including heat and flooding.[6,7] As the share of the population living in European cities is expected to grow from 75% in 2018 to 84% in 2050, cities will increasingly face climate impacts that require strong climate change mitigation and adaptation measures to protect residents' health.[8]

Climate policy is shaped across multiple levels of governance, from national frameworks to local initiatives, with urban areas playing a crucial role in implementation. European subnational regions and cities implement approximately 90% of all climate adaptation and 70% of climate mitigation policies.[4] Cities also contribute to international climate processes via networks such as the International Council for Local Environment Initiative (ICLEI), which participates as an observer in Intergovernmental Panel on Climate Change and UN Framework Convention on Climate Change meetings.[9–11] Cities' close engagement with citizens and their ability to tailor policies to local contexts position them as key implementers of climate action. Although frameworks, such as the 2020 New Leipzig Charter and the EU Missions on Adaptation to Climate Change and Climate-Neutral and Smart Cities (ie, Net Zero Cities) provide guidance for climate action in European cities,[12,13] the climate–health dimension is still poorly addressed at the urban scale.[14,15]

This 2026 Europe Report of the *Lancet* Countdown focuses on cities, which face high susceptibility to climate-related health impacts and often have more agile governance structures to respond to climate change compared with national governments. Existing city-level monitoring frameworks and indicators are sparse, tend to be fragmented, and rarely capture specific pathways through which climate change affects health in urban contexts.[6,16–25] Therefore, this report aims to fill an urgent evidence gap by providing a systematic, policy-relevant set of indicators at the intersection of climate change and health, tailored for the urban scale.

In this report, 28 indicators track trends in climate change and health across five domains, including ten new city-specific indicators alongside 18 indicators featured in the European 2026 report[18] downscaled to city level (panel). Where possible, indicators included 885 cities (appendix 3) of the EU Urban Audit[26] from 32 European countries (appendix 4 pp 6–10). Cities were grouped by size and European geographical subregion. City population size reflects economies of scale among other attributes relevant to transport costs and infrastructure, productivity, and social inequalities.[27,28] If not stated otherwise, cities were classified as small (50 000–100 000 inhabitants), medium (100 000–250 000), large (250 000–500 000), extra-large (500 000–1 million), extra-extra-large (1–5 million), and global cities (more than 5 million) according to their population in 2023.[26] European subregions include western Europe (280 cities with a total population of 74·7 million people), northern Europe (185 cities with 53·7 million), southern Europe (225 cities with 58·4 million), eastern Europe (166 cities with 30·9 million), and western Asia whenever data

Panel: Indicators of the 2026 Europe Cities Report of the *Lancet* Countdown on health and climate change

Climate change exposures, health risks, and impacts
1.1: Heat and health
- 1.1.1: Urban heat island intensity and imperviousness*
- 1.1.2: Heat-related mortality

1.2: Health and extreme weather events
- 1.2.1: Wildfire smoke

1.3: Climate-sensitive infectious diseases
- 1.3.1: Climatic suitability to non-cholera *Vibrio*
- 1.3.2: Climatic suitability to dengue, chikungunya, and Zika

1.4: Allergens
- 1.4.1: Allergenic trees

Adaptation, planning, and resilience for health
2.1: Adaptation, planning, and assessment
- 2.1.1: City-level climate change risk assessments

2.2: Adaptation, delivery, and implementation
- 2.2.1: Heat-health early warnings
- 2.2.2: Surface urban heat island adaptation, green leaf area coverage, and albedo effect*
- 2.2.3: Exposure to green space
- 2.2.4: Urban tree cover*
- 2.2.5: Heat-resilient cycling infrastructure coverage*
- 2.2.6: City-level climate change adaptation goals and actions*

Mitigation actions and health co-benefits
3.1: Energy systems and health
- 3.1.1: Sectoral attribution of greenhouse gas emissions*

3.2: Air pollution and health co-benefits
- 3.2.1: Mortality attributable to $PM_{2·5}$

3.3: Sustainable transport
- 3.3.1: Infrastructure to support active and public transport*

3.4: Food, agriculture, and health
- 3.4.1: Lifecycle emissions from food demand
- 3.4.2: Deaths attributable to dietary risks

3.5: City-level climate change mitigation targets and actions*

Economics and finance
4.1: Health-linked economic impacts and mitigation of climate change
- 4.1.1: Heat impact on labour supply
- 4.1.2: Monetised cost of unhealthy diets

4.2: Economics of the transition to zero-carbon economies
- 4.2.1: City-level climate action funding*

Public and political engagement
5.1: Scientific engagement with health and climate change
- 5.1.1: Coverage of health and climate change in cities in scientific articles
- 5.1.2: Studies attributing health impacts to climate change in cities

5.2: Political engagement with health and climate change in urban areas
- 5.2.1: Engagement with health and climate change in urban areas in European Parliament
- 5.2.2: Political engagement with health and climate change in urban areas on social media

5.3: Corporate sector engagement with health and climate change in urban areas

5.4: Media engagement with health and climate change in urban areas
- 5.4.1: Coverage of health and climate change in urban areas across online newspaper articles*

*New city-level indicators not included in previous *Lancet* Countdown reports.

were available to account for Cyprus and Türkiye (29 cities with 39·0 million). While equity is an important and complex topic at the intersection of climate change, health, and cities,[29] our city-level indicators provide data only on the differences between cities and European regions that have substantial differences in the size and performance of their economies,[30] and do not cover important aspects of within-city inequities.

Section 1: climate change exposures, health risks, and impacts

Europe is facing more rapid warming than other world regions,[31] and record-breaking summer temperatures.[32] European cities' residents are exposed to climate hazards due to the high number of impervious surfaces and urban heat islands. Cities account for a large proportion of Europe's climate-related disease burden due to their high population sizes and infrastructure, with increasing effects on at-risk groups, such as children, outdoor workers, and people in low-income households.[33]

With six indicators, this section monitors: (1) exposure to climate change hazards, including urban heat island intensity and allergenic pollen; (2) health risks, including infection risk related to waterborne and vector-borne infectious diseases; and (3) health impacts, including deaths attributable to heat and wildfire smoke.

1.1: heat and health

Indicator 1.1.1: urban heat island intensity and imperviousness

The urban heat island effect is a growing public health concern, exacerbating heat-related morbidity and mortality.[6,34] This indicator tracks two components across 820 cities in 29 European countries. The first is the ambient urban heat island intensity, calculated as the

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For **Net Zero Cities** see https://netzerocities.eu/

See **Online** for appendix 3

See **Online** for appendix 4

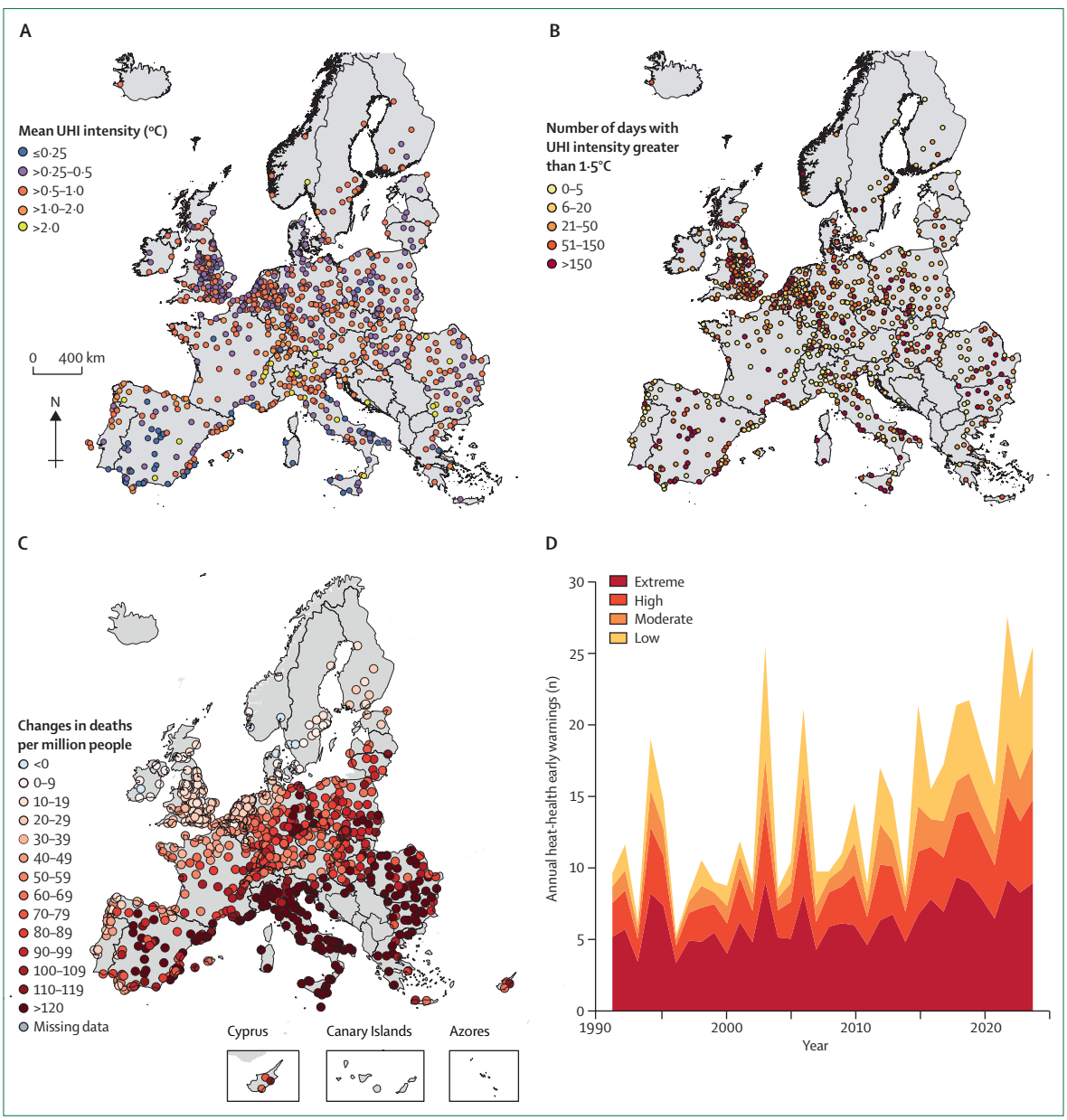

Figure 1: **Urban heat island intensity, heat-related mortality, and heat-health early warnings**
(A) Mean UHI intensity per city during the summer months (June–September) from 2003 to 2020. (B) Number of days when urban heat island intensity was higher than 1·5°C across the same period. (C) Change in heat-related mortality rate between 1991–2000 and 2015–24, expressed as the number of annual deaths per million inhabitants. (D) Annual time series of heat-health early warnings for European cities. Low, moderate, high, and extreme warnings are shown in yellow, orange, light red, and dark red, respectively. UHI=urban heat island.

area-weighted difference in daily mean temperatures between urban and rural zones during summer months,[35,36] using high-resolution temperature data from 2003 to 2020.[37] The indicator also tracks urban imperviousness, using Copernicus data from 2006 to 2018,[38] defined as the percentage of land converted from natural land cover to artificial, often impenetrable or sealed surfaces (appendix 4 pp 25–39).[39]

Mean urban heat island intensity values (figure 1A) remained stable across 2003–20 (yearly urban heat island intensity pooled across all cities was 0·5–0·7°C), with western European cities showing marginally higher mean values (0·66°C) compared with other subregions (range 0·54–0·63°C). Global cities (ie, with a population greater than 5 million) presented the highest mean urban heat island intensity values (0·66–0·88°C). On average, southern European cities had the highest number of days with urban heat island intensities higher than 1·5°C (south 218, west 134, north 55, and east 119 days; figure 1B). 80 (9·8%) of the 820 studied

cities had more than 300 days of urban heat island intensity that was 1·5°C or higher (corresponding to 14% of the total number of days across 2003–20); of these cities, 39 (48·7%) were in southern Europe.

Imperviousness remained stable between 2003 and 2014 but increased between 2015 and 2018. These increases varied according to city size, from 2% of land area in small cities to greater than 4% in global cities. Several small and medium cities in France, the UK, and Italy had imperviousness increases exceeding 9% across 2003–18. Percentages of imperviousness were consistently lower in southern and eastern cities (12–15%) and higher in western cities (22–25%).

Indicator 1.1.2: heat-related mortality

Europe is warming twice as fast as the global average,[40] and projections suggest a steep rise in heat-related deaths until the end of the 21st century.[41] This indicator uses ERA5-Land temperature data[42] and epidemiological exposure–response functions[20] from 845 European cities in 30 countries to compute the change in heat-related mortality rates between 1991 and 2000 and between 2015 and 2024 for populations aged 20 years and older (appendix 4 pp 40–41). Heat-related mortality is estimated to have increased in 834 (98·7%) of 845 cities (figure 1C), with an overall mean increase of 82 annual deaths per million people (95% CI 63–100). The largest increases were observed in southern European cities (132 deaths per million people, 95% CI 109–156), followed by eastern (98 deaths per million people, 95% CI 54–140), western (64 deaths per million people, 95% CI 48–80), and northern Europe (20 deaths per million, 95% CI 12–29). Among 845 cities, the steepest increases occurred in Trikala, Greece (390 deaths per million people, 95% CI 268–502), Xanthi, Greece (347 deaths per million people, 95% CI 254–430), and Pula, Croatia (336 deaths per million people, 95% CI 252–418). Strong adaptation and mitigation measures are needed to protect at-risk populations from the dangers of heat under current and projected future warming levels.[41,43]

1.2: health and extreme weather events

Indicator 1.2.1: wildfire smoke

The frequency and intensity of wildfire is increasing[44] due to climate change, in turn raising the production of small particles ($PM_{2·5}$), affecting cities far from the source.[45] The toxic components of wildfire-$PM_{2·5}$ might be more health-damaging than $PM_{2·5}$ from other sources, leading to more severe respiratory and cardiovascular effects,[46,47] increased hospital admissions, strained emergency services, and a need for urban planning for smoke resilience.[48]

This indicator tracks wildfire danger, population-weighted exposure to wildfire-$PM_{2·5}$, and deaths attributable to wildfire-$PM_{2·5}$ in 878 European cities across 32 countries during 2003–23 (appendix 4 pp 42–55). No clear trends in the three sub-indicators were observed in European subregion or city size categories. Peak wildfire-$PM_{2·5}$ exposure days (concentration above the 99th percentile 2·74 μg/m³) were more prevalent in western Asia and eastern and southern European cities during 2003–23. Increasing trends in wildfire-$PM_{2·5}$ attributable mortality were observed in 85 (9·7%) of 878 cities, while 37 (4·2%) cities had decreasing trends. In European cities, 68 312 (95% CI 64 510–72 115) cumulative wildfire-$PM_{2·5}$ attributable deaths occurred between 2003 and 2023; 31·9% and 23·2% of deaths were in southern and eastern European cities, respectively.

1.3 climate-sensitive infectious diseases

Indicator 1.3.1: climatic suitability to non-cholerae Vibrio

Warming conditions have expanded coastal areas suitable for the presence and transmission of non-cholera *Vibrio* across Europe, with a growing number of cases acquired from recreational waters in cities.[49–52] Using modelled salinity and sea surface temperature, this indicator showed that the annual average number of cities showing suitable conditions for *Vibrio* transmission increased by 19% (from 131 to 156 cities) from 1982–2010 to 2015–24 (appendix 4 pp 56–61). The largest increases in accumulated risk days per year (ADY) compared with the baseline were observed in cities from western and northern European countries: France (335 *vs* 71 ADY, 370% increase), Belgium (832 *vs* 299 ADY, 178% increase), the Netherlands (2404 *vs* 931 ADY, 158% increase), Finland (326 *vs* 189 ADY, 72% increase), and Germany (1399 *vs* 873 ADY, 60% increase). A second hotspot with increased risk was identified around the Black Sea, including Türkiye (1543 *vs* 1422 ADY, 9% increase), Romania (313 *vs* 290 ADY, 8% increase), and Bulgaria (980 *vs* 954 ADY, 3% increase).

Indicator 1.3.2: climatic suitability to dengue, chikungunya, and Zika

Large, densely populated cities[53] face the greatest pressure of climate-sensitive infectious disease dissemination, where urban heat island,[54] container breeding sites,[17,55–57] and high intracity and intercity mobility[56,58–60] amplify the introduction and transmission risk of vector-borne diseases, including dengue, chikungunya, and Zika.[17,55–57,59,61]

This indicator uses a model integrating temperature, rainfall, daylight duration, and mosquito abundance to estimate basic reproduction number (R_0) and duration of transmission season for dengue, chikungunya, and Zika viruses in cities (appendix 4 pp 62–65).[17,62–65] Overall, the average risk of dengue transmission (R_0) increased by 110·5% across European cities during 2015–24 compared with 1981–2010. The most substantial increase occurred in eastern European cities (R_0 increase of 369·3%), followed by western Europe (159·3%), southern Europe (112·2%), northern Europe (12·0%), and western Asia (59·8%). Similar trends were found for chikungunya and Zika viruses.

1.4: allergens

Indicator 1.4.1: allergenic trees

Climate change affects pollen seasons in cities by extending high temperature periods and altering dissemination patterns and allergenicity.[66–68] This indicator presents pollen exposure changes via two metrics: the shift in pollination time and annual pollen exposure. Pollen trends for the season start, end, duration, and total seasonal concentration were derived from the European pollen Reanalysis v1.1 (1991–2022)[69,70] and the System for Integrated Modeling of Atmospheric Composition (2023–24).[71–73] Trends were computed as decadal average differences of 2015–24 and 1991–2000 for alder, birch, and olive pollen (appendix 4 pp 66–81).

Compared with 1991–2000, total seasonal birch concentrations increased in western European cities, including a 66% rise in Berlin, Germany and 82% in Brussels, Belgium. Birch pollen intensity also increased in eastern European cities, with an average rise of 137% in Budapest, Hungary, 106% in Bratislava, Slovakia, and 120–175% in 23 Polish cities. Birch season started 1–2 weeks earlier in nearly all European cities. Olive season started 2–3 weeks earlier and pollen concentration increased in southern European cities, with the highest being Tarragona (200%), Córdoba (150%), and Valladolid (126%) in Spain in 2015–24 compared with 1991–2000. While heterogeneous across Europe, alder season was longer (about 2 weeks) and had higher pollen concentrations (about 200%) in eastern Europe, especially in Romanian, Polish, and Slovakian cities.

For **Forecaster.health** see https://forecaster.health

Conclusion

This section highlights several increasing environmental exposures and health risks of climate change among Europe's urban populations. Increasing heat-related mortality and risk of vector-borne diseases were particularly pronounced in southern European cities. Northern European cities had increased exposure to allergenic tree pollen concentrations and climatic suitability of *Vibrio*. Despite varying trends in exposures and the health risks of climate change across regions, the overall pattern in European cities calls for strategic adaptation tailored to the local context to reduce exposures, vulnerability, and ultimately, the health impacts of climate hazards.

Section 2: adaptation, planning, and resilience for health

Effective implementation of adaptation strategies is needed to protect the health of growing urban populations in Europe by reducing exposure and susceptibility to climate hazards.[74,75] Despite existing city-level strategies, increasing exposures and the current magnitude of health impacts[76,77] indicate that current adaptation measures are insufficient. This section includes six indicators that assess the extent to which adaptation measures have been planned or adopted across European cities, including four new indicators (panel).

2.1: adaptation, planning, and assessment

Indicator 2.1.1: city-level climate change risk assessments

Climate risk and vulnerability assessments are essential for understanding a city's current and future climate risks and vulnerabilities[78] and provide the basis for evidence-based adaptation and resilience planning. Climate risk and vulnerability assessments help cities strategically prioritise investments, make efficient use of scarce resources, and implement targeted measures to safeguard at-risk populations.[78] Based on Carbon Disclosure Project (CDP) and ICLEI data,[79] 170 (82·5%) of 206 responding WHO European cities reported having performed a climate risk and vulnerability assessment in 2024 (appendix 4 pp 82–83). An additional 7·8% cities were in the process and 8·3% planned to complete one within 2 years. The most frequently cited health outcomes in climate risk and vulnerability assessments included: heat-related illnesses, injuries and fatalities from extreme weather, mental health impacts, respiratory disease exacerbation, and overwhelmed health services. Most cities anticipate climate-related health impacts to increase in the medium term (2026–50). The most commonly identified at-risk populations were older people, children and adolescents, low-income households, outdoor workers, and minority communities.

2.2: adaptation, delivery, and implementation

Indicator 2.2.1: heat-health early warnings

Integrating epidemiology into heat early warning systems (eg, Forecaster.health) can enhance health indicators that inform public health and emergency plans at urban and suburban scales.[80,81] This indicator uses ERA5-Land temperature data[42] and epidemiological exposure–response functions[20] from 845 European cities in 30 countries to quantify potential heat-health early warnings between 1991 and 2024. Daily heat-health warnings were categorised as low (5–10%), moderate (10–15%), high (15–20%), or extreme if more than 20% of the deaths of the given day were related to heat (figure 1D). Between 2015 and 2024, European cities estimated annual averages of 8·1 (52·8% increase) low, 4·6 (91·7%) moderate, 2·8 (115·4%) high, and 5·2 (300%) extreme warnings compared with 1991–2000 (appendix 4 pp 84–85). Cities in southern Europe had the highest annual extreme warning average (10·0), followed by western (4·6), eastern (4·1), and northern Europe (1·7). At the city level, Osijek, Croatia (21·3), Ciudad Real and Jaén, Spain (both 20·9), and Campobasso, Italy (20·0) presented the highest number of annual extreme warnings for 2015–24. These findings underscore the need for integrating heat-health early warning systems into heat-health adaptation plans to effectively protect population health.

Indicator 2.2.2: surface urban heat island adaptation, green leaf area coverage, and albedo effect

Climate change and urbanisation contribute to urban heat island intensity, with urban areas becoming warmer than

rural surroundings due to the built-up environment and artificial heat-retaining materials, increasing the health impacts of heatwaves.[82,83] This indicator derived data from night-time satellite land surface temperature to identify areas with a change in surface urban heat island intensity between each summer value and the reference period mean (2014–19), due to changes in green leaf area coverage and surface albedo (ie, measure of solar radiation reflective power of a surface), across 533 European cities with more than 100 000 inhabitants.[84] Absolute changes in surface albedo[85] and green leaf area coverage[86] were calculated as the area-weighted average in areas with surface urban heat island change (ie, surface urban heat island change of 0·5°C or more; see appendix 4 pp 86–87).

Surface urban heat island intensity decreased in 470 (88·2%) of the 533 cities, with an average reduction of 0·7°C across the study period (2014–19). Reductions in surface urban heat island intensity were related to the city size, decreases in albedo, or increases in green leaf area coverage (figure 2). Across all geographical areas, more consistent decreases in surface urban heat island values were observed in larger cities, while greater variability was observed in smaller cities.

Indicator 2.2.3: exposure to green space

Urban green spaces provide health and other socio-economic and environmental benefits by promoting physical activity, reducing stress, improving air quality, and reducing the urban heat island effect.[6,87] EU biodiversity and climate adaptation policies emphasise the need to create biodiverse and accessible urban green spaces, including parks, forests, and tree-lined streets.[88,89]

This indicator calculates the change in population-weighted normalised difference vegetation index (NDVI), which quantifies overall greenness at 1 km scale,[21,90] for 860 European cities across 32 countries between 2000 and 2024. Median population-weighted NDVI was estimated to increase overall by 3·1% (IQR 1·88–4·69). Cities across European subregions had a similar increase in estimated population-weighted greenness except for northern cities, which exhibited a smaller gain (appendix 4 pp 88–91).

Indicator 2.2.4: urban tree cover

Urban trees, one of the high-density elements of green spaces in cities, provide essential ecosystem functions[91] that directly benefit health by reducing heat stress, improving air quality, and supporting mental well-being.[92,93] The EU Nature Restoration Law recommends a minimum of 10% tree canopy cover for European cities, while the UN Economic Commission for Europe suggests a minimum canopy cover threshold of 30%.[94,95] This indicator measures tree cover changes across 877 cities from 2000–20 using the Global Land Analysis and Discovery dataset,[96] expressing the proportion of urban area occupied by the horizontal projection of tree crowns (appendix 4 pp 92–98).[97]

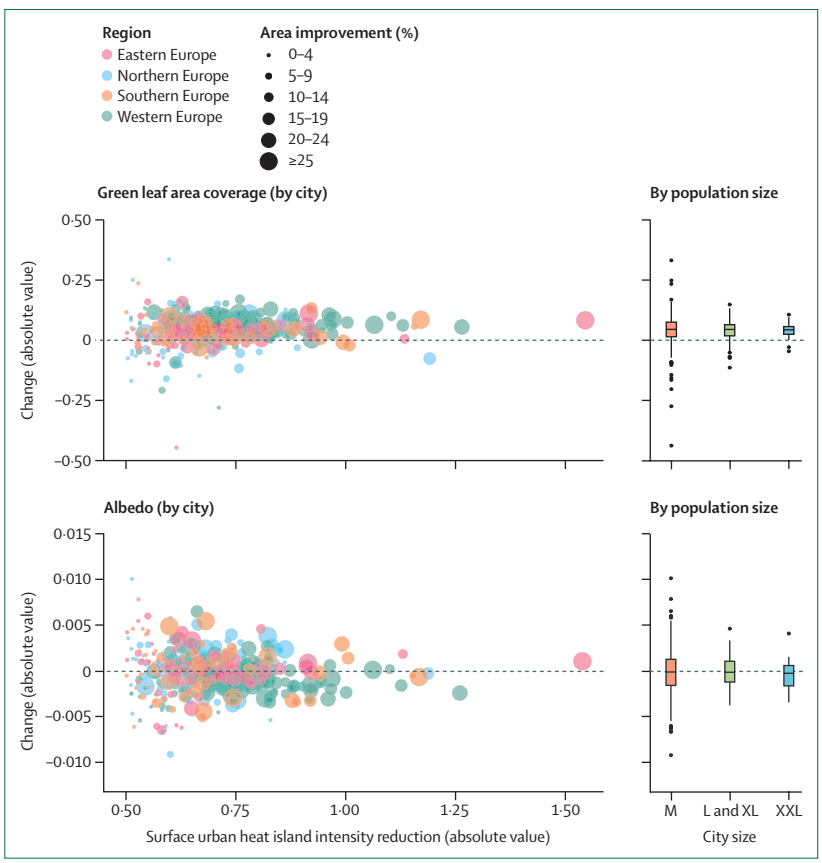

Figure 2: **Surface urban heat island intensity, green leaf area coverage, and albedo changes**
Area improvement (%) and reduction in surface urban heat island intensity by changes in total green leaf area (increase; top chart) and albedo (no change; bottom chart) for cities in Europe by geographical region (scatter plots) and population size (boxplots), for the 2014–19 period. Whiskers extend to the lowest and highest values within 1·5 times the IQR from the box boundaries. Points beyond the whiskers denote outliers for individual cities. M=medium. L=large. XL=extra-large. XXL=extra-extra-large.

In 2020, tree cover was highest in eastern European cities (22·04±15·27%), followed by western Asia (16·39±19·35%), southern Europe (13·75±13·74%), western Europe (11·37±9·89%), and northern Europe (10·66±16·20%). When cities are aggregated by subregion, marked spatial heterogeneity emerged in tree cover dynamics. Eastern (1·01% increase) and Northern Europe (0·74% increase) show the largest gains relative to city area, while Western (1·48% decrease) and Southern Europe (0·96% decrease) exhibit the greatest losses (figure 3A–B). More than 30% of western Asian and 28% of eastern European cities exceeded the 30% tree cover target. Both southern and northern Europe had 10–15% of cities reaching the target, while western Europe lagged behind with less than 6% of cities meeting the target. Overall, 125 (14·0%) of 877 cities met or exceeded the 30% threshold, illustrating how far most European cities remain from this goal.

Indicator 2.2.5: heat-resilient cycling infrastructure coverage

Tree cover plays a crucial role in reducing heat exposure for cyclists, lowering temperatures along urban cycling

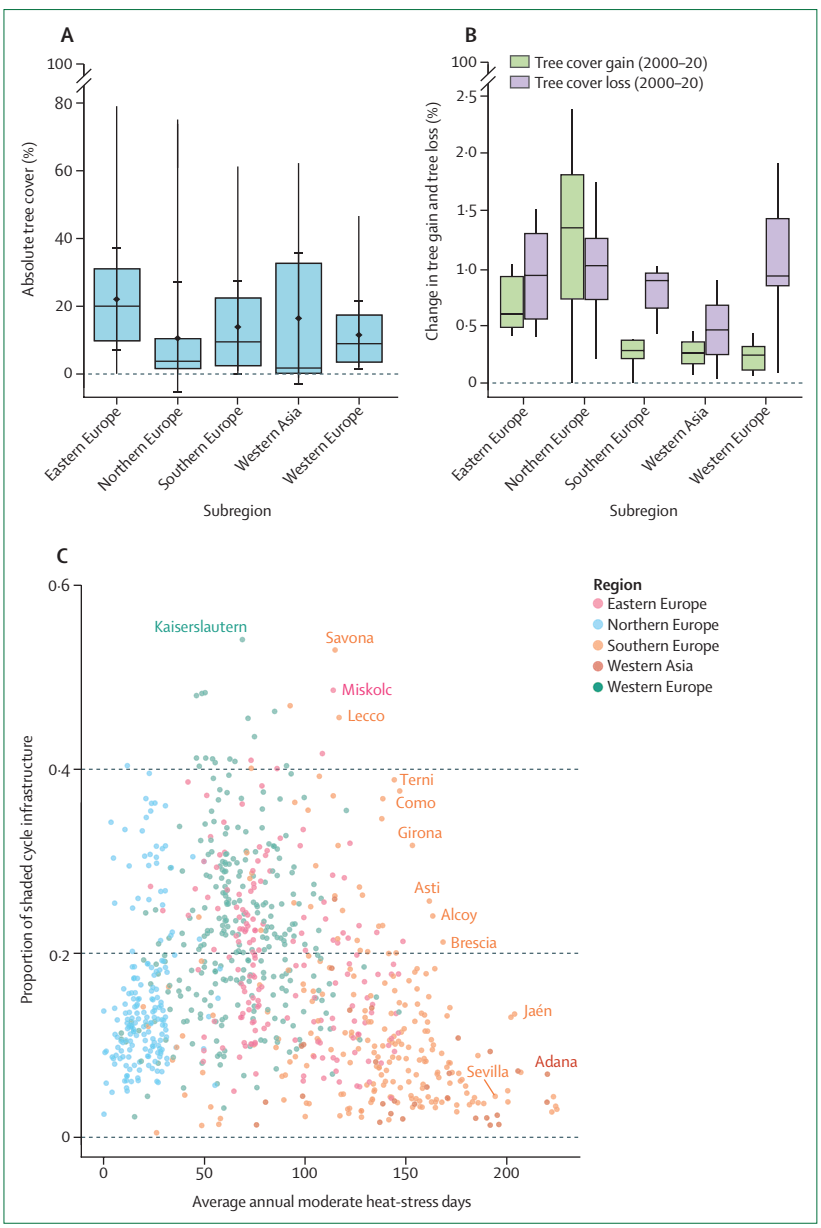

Figure 3: **Urban tree cover and shaded cycling infrastructure in European cities, according to subregion**
The boxplots present (A) the absolute percentages of net urban tree cover in 2020, and (B) the percentage changes in tree gain and tree loss between 2000 and 2020. Boxes represent the IQR (25th–75th percentile), with the horizontal line indicating the median. Whiskers extend to the lowest and highest values within 1·5 times the IQR from the box boundaries. The diamonds represent the average tree cover across cities within each region, with respective standard deviations demarcated with horizontal lines. (C) The proportion of cycling infrastructure shaded by trees during peak solar hours compared with average annual moderate heat exposure. Each point represents a single city and is coloured by region. The labelled points show the cities with relatively high shaded cycle infrastructure and many annual moderate heat-stress days. Western Asia includes cities in Cyprus and Türkiye.

routes, and improving comfort.[98] This indicator estimates the proportion of cycling paths shaded by trees during peak solar hours using high-resolution, satellite-derived temperatures[99] and tree canopies,[100,101] with OpenStreetMap cycling infrastructure data.[102] The proportion of shaded cycling infrastructure of each city was plotted against the average annual number of moderate heat-stress days, according to the Universal Thermal Climate Index (appendix 4 pp 99–102).[99,103]

Across 885 cities, mean canopy coverage during 2018–20 along all cycling paths was 17·2% and 30·5% along designated and shared pedestrian-cycle paths, respectively. Cycle-path coverage was highest in western European cities (22·3%), followed by eastern Europe (19·1%), northern Europe (15·4%), southern Europe (12·3%), and western Asia (6·6%). Cities with the most moderate intensity or greater heat-stress days had the lowest shaded cycle-path coverage (figure 3C). 211 (23·8%) of 885 cities, primarily in southern Europe and western Asia, had moderate heat stress on more than one-third of days (122 days per year) and had an average cycle-path coverage of only 10·5% (17·3% on designated and shared pedestrian-cycle paths). In comparison, 273 (30·8%) cities had moderate heat stress less than once per week on average and had an average cycle-path coverage of 16·7%.

Indicator 2.2.6: city-level climate change adaptation goals and actions

Developing city-level adaptation goals and strategies that integrate health components enable more targeted responses to climate-sensitive risks and maximise health co-benefits from cross-sectoral adaptation measures.[104] According to 2024 CDP–ICLEI data,[79] 173 (84·0%) of 206 cities across 30 WHO Europe countries reported having established adaptation goals, while 24 (11·7%) plan to introduce one within 2 years (appendix 4 pp 103–104). Overall, cities reported 1105 adaptation goals, with an average of six goals per city and a median target year of 2030. Most adaptation goals addressed multiple climate hazards simultaneously, including extreme heat (511 [46·2%] of 1105 cities), urban flooding (459 [41·5%]), heavy precipitation (402 [36·4%]), river flooding (330 [29·9%]), and drought (309 [28%]). Only 81 (7·3%) directly targeted infectious diseases.

Cities identified 1519 planned or implemented adaptation actions, with focus on community engagement (123 [8·1%]), green infrastructure (97 [6·4%]), flood defence (77 [5·1%]), and ecological restoration (68 [4·5%]). Public health co-benefits were reported for 596 (39·2%) actions; the most frequently cited were improved mental wellbeing and quality of life (167 [28·0%] of 596) and improved physical health (164 [27·5%]), followed by reduced disaster-related, disease-related, or contamination-related health impacts (85 [14·3%]); reduced health impacts from extreme temperatures (78 [13·1%]); improved air quality (60 [10·1%]); enhanced preparedness for health service delivery (31 [5·2%]); reduced health costs (seven [1·2%]); and reduced premature deaths (three [0·5%]).

Conclusion

Protecting urban populations from extreme heat is essential, particularly with the increasing health impacts

associated with rising temperatures.[32] Across Europe, heat-health warnings are rising (indicator 2.2.1) and prevention plans and measures should be implemented accordingly to improve urban adaptation. Encouragingly, surface urban heat decreased in 470 cities, with an average reduction of 0·7°C from 2014 to 2019 (indicator 2.2.2). However, local cooling needs to be intensified as global heating increases, including the expansion of urban greening and a shift towards land cover and building materials that absorb and retain less heat. Urban trees are more effective at reducing local temperatures than other types of green space;[105] however, the data show a mixed picture, with increasing tree cover in eastern and northern European cities and decreasing cover in other subregions (indicator 2.2.4). While green space estimates (as measured by NDVI) are increasing across the region (indicator 2.2.3), it is unclear whether this change is related directly to adaptation actions and what the implications are for reducing local temperatures, given that all types of vegetation are included. Expanding tree cover adjacent to cycling infrastructure (indicator 2.2.5), particularly in southern Europe and western Asia, could ensure that healthy sustainable travel remains safe in the face of increasing temperatures. Based on indicator 2.2.6, city-level adaptation is occurring, but efforts need to be accelerated to ensure adequate protection of public health in a changing climate.

Section 3: mitigation actions and health co-benefits

Many city-level mitigation actions can deliver health co-benefits, including reduced air pollution, healthier low-carbon diets, and increased physical activity. These actions include those that promote travel-related physical activity and urban greening to reduce energy demand for cooling.[106,107] Cities can also support lower carbon footprints, by reducing emissions of private transport and household energy via access to public transport, shorter trip distances, and more energy-efficient buildings, all of which can simultaneously deliver health gains.[108]

This section includes six indicators tracking efforts to reduce GHG emissions across high-emission sectors, including power generation, transport, residential buildings, and food production. This section also highlights the associated health co-benefits of reduced air pollution; healthy, low-carbon transport; and diets.

3.1: energy systems and health

Indicator 3.1.1: sectoral attribution of greenhouse gas emissions

Sectoral attribution of city-level GHG emissions is key for understanding opportunities for realising health co-benefits of mitigation. Urban activities, such as fossil fuel combustion, contribute to health-damaging air pollution.[109] This indicator tracks total GHG emissions (scope 1 territorial-based emissions) in cities, using 0·01° resolution gridded data from the Emissions Database for Global Atmospheric Research GHG database.[110] Emissions were aggregated by sector and normalised per person using Eurostat population data (appendix 4 pp 105–106).

In 2024, the lowest GHG emissions per person occurred in very large cities (extra-extra-large and global cities, average 2·4 tonnes of CO_2 equivalent per person), followed by extra-large cities (3·6), large (4·2), small (5·5), and medium cities (6·9).

GHG emissions per person have declined in cities between 2000 and 2024 across European subregions but not in western Asia (figure 4). The rate of decrease depended on the region and city size, with higher decreases for northern (reductions of 49% for medium and 54% large cities) and western Europe (reductions of 41% for medium and 53% for both extra-extra-large and global cities), and lower in eastern (31% average decrease) and southern European cities (30% average decrease).

Average emissions per person from energy production, which were the largest contributing sector in 2000, decreased by 54% on average from 2000 to 2024. During this period, emission reductions were also evident in industry (42% decrease), waste (44% decrease) and residential sectors (33% decrease). Agriculture decreased by 7%, while the international sector (encompassing international aviation and shipping) increased by 45%, despite low absolute values. In western Asian cities, emissions per person from energy and industry increased sharply, driven by coal-fired power plants in a medium-sized city (eg, Zonguldak, Türkiye), and by economic activities in a small-sized city (eg, Kars, Türkiye) respectively.

3.2: air pollution and health co-benefits

Indicator 3.2.1: mortality attributable to $PM_{2·5}$

Long-term $PM_{2·5}$ exposure is the main environmental risk factor for human health in the EU, causing 346 000 deaths in 2023.[111] Urban populations are exposed to air pollution from high-density local sources (eg, traffic and residential heating) on top of regional pollution. This indicator tracks contributions to $PM_{2·5}$-related mortality in 872 cities across 31 countries, using results from the Greenhouse gas–Air pollution Interactions and Synergies model from sectors and fuels contributing to $PM_{2·5}$ and GHG emissions (appendix 4 pp 107–113).

Due to tighter legislation, $PM_{2·5}$ exposure from many sources has decreased greatly in recent decades. As a result, total premature deaths attributable to $PM_{2·5}$ exposure in European cities decreased by 40% since 2000. Reductions in mortality from coal combustion were large (53% reduction since 2000) due to the decrease in coal use in electricity generation and better flue gas cleaning. Nonetheless, 20% of all premature deaths in 2023 were still due to coal combustion (22% in 2000). Tighter exhaust controls for combustion vehicles and progress toward electrification in recent years have decreased mortality rates from transport emissions

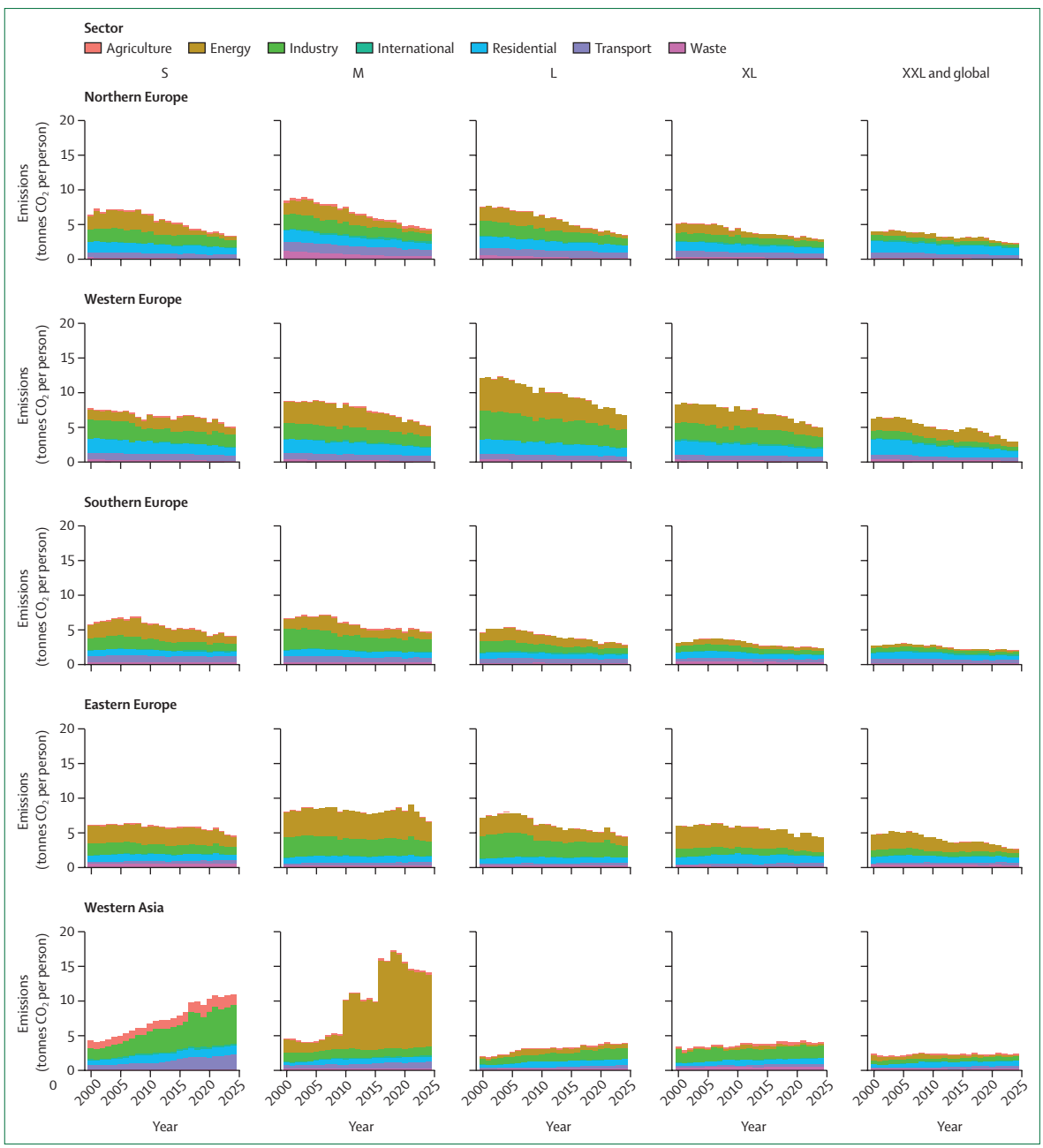

Figure 4: **Trends in greenhouse gas emissions per person according to emission source, grouped by city size and European subregion**
Western Asia includes Cyprus and Türkiye. S=small. M=medium. XL=extra-large. XXL=extra-extra-large.

by 63%, making the residential sector the dominant $PM_{2.5}$ contributor in cities (38% of deaths in 2023). Regional differences are large: solid fuel (ie, biomass and coal) combustion is particularly prevalent in eastern European cities, leading to a $PM_{2.5}$-attributable mortality rate more than three times that of northern cities (153 of 100 000 *vs* 45 of 100 000 inhabitants), highlighting the large opportunity for health co-benefits of transitioning to cleaner, more efficient residential heating.

3.3: sustainable transport

Indicator 3.3.1: infrastructure to support active and public transport

Promoting walking, cycling, and public transport use reduces car dependence and GHG emissions, air and noise pollution, and urban heat.[23,112–115] This indicator comprises four scores using OpenStreetMap data across 917 European cities for 2022 to measure the extent of infrastructure for walking, cycling, and public transport, and a combined sustainable transport score. Scores

(0–10) were calculated based on length of walking or cycling infrastructure relative to total street network length and the number of public transport stops per 250 m × 250 m grid.[24] Cluster-based linear interpolation was applied at the grid level for each score and aggregated to generate city-level scores (appendix 4 pp 114–118).[116]

The opportunity to walk was highest in western (6·36) and eastern (6·31) European cities, reflecting compact urban forms, while it was lower in northern (5·70) and southern (4·98) cities (figure 5). The opportunity to cycle was highest in northern (3·51) and western cities (2·97), and lowest in southern (2·69) and eastern (2·22) European cities where dedicated cycling infrastructure remains scarce. Scores for public transport followed a similar pattern: higher availability in northern (3·90) and western (3·22) cities than in southern (2·92) and eastern (2·60) cities. Overall, the opportunity to walk generally exceeded cycling and public transport access, highlighting a persistent gap in transport infrastructure. Average combined sustainable transport scores were highest in northern (6·5) and western (6·2) cities, and lower in southern (5·4) and eastern (5·8) European cities.

3.4: food, agriculture, and health

Indicator 3.4.1: lifecycle emissions from food demand

Cities are responsible for a substantial share of food demand and consumption and the associated environmental and health impacts.[117] To quantify GHG emissions attributable to food demand in 412 cities across 31 European countries, 2020 national-level estimates of food demand[118] were downscaled to the city level and paired with emissions footprints from lifecycle assessments.[119] City-level food intake was calculated using food intake in urban residences, paired with national-level and city-level demographic data (appendix 4 p 119).

European cities with a population greater than 100 000 emitted 540 million tonnes CO_2 equivalent in GHG emissions in 2020, amounting to 2·6 tonnes CO_2 equivalent per person. Around 63·7% (340 megatonnes CO_2 equivalent) of emissions were due to demand for animal-source foods, including meat and dairy products. Emission rates ranged from 2·1 tonnes CO_2 equivalent per person in eastern cities to 3·0 in northern ones, and from 2·5 in large cities to 2·7 in global cities, in line with demand trends for ruminant meat.

The greatest emissions per person occurred in Oslo, Norway (5 tonnes CO_2 equivalent per person); Dublin, Ireland (3·2); and Aberdeen, UK (3·0). The cities with lowest emissions were Chiinu, Moldova (1·4 tonnes CO_2 equivalent per person); Burgas, Bulgaria (1·7); and Novisad, Serbia (1·7). Absolute emissions were highest in Paris, France (30 million tonnes CO_2 equivalent); London, UK (27); and Madrid, Spain (17), in line with their populations.

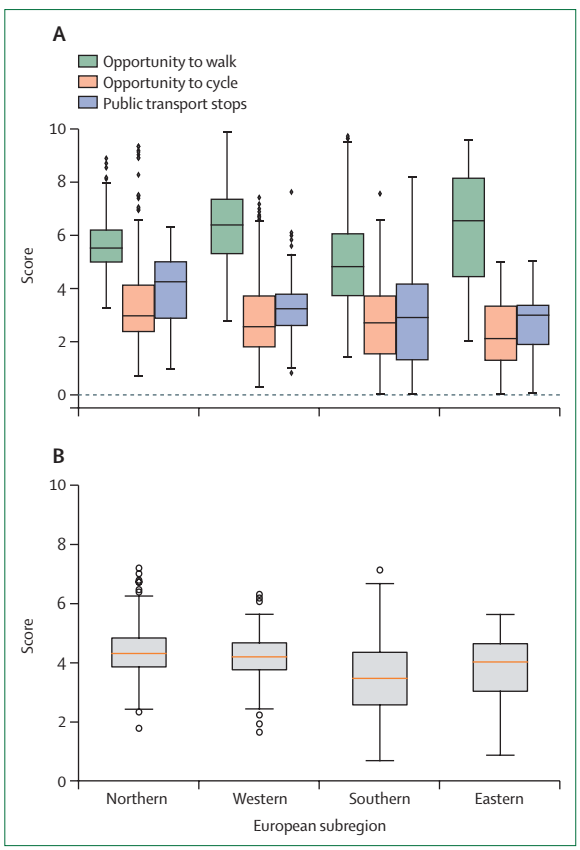

Figure 5: **City-level scores measuring extent of infrastructure supporting active and public transport, by European subregion**
Boxplot of city-level scores (0–10) measuring (A) the extent of infrastructure to support walking, cycling, and public transport, and (B) overall sustainable transport (right), by European subregion. A score of 10 corresponds to better performance. Boxes represent the IQR (25th–75th percentile), with the horizontal line indicating the median, and diamonds represent individual cities falling outside this range.

Indicator 3.4.2: deaths attributable to dietary risks

Unhealthy diets with excess energy intake and high animal-source and ultra-processed foods contribute to poor health and GHG emissions.[120] This indicator estimates the burden of dietary ill-health in 412 cities across 31 European countries for 2020. Downscaled estimates of food intake and weight distributions in cities were used in a comparative risk assessment of diet-related and weight-related risk factors[121] (appendix 4 pp 120–125).

Unhealthy diets in medium (100 000–250 000 people) or larger European cities were associated with 540 000 deaths in 2020, equivalent to 2·6 deaths per 1000 people. More than a third of deaths were due to excess energy intake linked to overweight and obesity, about a fifth to low intake of whole grains, and a tenth each to low intake of vegetables, legumes, fruits, and to high intake of red and processed meat. Diet-related mortality rates (deaths per 1000) ranged from 2·2 in northern Europe to 4·5 in eastern Europe, and from

1·8 in global cities to 2·8 in extra-large cities. Trends were in line with high share of animal-sourced foods and mortality rates.[122]

The cities with the highest diet-related mortality rates were Ruse, Bulgaria (6·5 deaths per 1000 people); Klaipeda, Lithuania (5·6); and Pitesti, Romania (5·6). The cities with lowest diet-related mortality rates were in Mamoudzou, France (0·4 deaths per 1000 people); Ceuta, Spain (1·2); and Almere, the Netherlands (1·2).

3.5: city-level climate change mitigation targets and actions

Mitigation measures accounting for health and socio-economic co-benefits can foster more equitable and sustainable urban transitions.[123,124] This indicator tracks self-reported city-level GHG mitigation targets and actions (appendix 4 pp 126–127). Based on CDP–ICLEI data,[79] 193 (93·7%) of 206 responding cities across 30 WHO Europe countries reported having one or more active GHG emission reduction target(s) in 2024, while nine (4·4%) indicated plans to introduce targets within 2 years. Overall, 418 targets were reported, with a median of five targets per city and a median target year of 2030. Of these, 222 (53·6%) of 414 targets encompassed all emission sources covered by the cities' respective GHG inventories, without further sectoral attribution. 355 cities reporting GHG targets include CO_2 targets, with 247 (69·6%) including additional GHGs. 193 (55·0%) of 351 targets were defined as net-zero targets, of which 107 (30·5%) represented mid-term targets towards net zero.

1967 mitigation actions were identified for cities; with 310 (15·8%) focused on energy efficiency or retrofit measures in existing buildings; 122 (6·2%) on-site renewable energy generation; and 77 (3·9%) improvements in walking, cycling, and integrated public transit access. From the 1349 actions reporting co-benefits, 568 (42·1%) mentioned at least one health co-benefit. The most commonly reported health co-benefits related to improved air quality (262 [46·1%] of 568), improved physical health (196 [34·5%]), mental wellbeing or quality of life (77 [13·6%]), and reduced health impacts from extreme temperatures (28 [4·9%]).

Conclusion

While city-level GHG emissions are decreasing, there are notable geographical inequalities in the pace of reductions with higher-income regions of northern and western Europe leading the way. Indicator 3.1.1 highlights the potential for largest cities to leverage innovation, investment, and infrastructure to enable lower GHG emissions than smaller cities. Nonetheless, air pollution from fossil fuels and solid biomass combustion continues to drive premature deaths in cities. Indicator 3.3.1 highlights the need to expand cycling and public transport infrastructure, especially in southern and eastern European cities, and particularly in small and medium-sized cities, to support low-carbon, healthy transport.

Local governments are crucial to promote their residents' health by optimising health co-benefits of actions, such as transitioning away from combustion of fossil and solid biomass fuels and towards modern, renewable energy, expanding infrastructure for public and active transport, and increasing availability and affordability of healthy, low-carbon foods.[125]

Section 4: economics and finance

Cities are pivotal to economic growth and innovation, often offering enhanced access to employment, education, and health care.[4] Cities also account for a substantial share of energy consumption and GHG emissions,[126,127] while being particularly exposed to climate-related health and economic risks.[4,33] Rising temperatures, for instance, are linked to increased health-care expenditures and reduced labour productivity.[128] Amplified by the urban heat island effect, these economic impacts can be particularly pronounced in cities.[129] Evidence from 85 European cities indicates that the monetised value of heat-related mortality attributable directly to urban heat island effects amounts to roughly €192 per adult resident annually.[129]

This section tracks the key economic and health dimensions of urban climate impacts and financial instruments supporting zero-carbon transitions via three indicators: heat-related labour supply, unhealthy-diet costs, and funding for city-level climate adaptation and mitigation.

4.1: health-linked economic impacts and mitigation of climate change

Indicator 4.1.1: heat impact on labour supply

Labour force outcomes, such as labour supply, productivity, and capacity are increasingly affected by heat stress.[130–133] This indicator combines the number of working hours with ERA5-Land temperature data[42] for 398 European nomenclature of territorial units for statistics (3-level) predominantly urban areas (more than 80% of population living in urban clusters) to track the impact of temperature on labour supply (appendix 4 pp 128–129).

A non-linear temperature–labour supply response function suggests that the number of working hours in European urban areas peaks at an annual mean temperature of 11°C. Combining this response function with temperature change from the long-term mean of 1965–94, average working hours per worker per year have decreased with time. Labour supply in European urban areas was 1·1% lower in 2020–24 (around 17 h per worker per year) than what it would have been in the same period without temperature changes. The highest declines in working hours are estimated to be in Córdoba, Spain; Sevilla, Spain; Bouches-du-Rhône, France; and

Milan, Italy. Temperature change has resulted in increased labour supply in a few cold areas, such as Liechtenstein; Oslo, Norway; and Innsbruck, Austria.

Indicator 4.1.2: monetised cost of unhealthy diets

The costs of illness related to unhealthy, high-carbon diets are increasing,[134] This indicator estimates the costs of diet-related illness in 412 cities across 31 European countries in 2020. Country-specific and cause-specific cost-of-illness estimates per death were downscaled based on a city's income relative to national income,[135] and paired with city-level cause-specific mortality estimates (appendix 4 p 130).

In 2020, unhealthy diets in European cities were associated with estimated health costs of €85 billion, equivalent to €400 per person. About €40 billion (46%) were direct health-care costs, whereas €45 billion (54%) were indirect costs arising from lost labour and care provision. Coronary heart disease and cancer accounted for roughly a third of total costs each (€31 billion), with stroke and type 2 diabetes-related deaths accounting for €12 billion and €9 billion, respectively.

Average health costs per person varied across European subregions, from €343 in cities in southern Europe to €526 in eastern cities (figure 6), and from €300 in global cities to €440 in extra-extra-large cities. The cities with the greatest per-person costs were Bratislava, Slovakia (€1040), Brunswick, Germany (€900), and Prague, Czechia (€740). The cities with the lowest per-person costs were Mamoudzou, France (€50), Durres, Albania (€100), and Ceuta, Spain (€100), consistent with mortality rates associated with unhealthy diets.

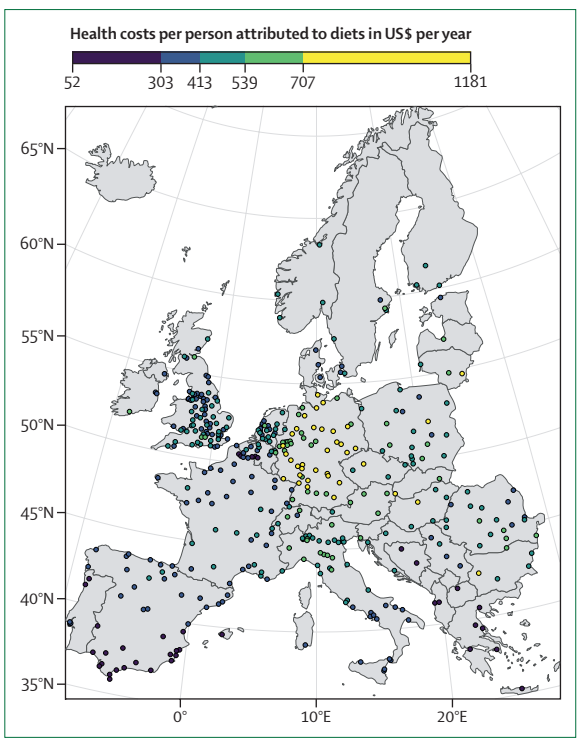

Figure 6: **Health costs per person attributed to unhealthy diets, in US$ per year**

Oversea islands and territories were included in the analysis but are not shown in this figure.

4.2: economics of the transition to zero-carbon economies

Indicator 4.2.1: city-level climate action funding

Constraints in financial capacity, coupled with competing budgetary priorities, may hinder cities' ability to plan, implement, and sustain financing of comprehensive climate action. Using 2024 CDP–ICLEI data (appendix 4 pp 131–132),[79] this indicator highlights the main financial sources reported by WHO European cities for implementing climate adaptation and mitigation actions.

When examining funding sources for existing climate change adaptation (indicator 2.2.6) and mitigation activities (indicator 3.5), cities reported funding for 1436 (94·5%) of 1519 of adaptation actions and 1246 (63·3%) of 1967 mitigation actions. Across both areas, cities most frequently reported relying on their own resources (79·0% for adaptation actions and 72·4% for mitigation actions), supplemented by national (38·0% and 45·2%) and regional (28·6% and 26·9%) funds and programmes. A smaller proportion of actions were financed by international sources (14·1% adaptation actions and 9·8% mitigation actions), public–private partnerships (13·4% and 20·2%), or carbon credits (1·0% and 0·6%).

Beyond existing climate actions, 166 cities across 28 countries also reported 855 planned climate-related projects for which they sought funding, most commonly in transport (16·4%), buildings (14·3%), and renewable energy (13·6%). Notably, only 0·5% of planned projects directly addressed health systems and services. When looking at efforts to address the health issues identified in climate risk and vulnerability assessments (indicator 2.2.1), some cities reported constraints arising from limited financial capacity (101 [41·2%] of 245 projects) or from a combined lack of financial and technical capacity (71 [29·0%]). While self-financing remains the predominant mechanism for city-level climate financing, some jurisdictions integrate alternative financing mechanisms to strengthen climate finance portfolios.

Conclusion

These indicators show that rising temperatures are associated with reduced labour supply in most European cities, with working hours decreasing by 1·1% in 2020–24 relative to a counterfactual scenario without temperature changes (indicator 4.1.1). Unhealthy, unsustainable diets, including meat and dairy, were estimated to result in €160 billion in health-related costs in 2020 (indicator 4.1.2). Yet, city-level initiatives, such as Stockholm's plant-based, climate-optimised school meals, show that diets can be made healthier, more

economical, and more climate-friendly.[136] Despite positive examples, many cities report financial and technical barriers to addressing the climate-related health risks identified in vulnerability assessments (indicators 4.2.1 and 2.1.1).

Overall, these indicators provide evidence that support efforts to adapt working conditions to higher temperatures, promote sustainable diets, and navigate existing funding barriers. However, the economic and financial implications of climate-related health risks overall could vastly exceed those reflected in this section. Further empirical investigation is needed to fully capture the economic and financial implications related to the health impacts of climate change and enable a comprehensive cost–benefit analysis for climate action.

Section 5: public and political engagement

Public and political engagement are central to addressing the health impacts of climate change in European cities. This section examines how climate change and health are framed across arenas that shape problem recognition and policy priorities: scientific research, parliamentary debate, political communication on social media, corporate reporting, and news media. Together, these domains influence which urban risks are measured, whose experiences are made visible, and which mitigation and adaptation options become politically feasible.

The indicators draw on large bibliometric databases, European Parliament transcripts, tweets from political leaders, UN Global Compact Communication on Progress reports, and a multi-country corpus of online newspaper articles. Machine learning and large language model approaches are used to classify documents; identify climate and health content; and detect urban, rural and inequality framings, allowing systematic comparison across thousands of texts from multiple years. The indicators presented here shed light on the misalignment of engagement with the scale of exposure and vulnerability.

5.1: scientific engagement with health and climate change

Indicator 5.1.1: coverage of health and climate change in cities in scientific articles

This indicator quantifies the scientific literature on the nexus of climate and health using machine learning[137] and bibliographic data from OpenAlex.[138] Cities were extracted using both geographical location and title and abstract matching of cities' names according to the Global Human Settlement Urban Centre Database,[139] as described by Montfort and colleagues[140] (appendix 4 pp 133–136). A total of 3153 scientific publications were detected on the climate change and health nexus in European cities across 1990–2024. The number of publications increased continuously from one to two dozen per year during the 1990s to more than 200 annually during the 2020s, with most on the health impacts of climate change and large cities and fewer studies on climate solutions and small cities. The cities with the largest amount of climate and health research in 2024 were London, UK (20 studies); Paris, France (18 studies); and Madrid, Spain (15 studies).

Indicator 5.1.2: studies attributing health impacts to climate change in cities

This indicator measures the subset of literature from indicator 5.1.1, focusing on articles that show an attributable link between human influence on climate and health impacts, based on the attribution pathway documented by Callaghan and colleagues.[141] A study was regarded to show attribution if it links a health outcome to temperature or precipitation, and if an attributable change in temperature or precipitation in the grid cell containing the city is observed (appendix 4 pp 137–138). Overall, 2325 studies with attributable health impacts for European cities were identified, growing from four in 1990 to 213 in 2023 and 176 in 2024. London had the highest number of attributable studies, with 217 studies recorded between 1990–2024. The largest number of attributable health outcomes were seen in the mortality and morbidity category, with the topic being discussed in 1906 (82·0%) of the 2325 studies. Studies were concentrated in large western and northern cities, with very limited coverage of smaller and eastern cities.

5.2: political engagement with health and climate change in urban areas

Indicator 5.2.1: engagement with health and climate change in urban areas in the European Parliament

This indicator tracks the extent to which urban-related issues are discussed in the context of climate change and health within European parliamentary speeches. Specifically, the indicator measures how urban topics (eg, cities, urbanisation, and related terms) are mentioned alongside references to health, climate, and their intersection by assessing mentions of climate-change-related and health-related terms in the European Parliament legislator's speeches between 2020–24 (appendix 4 pp 139–143) and classifying the documents as either rural or urban. This indicator shows a slightly higher engagement in both health and climate change in rural-classified documents (47% and 27% documents, respectively) as opposed to urban-classified documents (32% health and 19% climate documents), with engagement in health peaking in 2021 in both cases.

Indicator 5.2.2: political engagement with health and climate change in urban areas on social media

Recognising social media as a key communication tool, this indicator tracks how political leaders use their X (formerly Twitter) official accounts to shape public discourse on the intersection of climate change and health in urban areas. Posts from verified accounts of European Economic Area (EEA) state leaders, European Parliament members, and European Commission members were

analysed between 2022 and 2024 (appendix 4 pp 144–153). In total, 268 297 relevant tweets were collected: 70 251 (26·2%) from 98 state leader accounts, 70 538 (26·3%) from European Parliament accounts, and 64 017 (23·9%) from European Commission members. Of these, 44 199 (15·4%) tweets were classified as urban, and 22 475 (8·4%) were classified as rural, using a combination of topic modelling and keyword matching for classification.

Overall, average health mentions were higher in urban contexts (average: 8%, peak: 11% in quarter 1 of 2022), whereas average climate change mentions were higher in rural contexts, peaking at 3·7% in quarter 4 of 2024. The health and climate change intersection remains low overall.

5.3: corporate sector engagement with health and climate change in urban areas

Corporate engagement is key to reducing fossil fuel reliance.[142] This indicator analyses 32 112 UN Global Compact Communication on Progress reports from EEA and UK companies (2011–24), using keyword searches to identify references to climate and health and classify reports as urban, rural, or neutral in focus (appendix 4 pp 154–156). Most reports are framed in an urban context (29 314 [91·3%] of 32 112), with only a few classified as rural (2227 [6·9%]). Corporate reporting has increasingly referenced climate and health since 2011, particularly after 2020, but explicit discussion of their intersection remains rare in both urban and rural reports, accounting for a mean of 80·2 (climate) and 72·9 (health) mentions per year across 2011–24. The counts of health, climate and intersection mentions by context highlight a sharp rise in health and climate references in urban reports from 2020 onwards, with a uniform trend for rural reporting.

5.4: media engagement with health and climate change in urban areas

Indicator 5.4.1: coverage of health and climate change in urban areas across online newspaper articles

Media plays a crucial role in shaping public perceptions of climate change and influencing political agendas.[143–145] This indicator examines media engagement by analysing 287 662 climate-related news articles published between January 2023, and August 2025, in 175 major online newspapers from 40 European countries, tracking references to health, urban–rural contexts, and inequality (appendix 4 pp 157–164). Almost one (24·0%) in four climate articles mention health, with health-related coverage following a clear seasonal pattern: the share of climate articles referencing health peaks in summer (June–August average 28%) and is lowest in winter (December–February 21%). Climate articles mentioning health are more likely to discuss urban–rural dynamics (59% *vs* 45% for climate-only stories), and 37% of climate-health articles explicitly reference inequality, particularly demographic and spatial disparities and differential climate vulnerability.

Conclusion

Section 5 indicators suggest engagement with the climate–health nexus in European urban areas is expanding but remains uneven and fragmented. Scientific output on climate and health in cities has grown in the past decade yet remains heavily skewed toward large cities in western and northern Europe. Attribution studies that explicitly link health outcomes to climate change form only a small subset of this literature and declined in the most recent year of observation despite intensifying climate risks.

In the political, corporate, and media spheres, climate and health are increasingly visible but rarely framed together in a sustained way. References to climate change and health in European Parliament debates, political leaders' social media, and corporate sustainability reports have risen, yet mentions of their intersection remain low. Media coverage shows the most systematic linking of climate, health, and inequality, with around one quarter of climate articles addressing health and more than a third of climate–health stories referencing disparities, but most climate reporting still omits health altogether.

From a governance perspective, these patterns highlight several priorities. Evidence on climate–health impacts and attribution needs to be broadened beyond large, well resourced cities and deepened for highly exposed but understudied populations, to ensure that the health impacts of climate change are properly understood and to underpin action that meets the needs of all communities and individuals. Political, corporate, and media actors need to integrate health more consistently into climate narratives and explicitly acknowledge the unequal burdens of climate risk across and within cities, if policy responses are to match projected harms. Lastly, the indicators underline the value of sustained, transparent monitoring of public and political engagement: without it, persistent blind spots in the urban climate–health nexus would remain hidden.

Conclusion: the 2026 Europe Cities Report of the *Lancet* Countdown on health and climate change

This special report of the *Lancet* Countdown in Europe provides several insights. Findings highlight several increasing climate change exposures, health risks, and impacts across European subregions. Notably, wildfire danger and heat-related mortality are increasing in European cities, with the largest increases with time observed in southern and eastern European cities, whereas the trend in attributable mortality to wildfire smoke was highest in western Asian cities. The increase in climate suitability for dengue was largest in eastern Europe (figure 7A).

There are signs that cities are implementing heat-adaptation measures, including heat-health early warnings, increasing leaf area coverage (largest in western Europe), urban green space (largest in eastern Europe), and tree cover (largest in eastern Europe).

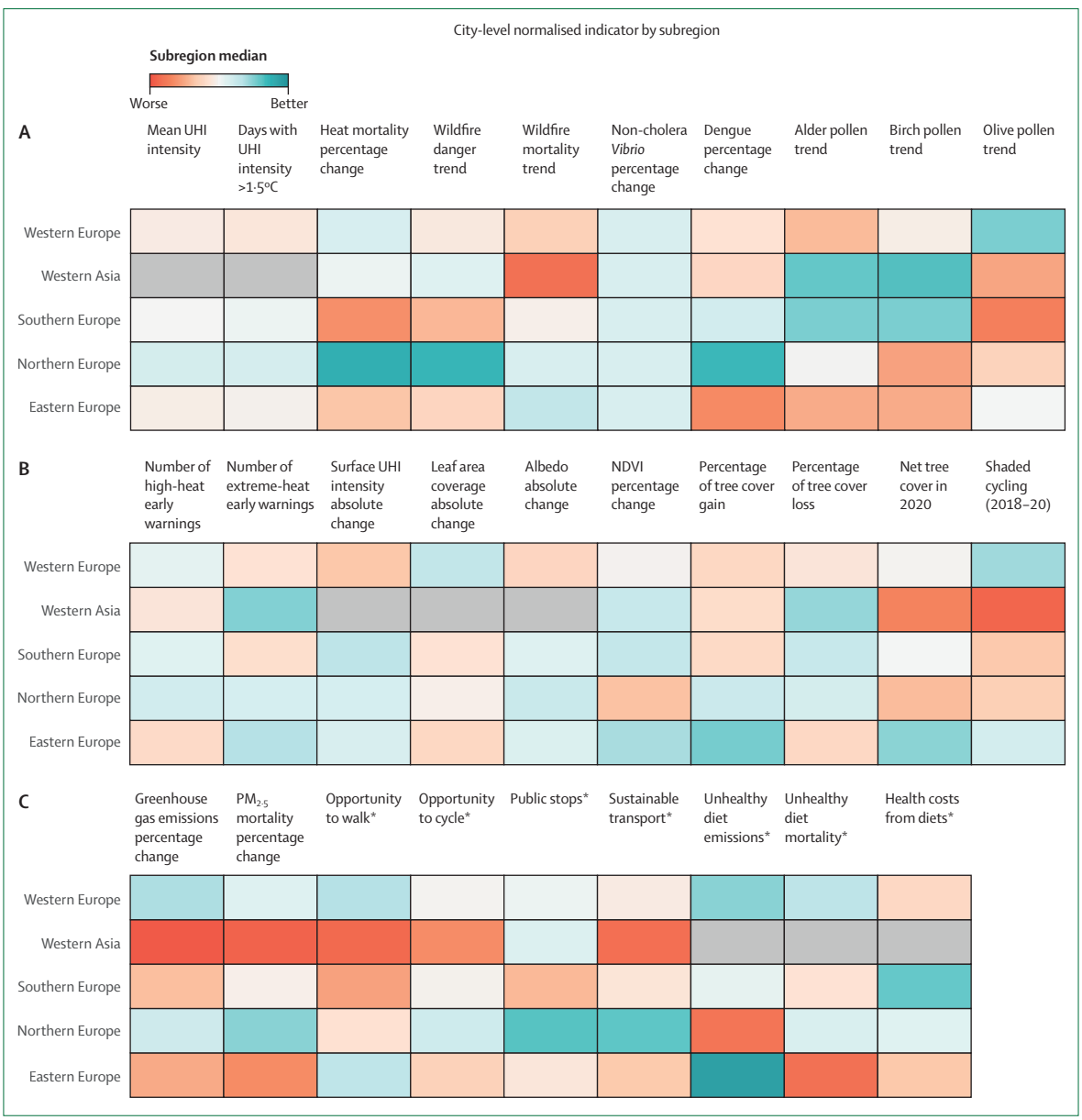

Figure 7: **City-level normalised indicators by subregion**
Summary indicators per European subregions, expressed by city medians for each indicator, for (A) impact, (B) adaptation, and (C) mitigation indicators. Normalisation was applied to standardise indicators to a common scale, enabling comparison across variables with different units and distributions. Grey indicates that the region was not covered by the indicator. Each indicator tracks a specific timeframe. The colors reflect the relative comparison of the median across subregions rather than absolute change. NDVI=normalised difference vegetation index. UHI=urban heat island. *Data for a single year.

Meanwhile, the absence of shaded cycling infrastructure was most evident in western Asian cities (figure 7B).

Northern European cities lead the way in terms of low-carbon energy systems, while presenting high emissions per person from food demand. Death rates attributable to unhealthy diets, including meat and dairy, were largest in eastern European cities. Associated health costs per person of unhealthy diets were highest in western and eastern European cities. Western Asian cities in Türkiye and Cyprus lagged behind for several mitigation indicators (figure 7C), including increasing GHG emissions per person, $PM_{2.5}$-attributable mortality, and limited access to sustainable transport infrastructure.

The negative effects of warming on the European urban labour force have increased with time, and while cities are taking adaptation and mitigation actions, financial and technical constraints pose considerable barriers to implement such measures for nearly a third of surveyed cities. Furthermore, political engagement with the intersection of climate change and health was low overall.

However, one-quarter of newspaper articles on climate change addressed health issues, and most of these touched on the urban dimension.

Our indicators highlight the importance of taking an integrated cross-sectoral approach to protect health from climate change in cities.[75] Cities provide an opportunity to align mitigation and adaptation goals that benefit health. For example, urban greening, especially with increased tree cover, can reduce heat exposure, decreasing cooling-related energy demand and associated CO_2 emissions, and making active travel safer.[106,146,147] While there are opportunities for synergies across mitigation and adaptation goals, there are potential trade-offs requiring careful consideration. For example, increased green space as part of heat adaptation can, if not adequately designed, increase allergenic pollen and create favourable conditions for vector-borne disease spread.[148–152] Similarly, compact urban designs, which promote walkability and low-carbon transport,[24] can also contribute to increasing flood risk and urban heat island due to high levels of imperviousness.[146] Beyond health and economic considerations of climate action, city-level climate strategies should also consider equity implications and other ecological impacts to avoid exacerbating inequalities and to promote social acceptability of potential solutions.[33,153]

Several data and evidence gaps limit the scope for evidence-based approaches to city-level climate solutions for protecting health.[75,154] While diverse city-level climate policies have been implemented, comprehensive analysis of their effectiveness to protect health are limited.[155,156] Evidence gaps can lead cities to implement solutions with restricted effectiveness or that are not well suited for their local context.[157] While our report provides a comprehensive set of city-level indicators covering multiple dimensions of the intersection of climate change and health, not all potentially relevant indicator areas are covered due to data and evidence gaps, including data on the impacts of climate change on health-care provision in cities, implications for health-care costs of exposure to climate hazards, and city-level adaptation and mitigation actions.

In conclusion, our indicators highlight three priority areas for city-level climate action. First, urgent action is needed to tackle heat-related health effects in cities, focusing on strengthening and evaluating heat-health early warning systems and its incorporation in heat-health adaptation plans.[158,159] Second, intersectoral urban and transport planning in cities is crucial to reduce climate change impacts, with increased urban green spaces (especially tree canopy), using building materials that absorb less heat, de-sealing impermeable surfaces, and promoting active and public transport. Improving compactness while also investing in urban greenness can effectively support active travel while offsetting negative trade-offs related to the urban heat island effect. Third, accelerating the reduction of GHG emissions across sectors, particularly energy and transport, has the potential to deliver major health gains from reduced air pollution.

Large cities have been leading the transition to lower GHG emissions per person; targeted strategies should be considered to ensure that small cities are not left behind. Crucial for implementing these climate actions are governance, financing, technical capacity, and implementation tools,[160–162] which can be accelerated with strategies and initiatives such as the EU Urban Agenda for Cities and the Climate-Neutral and Smart Cities Mission. Our report underscores the importance of embedding health outcomes into these frameworks, by assessing, monitoring, and evaluating health co-benefits of climate change actions, measurable at a city-scale across Europe. With robust evidence, capacity, and financing, cities can lead the green transition for a healthier and more equitable Europe.

Contributors

The work for this manuscript was conducted by five working groups that were responsible for the design, drafting, and review of their individual indicators and sections. All authors contributed to the overall paper structure and concepts and provided input and expertise to the relevant sections. JRo, JCS (Working Group leads), JB, Z-YC, CV, JT, JM-U, HS, PF, PS, RH, MSo, LS, and JP contributed to Working Group 1. JCS, JRo (Working Group leads), CT, KRvD, JC-X, EDP, MvdB, JB, XL, BP-C, Fd'D, FN, MNie, MCi, CRSH, DGa, AB, RV, and KdH contributed to Working Group 2. CT (Working Group lead), GK, FL, EP, MCr, DGu, MSp, KRvD, FM, NM, JRa, OA, and SC contributed to Working Group 3. AM, HKK (Working Group leads), SD, MSp, OA, and KRvD contributed to Working Group 4. ND, SJ (Working Group leads), HB, MWC, JCM, IG, TGC, SO'N, and RM contributed to Working Group 5. MR and MW provided support from the global *Lancet* Countdown. JC-X and CT (Co-director) provided coordination and strategic direction, with support from JRo (Co-director), HKK, MNil (Co-Chair), and JMA (Co-Chair).

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