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Supplementary information

Climate change and cardiovascular disease: implications for global health

Supplementary Table 1 | **Studies describing the association between temperature and diabetes mellitus**

Author, year	**Study population and period**	**Exposure and/or exposure assessment method**	**Outcomes measured and/or outcome assessment method**	**Statistical analysis**	**Main outcome**
Ushigome et al. 2020[1]	Total of 41 patients with type 2 diabetes mellitus attending outpatient clinic at the hospital of the Kyoto Prefectural University between 2013–2015	Ambient temperature including room temperature transmitted from the blood pressure measurement machine	Home BP monitoring; triplicate morning and evening BP measurement at least 5 days per month for 12 consecutive months	Pearson's correlation analysis was used to investigate the relationship between morning home BP levels and room temperature or ambient temperature.	Both SBP and DBP showed seasonal variation. BP was lowest in August (mean monthly ambient temperature 28.4° C) and highest in January (mean monthly ambient temperature 5.0° C). Pearson's correlation between mean SBP with room temperature (0.335, *P*<0.001) and ambient temperature (0.344; *P*<0.344). Adjusted root mean squared error and mean difference between SBP and ambient temperature were 6.14 mmHg and −0.547 (95% CI −0.617 to −0.477), respectively.
Valdes et al. 2019[2]	A total of 5072 participants involved in a national, cross-sectional population-based study representative of the Spanish adult population (Di@bet.es study)	The mean annual temperature (°C) in each individual municipality was collected from the Spanish National Meteorology Agency	Blood sampling was conducted (75 g oral glucose tolerance test). Insulin resistance was estimated with the homeostasis model assessment	Linear regression analysis and logistic regression analyses controlled by multiple socio-demographic variables, lifestyle factors, adiposity (BMI) and geographical elevation	A significant positive association was found between mean annual temperature and fasting plasma glucose (0.087, *P*<0.001), 2 h plasma glucose (0.049, *P* = 0.008) and homeostasis model assessment (0.046, *P* = 0.008) in multivariate adjusted models. Adjusted logistic regression analyses showed increasing odds ratios with increasing quartiles of mean annual temperature: OR for prediabetes (Q1, 2, 3, 4): 1, 1.26 (0.95–1.66), 1.08 (0.81–1.44) and 1.37 (1.01–1.85); *P* for trend = 0.086 OR for insulin resistance (homeostasis model assessment ≥75th percentile of the non-diabetic population); Q1, 2, 3, 4: 1, 1.03 (0.82–1.30), 1.22 (0.96–1.55), 1.26 (0.98–1.63); *P* for trend = 0.046

Blauw et al. 2017[3]	Population of 50 USA states and 3 territories	Mean annual temperature during 1996–2009 for each of the US states collected through the National Center for Environmental Information	Incidence of diabetes in 50 USA states and 3 territories from the National diabetes Surveillance System from the Centers for Disease Control and Prevention	For each state, a weighted met-regression analysis to estimate the association between mean annual temperature and age-adjusted yearly diabetes incidence. A meta-analysis was performed to integrate the results of the meta-regression analyses into an overall effect estimate, representing the mean strength of the association between mean annual temperature and diabetes incidence in the USA during the period 1996–2009.	For each 1°C increase in temperature, age-adjusted diabetes incidence increased by 0.314% (95% CI, 0.194–0.434) per 1000 population. Similarly, the worldwide prevalence of glucose intolerance increased by 0.170% (95% CI 0.107–0.234) per 1°C rise in temperature. These associations persisted after adjustment for obesity.
Speakman et al. 2016[4]	Population of USA mainland (2014). Census data from 2010 was used to control for potential confounders	Mean annual ambient temperature and variations	County level data for obesity and diabetes prevalence across mainland USA	Least squares fit regression (unadjusted and adjusted)	Average annual ambient temperature explained 12.4% of the variation in the prevalence of type 2 diabetes after adjustment for obesity, poverty and race. Obesity was not related to ambient temperature after correcting for poverty and race.

BP, blood pressure; DBP, diastolic blood pressure; OR, odds ratio; SBP, systolic blood pressure.

Supplementary Table 2 | **Time-series studies describing the association between ambient temperature and cardiovascular mortality**

Author, year	**Study population and period**	**Exposure and/or exposure assessment method**	**Outcomes measured and/or outcome assessment method**	**Estimate (95% CI)**	**Main outcomes**
Iranpour et al. 2020[5]	Residents of Ahvaz, Iran (2014-2018)	Temperature extremes 1st percentile (9.3°C) and 99th percentile (41.2°C) compared to 25th (18.1°C) and 75th percentile (36.6°C), respectively	Daily counts of deaths from CVD (1CD-10 codes I00-I99) by the Municipal Center of Disease Control and Prevention	Cumulative mortality risk: Cold effect: 1.08 (0.86–1.36) Heat effect: 1.04 (0.98–1.11) Elderly ($\geq$75 years): Cold effect: 1.08 (0.79–1.47) Heat effect: 1.07 (1.00–1.16)	Weak but significant association was found between cardiovascular mortality and high temperature in the elderly only. No association between cardiovascular mortality and cold temperature.
Ferreira et al. 2019[6]	Residents of 6 metropolitan areas in Brazil (1996–2013)	Temperature extremes 2.5th percentile and 97.5th percentile compared to MMT. Lag period (0–14 days)	AMI mortality data (ICD-10 code I21) from DATASUS	Varied effects depending on the climate: In regions closer to the Equator, with small thermal amplitudes, there was no association between ambient temperature and AMI mortality. In tropical and subtropical regions, cold temperature (but not hot) was associated with AMI mortality, most pronounced in Brasilia: RR 1.91 (1.27–2.88).	Within Brazil, the association between temperature and AMI are more substantial in regions with higher thermal amplitude. Cold was associated with AMI mortality but not heat.
Hurtado-Díaz et al. 2019[7]	Residents of 10 metropolitan areas of Mexico (1998–2014)	Temperature extremes 5th percentile (lag 0–7) and 95th percentile (lag 0–3) compared to MMT (corresponded to 75th percentile in most regions).	Cardiovascular mortality data (1CD-10 codes I00-I99) from the General Direction of Information on Health	Increase in adjusted relative risk of cardiovascular mortality amongst individuals $\geq$ 65 years Cold effect: 7.1% (0.01–14.7) Heat effect: 7.1% (0.6–14.0)	Heat and cold were associated with similar cardiovascular mortality. Heat effects on non-external and specific causes of mortality occurred immediately, while cold effects occurred within a few days and last longer.
Silveira et al. 2019[8]	Residents of 27 Brazilian cities (2000–2015)	Temperature extremes 1st percentile and 99th percentile compared to MMT. Lag period (0–21 days)	Cardiovascular mortality data (1CD-10 codes I00-I99) from DATASUS	Cold effect: 1.26 (1.17–1.35) Heat effect: 1.07 (1.01–1.13)	Both heat and cold are associated with increased CVD mortality with higher effect size of cold temperature.
Ying et al. 2019[9]	Residents of Nanjing, China (2010–2016)	Temperature extremes 2.5th percentile and 97.5th percentile compared to MMT. Lag period (0–21 days)	Cardiovascular mortality data (1CD-10 codes I00-I99) from the CDC	Attributable fractions Cold effect: 16.42 (9.01–23.83) Heat effect: 3.35 (2.64–4.06)	Both heat and cold are associated with increased CVD mortality with higher effect size of cold temperature.

Chenet al. 2018[10]	Resident of 272 cities in China (2013–2015)	Temperature extremes 2.5th percentile (lag 0–7) and 97.5th percentile (lag 0–21) compared to MMT (80th percentile)	Cardiovascular mortality data (1CD-10 codes I00-I99) from the Chinese Center for Disease Control and Prevention	RR of cardiovascular mortality: Cold effect: 1.92 (1.75–2.10) Heat effect: 1.22 (1.16–1.28) RR of IHD mortality: Cold effect: 1.96 (1.74–2.22) Heat effect: 1.19 (1.11–1.28) RR of stroke mortality: Cold effect: 1.85 (1.63–2.09) Heat effect: 1.24 (1.16–1.32)	Both heat and cold are associated with cardiovascular mortality with larger effect size associated with cold. Majority of mortality burden is mainly related to moderate cold temperatures.
Scovronick et al. 2018[11]	Residents of South Africa (1997–2013)	Temperature extremes 1st percentile and 99th percentile compared to MMT (80th percentile)	Cardiovascular mortality data (1CD-10 codes I00-I99) from civil registration system	RR of cardiovascular mortality (overall): Cold effect: 1.33 (1.24–1.42) Heat effect: 1.08 (1.02–1.14) RR of cardiovascular mortality (65+ years): Cold effect: 1.34 (1.28–1.41) Heat effect: 1.13 (1.07–1.20)	Both heat and cold are associated with cardiovascular mortality with larger effect size associated with cold. Elderly were identified as most vulnerable.
Ciu et al. 2016[12]	Residents of Chengdu, China (2011–2014)	Average daily temperature. Cold and heat were defined as temperatures below and above the MMT, respectively.	Cardiovascular mortality data (1CD-10 codes I00-I99) from the Chinese Center for Disease Control and Prevention	Cold was responsible for most of the burden %AR: 9.96% (6.90–12.81) Heat attributable fraction was relatively small: %AR: 0.97% (0.46–2.35)	In Chengdu, temperature was responsible for a substantial fraction of cardiovascular deaths, with cold responsible for a higher proportion of deaths than heat.
Zhang et al. 2016[13]	Residents of Wuhan, China (2003–2010)	Cold: a 1°C decrease of mean temperature below the cold thresholds (15.6°C) Heat: a 1°C decrease of mean temperature below the cold thresholds (31.4°C)	Cardiovascular mortality data (1CD-10 codes I00-I99) from the Chinese Center for Disease Control and Prevention	Cold effect: 3.65% (2.62–4.69) Heat effect: 34.10% (25.63–43.16)	Both low and high temperature were associated with increased mortality in Wuhan
Rehill et al. 2015[14]	Residents of London, UK (1949–2006)	1°C of average cold (or heat) below (or above) the threshold (18°C) across each year	Percent change in cardiovascular mortality from Registrar General (1949–1975) and Office of National statistics (1950–2006)	Percent change in cardiovascular mortality: Cold effect: 2.9% (0.9–5.0) Heat effect: −0.1% (−5.9–6.1)	Colder years are associated with increased cardiovascular mortality but not heat.
Yang et al. 2015[15]	Residents of 15 Chinese megacities (2007–2013)	Daily average temperature. Cold and heat were defined as temperatures below and above the MMT, respectively.	Cardiovascular mortality data (1CD-10 codes I00-I99) from the Chinese Centers for Disease Control and Prevention (CDC)	Cold was responsible for most of the burden: %AR: 15.8% (13.1–17.9) Heat attributable fraction was relatively small: %AR: 1.3% (1.0–1.6)	Most of temperature-related mortality was attributable to cold.

Revich et al. 2008[16]	Residents of Moscow, Russia (2001–2006)	Heat effect: 1°C increase of daily average temperature with lag of 0 above 18°C. Cold effect: 1°C decrease of daily average temperature with lag of 3 days below 18°C.	Daily mortality from IHD (codes I20–25), cerebral vascular diseases (codes I60–69)	Percent change in IHD mortality: Cold effect: 2.7% (1.7–3.7) Heat effect: 0.57% (0.77–0.61) Percent change in cerebral vascular disease mortality: Cold effect: 4.7% (3.5–5.9) - Heat effect: 0.78% (0.70–0.86)	Both heat and cold are associated with increased IHD and cerebral vascular mortality. Cold effects are more pronounced on cardiovascular mortality compared to cold.
Gouveia et al. 2003[17]	Residents of Sao Paulo, Brazil (1991–1994)	Heat effect: mean daily temperature average (lag 0–1) for a 1°C increase above 20°C. Cold effect: mean daily temperature weighted average (lags 0–20) for a 1°C decrease below 20°C.	CVD (ICD-9: 390–459): daily counts of deaths for different causes and age groups were extracted from the city's mortality information system.	In elderly (≥ 65 years), percent change in cardiovascular mortality: Cold effect: 6.4% (5.9–7.0) Heat effect: 2.3% (1.6–3.1)	Both heat and cold are associated with cardiovascular mortality in a sub-tropical city.
O'Neill et al. 2003[18]	Residents of Denver, Detroit, Minneapolis, New Haven, Pittsburgh, Chicago and Seattle (1986–1993)	Temperature extremes (–5°C for cold and 29°C for hot) were compared to 15°C.	Percentage change in daily cardiovascular mortality	Percent change in cardiovascular mortality: Cold effect: 10.05% (7.6–12.3) Heat effect: 0.86% (-2.7 to 4.6)	Only cold was found to be associated with cardiovascular mortality
Pan et al. 1995[19]	Residents of Taiwan (1981–1991).	Daily mean outdoor temperatures from the Central Weather Bureau in Taiwan (14 weather monitoring stations) compared to temperature of lowest events (26–29°C)	ICD codes for HS (ICD 430-432), IS (ICD 433-435) and CAD (ICD 410-414) (8th edition). Mortality data from Department of Health from areas surrounding the stations.	In the elderly (≥65 years), the risk of mortality due to CAD was 22% higher at 32°C compared to 26–29°C. The risk increased by 2.8% per 1°C reduction from 26–29°C. The risk of IS death was 66% higher at 32°C compared to 26–29°C, in elderly patients. The risk increased by 3.0% per 1°C reduction from 26–29°C. Mortality from HS decreased per 1°C increase in ambient temperature from 26–29°C by 3.3%.	Colder days were associated with increased mortality from CAD, IS and HS. Cold effect size was larger than heat. No association was found between heat and HS.
Xu et al. 2013[20]	Elderly residents of Hong Kong (1998–2009)	1 °C decrease in daily mean apparent temperature at the best lagged day (lag 3 day) on cool days (≤20.8 °C)	Daily counts of deaths from CVD (ICD-9: 390–459 or ICD-10: I00–I99) from cohort data and mortality data among elderly patients in Hong Kong.	Excess risk percent of cardiovascular mortality: Cold effect: 2.48% (0.57–4.36) Women were more susceptible than men.	The association between cold temperatures and cardiovascular mortality differed between men and women

Analitis et al. 2008[21]	15 European cities (1990–2000)	Cold: a 1°C decrease in minimum apparent temperature (lag 0–15) during the cold season (October–March)	Daily counts of deaths from CVD (1CD-9 codes 390-459) and cerebrovascular disease (codes 430–438) from the Assessment and Prevention of Acute Health Effects of Weather Conditions in Europe database	Percent change in cardiovascular mortality: Cold effect: 1.72% (1.44–2.01) Percent change in cardiovascular mortality **Mediterranean climate:** Cold effect: 2.29% (2.01–2.57) Percent change in cardiovascular mortality **North-Central:** Cold effect: 1.38% (1.16–1.61)	The cold effect was found to be greater in warmer (southern) cities.
Carder et al. 2005[22]	Residents of the three largest Scottish cities (Glasgow, Edinburgh and Aberdeen) (1981–2001)	Cold: 1°C drop in daily average ambient temperature below 11°C	Daily counts of deaths from CVD (1CD-9 codes 410–414, 426–429, 434–440) from the Information and Statistics Division (ISD) of the Common Services Agency (CSA) of the Scottish Health Service	Percent change in cardiovascular mortality: Cold effect: 3.4% (2.6–4.1).	Cold temperatures were associated with significant increase in cardiovascular mortality in Scotland.
Kouis et al. 2019[23]	Residents of Thessaloniki, Greece (1999–2012)	1°C increase in average ambient temperature above a threshold of 33°C	Circulatory system deaths (1CD-10 codes I00-I99) from Hellenic Statistical Authority (ELSTAT)	Increase in adjusted relative risk of cardiovascular mortality Heat effect: 4.4% (2.7–6.1)	Significant association between cardiovascular mortality and hot temperatures.
Burkart et al. 2014[24]	Residents of 26 regions in Bangladesh (2003–2007)	Heat: 1 °C increase above breakpoint of 29°C	Daily cardiovascular mortality from the Sample Vital Registration System – Bangladesh Bureau of Statistics	Percent increment in mortality CVD: 20.0% (10.6–34.7)	A 1 °C increase above breakpoint of 29°C was associated with 20% increment in cardiovascular mortality
Harlan et al. 2014[25]	Residents of central Arizona, US (2000–2008)	Heat: daily maximum apparent temperature during the months of May–October. Heat threshold was defined as apparent temperature at which the mortality ratio begins an exponential upward trend.	Daily cardiovascular mortality from death certificates filed in Maricopa County	RR for CVD mortality above heat threshold: RR in individuals aged <65 years: 1.03 (1.00–1.05) RR in individuals aged ≥65 years: 1.03 (1.01–1.05)	- Extreme heat was associated with modest but significant increase in mortality
Gasparrini et al. 2012[26]	Residents of 10 regions in England and Wales (1993–2006)	Heat: per 1°C increase in temperature above regional heat threshold	Daily counts of cardiovascular cause-specific mortality using ICD-9 codes for the period 1993–2000 and ICD-10 codes for 2001–2006 from Office for National Statistics	Percent change in RR of cardiovascular mortality above heat threshold CVD: 1.8% (1.2–2.5) MI: 1.1% (0.7–1.5) Arrhythmias: 5.0% (3.2–6.9)	The risk of heat-related mortality is distributed across a wide range of different causes

Almeida et al. 2010[27]	Residents of two largest urban areas in Portugal: Lisbon and Oporto (2000–2004)	Heat: per 1°C increase in average daily temperatures above cut-off point	Daily counts of cardiovascular mortality (ICD-9: 390–459) during April–September months from the National Institute of Statistics	Percent change in cardiovascular mortality in Lisbon: 2.4% (1.7–3.1) Oporto: 2.1% (1.3–2.9)	Heat was associated with an increase in cardiovascular mortality
Baccini et al. 2008[28]	15 European cities (1990–2000)	Heat: 1°C increase in maximum apparent temperature above city-specific threshold, which corresponds to MMT. MMT for Mediterranean cities was 29.4°C; MMT for north-continental cities was 23.3°C	Daily counts of cardiovascular mortality (ICD-9: 390–459) during warm season (April– September) from PHEWE database.	Percent change in cardiovascular mortality for Mediterranean cities: Heat effect: 3.7% (0.36–7.04) Percent change in cardiovascular mortality for north-continental cities: Heat effect: 2.44% (-0.09–5.32)	The association between heat and cardiovascular mortality is most apparent in June through August. Heat effect is limited to the first week following temperature excess. Residents of Mediterranean cities were more affected by heat effects compared to their north-continental counterparts. The effects of heat were more pronounced among the elderly (≥ 75 years).
Ishigami et al. 2008[29]	Residents of three cities in Europe (Budapest, London, and Milan) (1993–2004)	Heat: per 1°C increase in mean daily temperature above cut-point (corresponds to lowest mortality) Budapest: 24.4°C London: 20.4°C Milan: 26.3°C	Daily counts of cardiovascular mortality (ICD-9: 390–459) supplied by the Central Statistical Office in Budapest, the Office for National Statistics (ONS) in the UK, and the Local Health Authority in Milan.	RR of heat per 1°C increase above cut-point among non-elderly (<75 years): Budapest: 1.04 (0.99–1.08) London: 1.03 (1.01–1.04) Milan: 1.15 (1.07–1.24) RR of heat per 1°C increase above cut-point among elderly (≥75 years): Budapest: 1.08 (1.04–1.12) London: 1.06 (1.05–1.07) Milan: 1.20 (1.15–1.25)	Heat was associated with cardiovascular mortality with age being an effect modifier. No association with socio-economic status.

Red indicates heat effect only; blue indicates cold effect only. AMI, acute myocardial infarction; AR, attributable risk; CAD, coronary artery disease; CVD, cardiovascular disease; IHD, ischaemic heart disease; ICD, international classification of diseases; IS, ischaemic stroke; HS, haemorrhagic stroke; RR, relative risk; MI, myocardial infarction; MMT, minimum mortality temperature.

Supplementary Table 3 | **Studies describing the association between ambient temperature and acute myocardial infarction**

Author, year	**Study population and period**	**Exposure and/or exposure assessment method**	**Outcomes measured and/or outcome assessment method**	**Main outcomes**
Rowland et al. 2020[30]	Residents of New York state, USA (2000–2015)	Hourly temperature estimates from the North American Land Data Assimilation System, (NLDAS-2) Forcing	AMI cases (ICD-9; code 410.x1(pre-2015) or (ICD-10 code I21) from New York State Department of Health Statewide Planning and Research Cooperative System	The cumulative percent increase in hourly AMI rate was 7.9% (95 CI 5.2–10.6) for an 11°C (median) to 27 °C (95th percentile) temperature increase for lag hours 0–5. Increase in hourly ambient temperature can trigger AMI. Younger men (<65 years) were most susceptible.
Dang et al. 2019[31]	Residents of two different climate zones in Vietnam (Tropical savannah and tropical monsoon regions) (2008–2015)	Meteorological data were obtained from the National Hydro-Meteorological and Environment Network Centre.	AMI hospital admission data (with hospital records cross-checked by clinicians) were collected from three hospitals in the South-Central Coast region (tropical savannah climate) and North-Central Coast region (tropical monsoon climate)	There was a negative and significant association between AMI, HAs and temperature in the North-Central Coast region. There was a positive and significant association in the South-Central Coast region. North-Central Coast region: RR: 1.11 (95% CI 0.91–1.35; 10th percentile of temperature range -18.5 °C) RR: 1.25 (95% CI 1.02–1.55; 5th percentile of temperature range -16.8 °C) South-Central Coast region: RR: 1.18 (95% CI 0.95–1.47; 90th percentile of temperature range -29.5 °C) RR: 1.36 (95% CI 1.06–1.73; 95th percentile of temperature range -29.9 °C)
García-Lledó et al. 2019[32]	Residents of Madrid, Spain (2013–2017)	Heatwave alert periods and maximum daily temperature	Confirmed STEMI cases registered in the Infarction Code of the Community of Madrid	Incidence RR for heatwave alert periods: 1.14 (95% CI 0.76–1.41) Compared to 18°C, warmer temperatures were not associated with higher MI incidence.
Sun et al. 2018[33]	Meta-analysis of 23 studies	1°C increase or decrease in temperature	Mortality and morbidity from AMI	- RR for AMI hospitalizations per 1°C increase in temperature was 1.016 (95% CI 1.004, 1.028). - RR for AMI hospitalizations per 1°C decrease in temperature was and 1.014 (95%CI: 1.004, 1.024). - RR for AMI mortality during heat wave was 1.639 (95% CI 1.087, 2.470). - The heterogeneity was significant for heat exposure, cold exposure, and heatwave exposures.
Zhao et al. 2018[34]	Residents of North China (2003–2011)	Several temperature parameters including daily average temperature, extremely low temperature, and daily temperature range.	AMI cases (ICD-9; code 410.x1 (pre-2015) or ICD-10 code I21) presenting to Changzhi Heping Hospital.	Low ambient temperature has substantial association with AMI, and can have an important role in warning and forecasting the incidence. A rise of 5°C of the daily average temperature led to a 5% decrease in AMI admissions.

Lam et al. 2018[35]	Residents of Hong Kong (2002–2011)	Cold: comparing 12°C versus 24°C with lag up to 22 days. Heat: comparing 30.4°C versus 28.8°C during hot season (May–October) with lag up to 4 days.	AMI cases (ICD-9; code 410.x1) from Hong Kong Hospital Authority	Cold season: Linear, negative association between AMI admissions and ambient temperature among patients with diabetes. In patients with diabetes, comparing 12°C versus 24°C during cold season (November – April), cumulative RR: 2.10 (95% CI 1.62–2.72). In patients without diabetes, comparing 12°C versus 22°C, cumulative RR: 1.43 (95% CI 1.21–1.69). In patients with diabetes, comparing 30.4°C versus 28.8°C during the hot season (May–October), cumulative RR: 1.14 (95% CI 1.00–1.31). In patients without diabetes, comparing 30.4°C versus 28.8°C during the hot season (May–October), cumulative RR: 1.00 (0.91–1.10). Cold has more pronounced effects on AMI admissions than heat.
Yamaji et al. 2017[36]	Residents of Japan (2011–2012)	Multiple temperature parameters including mean, maximum and minimum temperature.	STEMI cases from the Japan-PCI registry	Lower mean temperature from the previous day was associated with lower odds of STEMI (0.925 (95% CI 0.915–0.935)). Increase in maximum temperature from the previous day is associated with increased odds of STEMI (1.012 (95% CI 1.009–1.015))
Wichmann et al. 2013[37]	Residents of Gothenburg, Sweden (1987–1996)	Temperature and relative humidity were measured with the HMP45a probe. Daily averages (midnight to midnight) data were applied in the statistical analyses	AMI cases (ICD-9; code 410.x1 (pre-1997) or (ICD-10 code I21) from the national hospital discharge register in Sweden	Cold temperature was associated with modest increase in AMI hospitalizations. No association between ambient temperature and AMI mortality. No susceptible groups, based on age or sex, were identified.
Bhaskaran et al. 2010[38]	Residents of 15 conurbations in England and Wales (2003–2006)	1°C increase or decrease in mean daily temperature.	AMI cases from the Myocardial Ischemia National Audit Project	The association between average daily temperatures and incident AMI was broadly linear without temperature thresholds. A 1°C reduction in daily mean temperature was associated with a 2.0% (95% CI 1.1–2.9) cumulative increase in risk of myocardial infarction over the current and following 28 days. No association was found between higher temperatures and incident AMI.
Bhaskaran et al. 2009[39]	Meta-analysis (total of 14 studies)	Short-term effect of temperature on AMI.	Cold effect: 8 out of 12 studies reported a significant association between the risk of AMI and colder temperatures. Heat effect: 7 out of 13 studies reported a significant association between the risk of AMI and higher temperatures.	
Wolf et al. 2009 [40]	Population-based MI registry in Augsburg, Germany (1995-2004)	10°C decrease in 5-day average temperature.	AMI cases from the MONICA/KORA registry from Augsburg, Germany	Cold effect: 10°C decrease in 5-day average temperature was associated with an increase in AMI risk (95% CI 1.04–1.15).

AMI, acute myocardial infarction; ICD, international classification of diseases; MI, myocardial infarction; RR, risk ratio; STEMI, ST-elevation myocardial infarction.

Supplementary Table 4 | **Stakeholder mediation of climate change**

Federal governments	
Research priorities	• Continue research on climate mitigation research (such as seawalls, transportation, alternative fuels, etc.) • Incentivize further research that links climate change to health consequences and treatments • Incentivize private sector research through tax credits and subsidies
Government procurement programmes	• Mandate government agencies pursue ‘green procurement’ programmes that purchase sustainable goods
Cap and trade programmes (carbon pricing policies)	• Construct and promote the use of efficient, market-driven carbon trading systems
Transportation policies	• Decrease reliance on domestic air travel • Implement high-speed Maglev (magnetic levitation) trains
Clean energy policies	• Support and fund changes that utilize geothermal, solar, tidal and wind power • Incentivize the use of alternative fuels for transportation (such as electric cars)
Local and regional governments	
Urban design and landscaping	• Build and maintain green urban areas such as parks, nature preservers and natural habitats • Design easily accessible pathways and walkways for people to decrease roadway demand
Transportation	• Promotion and use of public transportation that uses alternative fuels • Construct roads that alleviate traffic congestion • Restrict driving areas and off-hour transportation for heavy trucking • Incentivize cycling, electric personal transportation (such as scooters), and walking through tax credits and the building of user-friendly pathways
Construction zoning and emission controls	• Implement emission standards for local businesses • Restrict industrial areas to their own locations within city limits • Incentivize new housing construction with alternative energy sources
Heat-health action plans	• Accurate and timely heat-health alert systems • Heat-health information plan on what information to communicate to the public • Reduction in indoor heat exposure • Preparedness of health and social care systems • Long-term urban planning • Real-time evaluation
Civil society	
Climate conscious policies	• Promote industries and decisions that are climate conscious and activities that take climate change into account • Initiate private–public partnerships to resolve issues and to promote climate conscious activities • Decrease the need for long-haul travel through technology such as videoconferencing
Public awareness campaigns	• Create media campaigns to highlight the costs and benefits of climate change mitigation
Individual behaviour	
Housing choices	• Use clean energy for housing and new home construction • Insulate houses to reduce heating and cooling needs • Incorporate architecture and building forms that promote naturally cooling and air circulation
Reduce indoor and outdoor air pollution	• Use indoor air purifiers • Use air conditioning that filters the air • Close windows during the day when air pollution emissions are highest
Transportation	• Walk and cycle instead of using cars • Avoid heavy traffic areas, especially during commuting times
Face masks	• Use masks that filter emission particles

Lifestyle and prevention	• Regular medical screenings, especially for those with conditions susceptible to climate exacerbation (such as cardiac and respiratory disease, and diabetes mellitus) • Exercise • Healthy diet less focused on proteins produced in large-scale farms that contribute to climate change and air pollution

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