

Supplemental Online Content

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This supplemental material has been provided by the authors to give readers additional information about their work.

eAppendix. Supplemental Methods and Results

Supplemental Methods

This systematic review examined the effect of climate change on cardiovascular health. We searched PubMed, Embase, Web of Science, and the Cochrane Library for English language publications related to climate change and cardiovascular health that were published between January 1, 1970 and November 15, 2023. See eTable 1 for the complete search strategy including climate change-related exposures and key cardiovascular outcomes of interest. Details of the protocol for this review were published in the International Prospective Register of Systematic Reviews (PROSPERO, ID Number CRD42022320923) (1). Figure 1 in the manuscript shows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of the search strategy (2).

Two reviewers independently abstracted data regarding the location, study design, definition of climate change-related exposure, effect on cardiovascular outcomes, and, when reported by study investigators, evidence of heterogeneity of effect. Quality assessment was initially performed using the Mixed Methods Appraisal Tool (MMAT) version 2018, which is designed to be used in reviews that include a variety of empirical studies, and allows investigators to appraise the methodological quality of qualitative research, randomized controlled trials, non-randomized studies, quantitative descriptive studies, and mixed methods studies (3). Quality was assessed by two independent investigators, with any disagreements mediated by a third investigator. All studies were evaluated with the following two screening questions: “Are there clear research questions?” and “Do the collected data allow to address the research question?” Studies that received “yes” answers to both screening questions were included. As all studies included in this manuscript fell into MMAT study design category 3 (quantitative non-randomized), the studies were evaluated with the following five criteria: “Are the participants representative of the target population?,” “Are measurements appropriate regarding both the outcome and intervention (or exposure)?,” “Are there complete outcome data?,” “Are the confounders accounted for in the design and analysis?,” “During the study period, is the intervention administered (or exposure occurred) as intended?” For the purpose of this

review, assessment for confounders was documented as positive if the authors attempted to control for one or more appropriate environmental, demographic, and clinical confounders. Information on research questions and study design were abstracted as able from the introduction and methods sections. Information on the intervention and outcome data were abstracted from the text and analyzed qualitatively to determine if a publication achieved its goals.

However, we found that a generic tool designed for clinical observational studies did not fully capture the variation in quality observed in environmental health studies. We therefore repeated the quality assessment process using the Navigation Guide framework for reviews of observational studies in environmental health (4). Specifically, we assessed each study for risk of bias, evaluated the quality of evidence across studies, and examined the strength of evidence across studies. Given the large number of studies included in this review, we focused on three components when assessing the risk of bias in individual studies: risk of bias in ascertaining the exposure, risk of bias in ascertaining outcomes, and risk of bias due to confounding. Each of these was categorized as low, probably low, probably high, or high using pre-defined categories. eTable 2 lists the broad criteria used for assessing risk of bias, but reviewers were allowed to exercise their judgment for individual studies, any disagreements were resolved by consensus. For each study, reviewers then provided an overall assessment of risk of bias, also categorized as low, probably low, probably high, or high (see eTable 2 and Liu et al.(5)). Stacked bar graphs were created to visualize the proportion of studies in each category of risk of bias, stratified by the environmental exposure.

Next, we used the Navigation Guide framework to assess the overall quality of evidence across included studies as adapted from Johnson and colleagues (4) and implemented by Liu and colleagues (5). We started with an initial rating of moderate quality of evidence since all included studies were observational. For each exposure, the assessment of the quality of evidence was then downgraded (e.g., for factors such as risk of bias across studies, inconsistency, or imprecision) or upgraded (e.g., for a large magnitude of

effect or dose-response effect) to produce an overall assessment of the quality of evidence (4). Finally, strength of evidence was rated across all studies as sufficient, limited, inadequate, or evidence of lack of association based on considerations such as the quality of evidence across studies, direction of estimates, confidence in estimates, and other attributes of the data that may influence certainty (4).

Supplemental Results

A total of 492 articles met the inclusion criteria for the study. Quality assessment of individual studies is reported in eTable 3, whereas the abstracted outcomes are reported in eTables 4 through 12). The majority (n = 465, 95%) assessed and adjusted for potential confounders as defined by the MMAT version for quantitative non-randomized studies. Of those 465 studies, 400 adjusted for potential environmental confounders (86%) Using the Navigation Guide framework for quality assessment, we found that most included studies were rated with low risk or probably low risk of bias (88% for extreme heat, 86% for extreme cold, 98% for ground-level ozone, 82% for wildfire smoke, and 78% for extreme weather) (eFigure 1).

Next, we assessed the quality of evidence across included studies as previously implemented by Johnson et al. and Liu et al. (eTable 3 and eFigure 1). We started with an initial rating of moderate quality of evidence since all included studies were observational (4). The evidence for extreme temperature was upgraded for exposure-response gradient, and therefore rated as high quality. The evidence for ozone and wildfire smoke was downgraded for inconsistency but upgraded for exposure-response gradient, and retained an overall moderate quality rating. Finally, evidence for extreme weather varied by exposure: evidence related to tropical storms/hurricanes/cyclones and dust storms was upgraded for large magnitude of effect, and therefore rated as high quality overall; evidence related to floods and drought was downgraded for imprecision and inconsistency, and therefore rated as low quality; and evidence related to mudslides was downgraded for risk of bias, imprecision, and inconsistency, and rated as low quality.

The overall strength of evidence was rated as sufficient for extreme temperature, ground-level ozone, tropical storms/hurricanes/cyclones, and dust storms (conclusion unlikely to be strongly affected by the results of future studies), limited for wildfires (observed effect could change as more information becomes available), and inadequate for drought and mudslides (limited number of studies, inconsistency of findings across studies, more information may allow an assessment of effects). In general, the evidence of association was stronger for cardiovascular mortality than for cardiovascular morbidity, likely reflecting the large number of disparate clinical endpoints that were included in the morbidity studies.

eTable 1. Search Strategy. Complete list of search terms and strategies, including exposure and outcome of interest. Searches were conducted on PubMed, Embase, Cochrane Library, and Web of Science using the following terms and strategies.

Keywords for Exposures
"climate change", "greenhouse effect", "global warming", "extreme hot weather”, "floods", "sea level rise", "extreme cold weather”, "hurricane", "cyclonic storms", "cyclonic storm", "cyclone", "monsoon", "salt water intrusion", "tropical storm", "heat wave", "wildfires", "forest fire", "fires", “fire season", "air pollution", "smoke”, "smoke event", "migration".
Keywords for Outcomes
"cardiovascular diseases”, "heart failure”, "congestive heart failure”, "acute heart failure”, "systolic heart failure", "diastolic heart failure”, "heart diseases", "heart arrest", "coronary artery disease”, "ischemic heart disease”, "heart muscle ischemia", "myocardial infarction", "heart infarction”, "cardiac arrhythmia", "heart arrhythmia", "cerebrovascular accident", "stroke", "cerebrovascular disorders", "cerebrovascular disease".
Search terms and strategies
PubMed: ("climate change"[mesh] OR "climate change"[tiab] OR "greenhouse effect"[mesh] OR "greenhouse effect"[tiab] OR "global warming"[mesh] OR "global warming"[tiab] OR "extreme hot weather"[mesh] OR "extreme hot weather"[tiab] OR "floods"[mesh] OR "flood*"[tiab] OR "sea level rise"[mesh] OR "sea level ris*"[tiab] OR "extreme cold weather"[mesh] OR "extreme cold weather"[tiab] OR "hurricane"[tiab] OR "cyclonic storms"[mesh] OR "cyclonic storm*"[tiab] OR "cyclone"[tiab] OR "monsoon"[tiab] OR "salt water intrusion"[tiab] OR "tropical storm*"[tiab] OR "heat wave"[tiab] OR "wildfires"[mesh] OR "wildfire*"[tiab] OR "forest fire"[tiab] OR "fires"[mesh] OR "fire*"[tiab] OR "fire season"[tiab] OR "air

pollution"[mesh] OR "air pollution"[tiab] OR "smoke"[mesh] OR "smoke"[tiab] OR "smoke
 event"[tiab] OR "particulate matter"[mesh] OR "particulate matter"[tiab] OR "particulate matter
 2.5"[tiab] OR "ozone"[tiab] OR "ozone"[mesh] OR "O3"[tiab] OR "photochemical"[tiab] OR
 "stratospheric ozone"[mesh])
 AND ("cardiovascular diseases"[mesh] OR "cardiovascular disease*"[tiab] OR "heart
 failure"[tiab] OR "congestive heart failure"[tiab] OR "acute heart failure"[tiab] OR "heart
 failure, systolic"[mesh] OR "systolic heart failure"[tiab] OR "heart failure, diastolic"[mesh] OR
 "diastolic heart failure"[tiab] OR "heart diseases"[mesh] OR "heart disease*"[tiab] OR "heart
 arrest"[mesh] OR "heart arrest"[tiab] OR "coronary artery disease"[mesh] OR "coronary artery
 disease*"[tiab] OR "ischemic heart disease"[tiab] OR "myocardial ischemia"[tiab] OR
 "myocardial infarction"[mesh] OR "myocardial infarction"[tiab] OR "heart infarction"[tiab] OR
 "arrhythmias, cardiac"[mesh] OR "cardiac arrhythmia"[tiab] OR "heart arrhythmia*"[tiab] OR
 "cerebrovascular accident"[tiab] OR "stroke"[mesh] OR "stroke"[tiab] OR "cerebrovascular
 disorders"[mesh] OR "cerebrovascular disorders"[tiab] OR "cerebrovascular disease*"[tiab] OR
 "heat stroke"[mesh] OR "heat stroke"[tiab] OR "heat exhaustion"[mesh] OR "heat
 exhaustion"[tiab]))
 NOT ("animals"[mesh] OR "animal*"[tiab] OR "respiratory system"[mesh] OR "respiratory
 system"[tiab] OR "respiratory tract disease*"[tiab] OR "asthma"[mesh] OR "asthma"[tiab] OR
 "lung"[mesh] OR "lung"[tiab] OR "lung diseases"[mesh] OR "lung disease*"[tiab] OR
 "pulmonary disease, chronic obstructive"[mesh] OR "chronic obstructive pulmonary
 disease"[tiab] OR "COPD"[tiab] OR "chronic obstructive lung disease"[tiab] OR "plants"[mesh]
 OR "plant*"[tiab] OR "bacteriophages"[mesh] OR "bacteriophage*"[tiab] OR "bacteria"[mesh]
 OR "bacteria"[tiab] OR "bacterium"[tiab] OR "pollen"[mesh] OR "pollen"[tiab] OR

"mice"[mesh] OR "mice"[tiab] OR "mouse"[tiab] OR "rats"[mesh] OR "rat"[tiab] OR

"fishes"[mesh] OR "fish*"[tiab] OR "heat shock proteins"[mesh] OR "heat shock

protein*"[tiab]) AND (english[lang])

Embase:

('climate change'/exp OR 'climate change':ti,ab OR 'greenhouse effect'/exp OR 'greenhouse effect':ti,ab OR 'global warming'/exp OR 'global warming':ti,ab OR 'extreme hot weather'/exp OR 'extreme hot weather':ti,ab OR 'floods'/exp OR flood*:ti,ab OR 'sea level rise'/exp OR 'sea level ris*':ti,ab OR 'extreme cold weather'/exp OR 'extreme cold weather':ti,ab OR hurricane:ti,ab OR 'cyclonic storms'/exp OR 'cyclonic storm*':ti,ab OR cyclone:ti,ab OR monsoon:ti,ab OR 'salt water intrusion':ti,ab OR 'tropical storm*':ti,ab OR 'heat wave':ti,ab OR 'wildfires'/exp OR wildfire*:ti,ab OR 'forest fire':ti,ab OR 'fires'/exp OR fire*:ti,ab OR 'fire season':ti,ab OR 'air pollution'/exp OR 'air pollution':ti,ab OR 'smoke'/exp OR smoke:ti,ab OR 'smoke event':ti,ab OR 'particulate matter'/exp OR 'particulate matter':ti,ab OR 'particulate matter 2.5':ti,ab OR ozone:ti,ab OR 'ozone'/exp OR o3:ti,ab OR photochemical:ti,ab OR 'stratospheric ozone'/exp) AND ('cardiovascular diseases'/exp OR 'cardiovascular disease*':ti,ab OR 'heart failure':ti,ab OR 'congestive heart failure':ti,ab OR 'acute heart failure':ti,ab OR 'heart failure, systolic'/exp OR 'systolic heart failure':ti,ab OR 'heart failure, diastolic'/exp OR 'diastolic heart failure':ti,ab OR 'heart diseases'/exp OR 'heart disease*':ti,ab OR 'heart arrest'/exp OR 'heart arrest':ti,ab OR 'coronary artery disease'/exp OR 'coronary artery disease*':ti,ab OR 'ischemic heart disease':ti,ab OR 'myocardial ischemia':ti,ab OR 'myocardial infarction'/exp OR 'myocardial infarction':ti,ab OR 'heart infarction':ti,ab OR 'arrhythmias, cardiac'/exp OR 'cardiac arrhythmia':ti,ab OR 'heart arrhythmia*':ti,ab OR 'cerebrovascular accident':ti,ab OR 'stroke'/exp

OR stroke:ti,ab OR 'cerebrovascular disorders'/exp OR 'cerebrovascular disorders':ti,ab OR 'cerebrovascular disease*':ti,ab OR 'heat stroke'/exp OR 'heat stroke':ti,ab OR 'heat exhaustion'/exp OR 'heat exhaustion':ti,ab) NOT ('animals'/exp OR animal*:ti,ab OR 'respiratory system'/exp OR 'respiratory system':ti,ab OR 'respiratory tract disease*':ti,ab OR 'asthma'/exp OR asthma:ti,ab OR 'lung'/exp OR lung:ti,ab OR 'lung diseases'/exp OR 'lung disease*':ti,ab OR 'pulmonary disease, chronic obstructive'/exp OR 'chronic obstructive pulmonary disease':ti,ab OR copd:ti,ab OR 'chronic obstructive lung disease':ti,ab OR 'plants'/exp OR plant*:ti,ab OR 'bacteriophages'/exp OR bacteriophage*:ti,ab OR 'bacteria'/exp OR bacteria:ti,ab OR bacterium:ti,ab OR 'pollen'/exp OR pollen:ti,ab OR 'mice'/exp OR mice:ti,ab OR mouse:ti,ab OR 'rats'/exp OR rat:ti,ab OR 'fishes'/exp OR fish*:ti,ab OR 'heat shock proteins'/exp OR 'heat shock protein*':ti,ab) AND [english]/lim

Cochrane Library:

#1 ('climate change' OR 'greenhouse effect' OR 'global warming' OR 'extreme hot weather' OR 'flood*' OR 'sea level ris*' OR 'extreme cold weather' OR 'hurricane' OR 'cyclonic storm*' OR 'cyclone' OR 'monsoon' OR 'saltwater intrusion' OR 'tropical storm*' OR 'heat wave' OR 'wildfire*' OR 'forest fire OR fire*' OR 'fire season' OR 'air pollution' OR 'smoke' OR 'smoke event' OR 'particulate matter' OR 'particulate matter 2.5' OR 'ozone' OR 'O3' OR 'photochemical' OR 'ozone layer')

#2 ('cardiovascular disease*' OR 'heart failure' OR 'congestive heart failure' OR 'acute heart failure' OR 'systolic heart failure' OR 'heart' OR 'diastolic heart failure' OR 'heart disease*' OR 'heart arrest' OR 'coronary artery disease*' OR 'ischemic heart disease' OR 'myocardial ischemia' OR 'myocardial infarction' OR 'heart infarction' OR 'cardiac arrhythmia' OR 'heart arrhythmia*')

OR 'cerebrovascular accident' OR 'stroke' OR 'cerebrovascular disorders' OR 'cerebrovascular disease*' OR 'heat stroke' OR 'heat exhaustion')

#3 #1 AND #2

#4 ('animal*' OR 'respiratory system' OR 'respiratory tract disease*' OR 'asthma' OR 'lung' OR 'lung disease*' OR 'chronic obstructive pulmonary disease' OR 'COPD' OR 'chronic obstructive lung disease' OR 'plant*' OR 'bacteriophages' OR 'bacteriophage*' OR 'bacteria' OR 'bacterium' OR pollen' OR 'mice' OR 'mouse' OR 'rat' OR 'fish*' OR 'heat shock protein*')

#5 #3 NOT #4

#6 ([mh ^2022]) AND (English[lang])

Web of Science:

("climate change" OR "climate change" OR "greenhouse effect" OR "greenhouse effect" OR "global warming" OR "global warming" OR "extreme hot weather" OR "extreme hot weather" OR floods OR flood* OR "sea level rise" OR "sea level ris*" OR "extreme cold weather" OR "extreme cold weather" OR hurricane OR "cyclonic storms" OR "cyclonic storm*" OR cyclone OR monsoon OR "salt water intrusion" OR "tropical storm*" OR "heat wave" OR wildfires OR wildfire* OR "forest fire" OR fires OR fire* OR "fire season" OR "air pollution" OR "air pollution" OR smoke OR smoke OR "smoke event" OR "particulate matter" OR "particulate matter" OR "particulate matter 2.5" OR ozone OR ozone OR O3 OR photochemical OR "stratospheric ozone") AND ("cardiovascular diseases" OR "cardiovascular disease*" OR "heart failure" OR "congestive heart failure" OR "acute heart failure" OR "heart failure, systolic" OR "systolic heart failure" OR "heart failure, diastolic" OR "diastolic heart failure" OR "heart diseases" OR "heart disease*" OR "heart arrest" OR "heart arrest" OR "coronary artery disease"

OR "coronary artery disease*" OR "ischemic heart disease" OR "myocardial ischemia" OR "myocardial infarction" OR "myocardial infarction" OR "heart infarction" OR "arrhythmias, cardiac" OR "cardiac arrhythmia" OR "heart arrhythmia*" OR "cerebrovascular accident" OR stroke OR stroke OR "cerebrovascular disorders" OR "cerebrovascular disorders" OR "cerebrovascular disease*" OR "heat stroke" OR "heat stroke" OR "heat exhaustion" OR "heat exhaustion") NOT (animals OR animal* OR "respiratory system" OR "respiratory system" OR "respiratory tract disease*" OR asthma OR asthma OR lung OR lung OR "lung diseases" OR "lung disease*" OR "pulmonary disease, chronic obstructive" OR "chronic obstructive pulmonary disease" OR COPD OR "chronic obstructive lung disease" OR plants OR plant* OR bacteriophages OR bacteriophage* OR bacteria OR bacteria OR bacterium OR pollen OR pollen OR mice OR mice OR mouse OR rats OR rat OR fishes OR fish* OR "heat shock proteins" OR "heat shock protein*") AND (2022) AND (English[lang])

AND

("cardiovascular diseases"[mesh] OR "cardiovascular disease*" [tiab] OR "heart failure" [tiab] OR "congestive heart failure" [tiab] OR "acute heart failure" [tiab] OR "heart failure, systolic" [mesh] OR "systolic heart failure" [tiab] OR "heart failure, diastolic" [mesh] OR "diastolic heart failure" [tiab] OR "heart diseases" [mesh] OR "heart disease*" [tiab] OR "heart arrest" [mesh] OR "heart arrest" [tiab] OR "coronary artery disease" [mesh] OR "coronary artery disease*" [tiab] OR "ischemic heart disease" [tiab] OR "heart muscle ischemia" [tiab] OR "myocardial infarction" [mesh] OR "myocardial infarction" [tiab] OR "heart infarction" [tiab] OR "arrhythmias, cardiac" [mesh] OR "cardiac arrhythmia" [tiab] OR "heart arrhythmia*" [tiab] OR "cerebrovascular accident" [tiab] OR "stroke" [mesh] OR "stroke" [tiab] OR "cerebrovascular disorders" [mesh] OR "cerebrovascular disorders" [tiab] OR "cerebrovascular disease*" [tiab])

NOT

("animals"[mesh] OR "animal*"[tiab] OR "respiratory system"[mesh] OR "respiratory system"[tiab] OR "respiratory tract disease*"[tiab] OR "asthma"[mesh] OR "asthma"[tiab] OR "lung"[mesh] OR "lung"[tiab] OR "lung diseases"[mesh] OR "lung disease*"[tiab] OR "pulmonary disease, chronic obstructive"[mesh] OR "chronic obstructive pulmonary disease"[tiab] OR "COPD"[tiab] OR "chronic obstructive lung disease"[tiab] OR "plants"[mesh] OR "plant*"[tiab] OR "bacteriophages"[mesh] OR "bacteriophage*"[tiab] OR "bacteria"[mesh] OR "bacteria"[tiab] OR "bacterium"[tiab] OR "pollen"[mesh] OR "pollen"[tiab] OR "mice"[mesh] OR "mice"[tiab] OR "mouse"[tiab] OR "rats"[mesh] OR "rat"[tiab] OR "fishes"[mesh] OR "fish*"[tiab] OR "heat shock proteins"[mesh] OR "heat shock protein*"[tiab])
AND
(English[lang])

eTable 2. Criteria for Evaluating Risk of Bias in Included Studies

Risk of Bias: Exposure	Categories	Comment
Temperature	L – multiple ground sensors, high confidence that exposure is true average population exposure (e.g. using gridded temperature data-interpolated or population weighted temperature). PL – indirect evidence to suggest low risk of bias. Multiple ground sensors PH – single ground sensor per large area, temperature readings less frequent than every 24 hours H – other or not specified	
Ozone	L – multiple ground sensors PL – validated chemical model PH – single ground-level sensor H – other or not specified	
Wildfire	L – multiple ground sensors PL – validated chemical model PH – satellite image of smoke H – other (“wildfire days”) or not specified	
Flood	L – Geographic Information Systems mapping , local on-the-ground data monitors PL – dates of flooding for a small geographic area PH – dates of flooding for a large geographic area H – other (“flooding seasons”) or not specified	
Drought	L – multiple ground sensors PL – validated chemical model PH – satellite image of smoke H – other (“wildfire days”) or not specified	
Dust Storms	L – multiple ground sensors PL – single ground sensor PH – satellite image of haze H – other (“dust storm days”) or not specified	
Mudslide	L – geographic mapping system, gridded area affected PL – dates of mudslide in local area without geographic mapping PH – indirect evidence of bias: dates of mudslide, exposure attributed to a large area H – other or not specified	
Risk of Bias: Outcome	L – mortality and morbidity cause classified based on diagnosis standard criteria (International	

	Classification System – ICD code) and provided by a National or Regional Database. PL – outcome was assessed based on diagnosis standard criteria (ICD) and collected by researcher, but did not specify the data source. PH – outcome was not assessed based on standard diagnosis criteria. Additionally, there is evidence that suggests the existence of misclassification bias. H – outcome was assessed based on self-reports (parents, family) and data collected by the researcher. Additionally, there is evidence that suggests the high risk of misclassification bias.	
Risk of Bias: Confounding	L – accounted for key environmental exposures and relevant demographic/clinical characteristics. PL – accounted for some but not all key environmental exposures, accounted for relevant demographic/clinical characteristics. PH – did not account for environmental exposures but adjusted for relevant demographic/clinical characteristics. H – did not account for environmental or relevant demographic/clinical characteristics.	
Risk of Bias: Overall (Combination of three key factors: Exposure, Outcome, and Confounding) (5)	High (H)	H+H+(H/PH/PL/L)
		H+PH+PH
	Probably high (PH)	H + PH + (PL/L)
		PH+PH+(PH/PL/L)
	Probably low (PL)	PH+(PL/L)+(PL/L)
		PL+PL+L
	Low (L)	PL+L+L
		L+L+L
Abbreviations: H= high; PH= probably high; PL= probably low; L= low.		

QUALITY ASSESSMENT OF INCLUDED STUDIES

eTable 3. Quality Assessment of Included Studies. Quality assessment of included studies was performed using the Mixed Methods Appraisal Tool version 2018 (3) as well as qualitative risk of bias analysis adapted from Liu, et al as outlined in eTable 2. MMAT Criteria included two screening questions and five questions relevant to quantitative non-randomized studies (MMAT study design category 3).* indicates screening questions.

	Components of the MMAT							Additional information	Risk of bias			
Study Details (title, author, year, location)	Are there clear research questions? *	Do the collected data allow to address the research questions?*	Are the participants representative of the target population?	Are the measurements appropriate regarding both the outcome and intervention (or exposure)?	Are there complete outcome data?	Are the confounders accounted for in the design and analysis?	During the study period, is the intervention administered (or exposure occurred) as intended?	Which environmental factors did the analysis adjust for?	Exposure	Outcome	Confounding	Overall
EXTREME HEAT												
<i>Impact of two recent extreme heat episodes on morbidity and mortality in Adelaide, South Australia a case-series analysis. Nitschke et al. 2011 Australia (6)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	PL	PL
<i>Associations between ambient temperature and daily hospital admissions for rheumatic heart disease in Shanghai, China. Ge et al. 2018 China (7)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM 2.5, O3), humidity	P H	L	L	PL
<i>Hot spot: impact of July 2011 heat wave in southern Italy (Apulia) on cardiovascular disease assessed by emergency medical service</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	P H	P H	PH

<i>and telemedicine support. Brunetti et al. 2014 Italy (8)</i>												
<i>Excess mortality during heat waves, Tehran Iran: an ecological time-series study. Ahmadnezhad et al. 2013 Iran (9)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM 2.5, PM 10, O3)	P H	L	L	PL
<i>Heat-related mortality trends under recent climate warming in Spain: A 36-year observational study. Achebak et al. 2018 Spain (10)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	PL	PL
<i>The effect of high ambient temperature on emergency room visits. Basu et al. 2012 United States (11)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, CO, NO2, SO2, O3), humidity	P H	L	L	PL
<i>Heat waves and cause-specific mortality at all ages. Basagana find 2011 Spain (12)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM, O3), humidity	P H	L	L	PL
<i>The effect of heat waves on ambulance attendances in Brisbane, Australia. Turner et al. 2013 Australia (13)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (O3, NO2, PM 10), humidity	P H	PL	L	PL
<i>Heatwave and risk of hospitalization: A multi-province study in Vietnam. Phung et al. 2017 Vietnam (14)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL
<i>Increased cause-specific mortality associated with 2003 heat wave in Essen, Germany. Hoffmann et al. 2008 Germany (15)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	PL	P H	PH
<i>The effects of hot nights on mortality in Barcelona, Spain. Roye et al. 2017 Spain (16)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (NO2)	P H	L	P H	PH

<i>Mortality and displaced mortality during heat waves in the Czech Republic. Kysely et al. 2004 Czech Republic (17)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	L	L	P H	PL
<i>Heat wave-related mortality in Sweden: A case-crossover study investigating effect modification by neighbourhood deprivation. Åström et al. 2020 Sweden (18)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	PL	PL
<i>Impact of Heat Wave Definitions on the Added Effect of Heat Waves on Cardiovascular Mortality in Beijing, China. Dong et al. 2016 China (19)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10), humidity	PL	L	L	PL
<i>Changes in cause-specific mortality during heat waves in central Spain, 1975-2008. Miron et al. 2015 Spain (20)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	P H	L	P H	PH
<i>The effect of heat waves on mortality and effect modifiers in four communities of Guangdong Province, China. Zeng et al. 2014 China (21)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution(Air pollution index), humidity	P H	L	L	PL
<i>Heat wave characteristics, mortality and effect modification by temperature zones: a time-series study in 130 counties of China. Sun et al. 2020 China (22)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5), humidity	L	L	PL	L
<i>Spatial Variability in the Effect of High Ambient Temperature on Mortality: An Analysis at Municipality Level within the Greater Athens Area. Zafeiratou et al. 2019 Greece (23)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	PL	PL

<i>The association between consecutive days' heat wave and cardiovascular disease mortality in Beijing, China. Yin et al. 2017 China (24)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5), humidity	P H	L	L	PL
<i>Can ultra short-term changes in ambient temperature trigger myocardial infarction? Rowland et al. 2020 United States (25)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	L	PL	L
<i>The short-term effect of heat waves on mortality and its modifiers in China: an analysis from 66 communities. Ma et al. 2015 China (26)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	PL	L	L	L
<i>Excess hospital admissions during the July 1995 heat wave in Chicago. Semenza et al. 1999 United States (27)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	P H	L	P H	PH
<i>Heat wave impact on mortality in Pudong New Area, China in 2013. Sun et al. 2014 China (28)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL
<i>Ambient extreme heat exposure in summer and transitional months and emergency department visits and hospital admissions due to pregnancy complications. Qu et al. 2021 United States (29)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, ozone), humidity	PL	L	L	L
<i>Impact of heat wave in 2005 on mortality in Guangzhou, China. Jun et al. 2013 China (30)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	P H	L	PL	PL
<i>The impact of heatwaves on mortality and emergency hospital admissions from non-external causes in Brisbane,</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, O3), humidity	P H	L	L	PL

<i>Australia. Wang et al. 2012 Australia (31)</i>												
<i>The Characteristic of Heat Wave Effects on Coronary Heart Disease Mortality in Beijing, China: A Time Series Study. Tian et al. 2013 China (32)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL
<i>Excess mortality related to the August 2003 heat wave in France. Fouillet et al. 2006 France (33)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	P H	PL
<i>Increase in out-of-hospital cardiac arrest attended by the medical mobile intensive care units, but not myocardial infarction, during the 2003 heat wave in Paris, France. Empana et al. 2009 France (34)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	H	P H	P H	H
<i>Spatial analysis of the effect of the 2010 heat wave on stroke mortality in Nanjing, China. Chen et al. 2015 China (35)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	P H	PL
<i>The 2006 California heat wave: Impacts on hospitalizations and emergency department visits. Knowlton et al. 2009 United States (36)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	H	L	H	H
<i>The added effects of heatwaves on cause-specific mortality: A nationwide analysis in 272 Chinese cities. Yin et al. 2018 China (37)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, O3), humidity	P H	L	L	PL
<i>The impact of the 2003 heat wave on mortality in Shanghai, China. Huang et al. 2010 China (38)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	L	PL

<i>Socio-demographic vulnerability to heatwave impacts in Brisbane, Australia: a time series analysis. Toloo et al. 2014 Australia (39)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, O3), humidity	PL	L	PL	PL
<i>Cause-specific risk of hospital admission related to extreme heat in older adults. Bobb et al. 2014 United States (40)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	P H	PL
<i>The effects of high temperature on cardiovascular admissions in the most populous tropical city in Vietnam. Phung et al. 2016 Vietnam (41)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	P H	L	L	PL
<i>Comparison of health risks by heat wave definition: Applicability of wet-bulb globe temperature for heat wave criteria. Heo et al. 2019 South Korea (42)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, O3), humidity	PL	L	L	L
<i>Quantification of the heat wave effect on cause-specific mortality in Essen, Germany. Hertel et al. 2009 Germany (43)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10), humidity	P H	L	L	PL
<i>Heatwave Events and Mortality Outcomes in Memphis, Tennessee: Testing Effect Modification by Socioeconomic Status and Urbanicity. Li et al. 2019 United States (44)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (O3), humidity	P H	L	L	PL
<i>Heat wave intensity and daily mortality in four of the largest cities of Spain. Royé et al. 2020 Spain (45)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	PL	L	P H	PL

<i>Effect of night-time temperatures on cause and age-specific mortality in London. Murage et al. 2017 United Kingdom (46)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, O3), humidity	P H	L	L	PL
<i>Time-series Analysis of Heat Waves and Emergency Department Visits in Atlanta, 1993 to 2012. Chen et al. 2017 United States (47)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL
<i>Ambient temperature and added heat wave effects on hospitalizations in California from 1999 to 2009. Sherbakov et al. 2018 United States (48)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, CO, NO2, SO2, O3), humidity	L	L	L	L
<i>Increased mortality associated with extreme-heat exposure in King County, Washington, 1980-2010. Isaksen et al. 2016 United States (49)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	L	L	L
<i>Heat and mortality for ischemic and hemorrhagic stroke in 12 cities of Jiangsu Province, China. Zhou et al. 2017 China (50)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, PM10, NO2, SO2, O3), humidity	PL	L	L	L
<i>Climate change, heat, and mortality in the tropical urban area of San Juan, Puerto Rico. Lázaro et al. 2018 United States (51)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	P H	L	P H	PH
<i>Morbidity and mortality during heatwaves in metropolitan Adelaide. Nitschke et al. 2007 France (52)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	P H	L	PL	PL
<i>The effects of heat stress and its effect modifiers on stroke hospitalizations in Allegheny</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, O3), humidity	P H	L	L	PL

<i>County, Pennsylvania. Ha et al. 2014 United States (53)</i>												
<i>The impact of the summer 2003 heat waves on mortality in four Italian cities. Michelozzi et al. 2003 Italy (54)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	P H	P H	PH
<i>The effect of heat waves on mortality in susceptible groups: a cohort study of a Mediterranean and a northern European City. Åström et al. 2015 Italy, Sweden (55)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	PL	PL
<i>Effects of heat on first-ever strokes and the effect modification of atmospheric pressure: A time-series study in Shenzhen, China. Bao et al. 2019 China (56)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	PL	PL
<i>Does particulate matter modify the short-term association between heat waves and hospital admissions for cardiovascular diseases in greater Sydney, Australia? Parry et al. 2019 Australia (57)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10)	PL	L	L	L
<i>Temperature modifies the association between particulate air pollution and mortality: A multi-city study in South Korea. Estella Kim et al. 2015 South Korea (58)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10), humidity	L	L	L	L
<i>Extreme temperatures and mortality in Kuwait: Who is vulnerable? Alahmad et al. 2020 Kuwait(59)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, O3), humidity	PL	L	L	L
<i>Emergency Cardiovascular Hospitalization Risk</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10,	P H	L	L	PL

<i>Attributable to Cold Temperatures in Hong Kong. Tian et al. 2016 China (60)</i>								NO2, O3), humidity				
<i>Association between climate variables (cold and hot weathers, humidity, atmospheric pressures) with out-of-hospital cardiac arrests in Rasht, Iran. Borghei et al. 2020 Iran (61)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	PL	L	PL
<i>Temperature and mortality on the roof of the world: a time-series analysis in three Tibetan counties, China. Bai et al. 2014 China (62)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	L	PL
<i>Burden of non-accidental mortality attributable to ambient temperatures: a time series study in a high plateau area of southwest China. Deng et al. 2019 China (63)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	PL	PL
<i>The Effects of Apparent Temperature on Cardiovascular Mortality Using a Distributed Lag Nonlinear Model Analysis: 2005 to 2014. Moghadamnia et al. 2018 Iran (64)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL
<i>Excess mortality during heat waves and cold spells in Moscow, Russia. Revich et al. 2008 Russia (65)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	P H	PH
<i>Temporal trends of the association between ambient temperature and hospitalisations for cardiovascular diseases in Queensland, Australia from 1995 to 2016: A time-stratified</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	L	L	L

<i>case-crossover study. Lu et al. 2020 Australia (66)</i>												
<i>The relationship between extreme temperature and emergency incidences: a time series analysis in Shenzhen, China. Guo et al. 2018 China (67)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, PM2.5, NO2, SO2, O3), humidity	PL	L	L	L
<i>The effect of temperature on cardiovascular disease hospital admissions among elderly people in Thai Nguyen Province, Vietnam. Giang et al. 2013 Vietnam (68)</i>	Yes	Yes	Yes	Yes	Yes	Yes	No	Humidity	PL	PL	PL	PL
<i>Effects of extreme temperatures on cause-specific cardiovascular mortality in China. Wang et al. 2015 China (69)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	P H	L	L	PL
<i>Short-term association between ambient temperature and acute myocardial infarction hospitalizations for diabetes mellitus patients: A time series study. Lam et al. 2018 China (70)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (SO2, NO2, O3), humidity	P H	L	L	PL
<i>Mortality as a function of temperature. A study in Valencia, Spain, 1991-1993. Ballester et al. 1997 Spain (71)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (SO2, Black smoke), humidity	P H	L	L	PL
<i>The effect of cold and heat waves on mortality in Urmia a cold region in the North West of Iran. Sharafkhani et al. 2020 Iran (72)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, CO, NO2, NO, NOx, SO2, O3), humidity	P H	L	L	PL
<i>Effects of extreme temperatures on</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, CO,	PL	L	L	L

<i>cardiovascular emergency hospitalizations in a Mediterranean region: a self-controlled case series study. Ponjoan et al. 2017 Spain (73)</i>								NO2, SO2, O3)				
<i>The impact of ambient temperature on acute myocardial infarction admissions in Tehran, Iran. Mohammadi et al. 2018 Iran (74)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2, O3), humidity	P H	L	L	PL
<i>Vulnerabilities to temperature effects on acute myocardial infarction hospital admissions in South Korea. Kwon et al. 2015 South Korea (75)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, CO, NO2, SO2, O3), humidity	P H	L	L	PL
<i>The effects of meteorological variables on ambulance attendance for cardiovascular diseases in Rasht, Iran. Pourshaikhian et al. 2019 Iran (76)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	PL	L	PL
<i>The impact of temperature on mortality in a subtropical city: effects of cold, heat, and heat waves in Sao Paulo, Brazil. Son et al. 2016 Brazil (77)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, O3), humidity	P H	L	L	PL
<i>Associations of extreme temperatures with hospitalizations and post-discharge deaths for stroke: What is the role of pre-existing hyperlipidemia?. Xu et al. 2021 Australia (78)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2), humidity	PL	L	L	L
<i>Extreme ambient temperatures and cardiorespiratory emergency room visits: assessing risk by comorbid health conditions in a time</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, NO2, SO2, O3), humidity	P H	L	L	PL

<i>series study. Lavigne et al. 2014 Canada (79)</i>												
<i>The effect of ambient temperature on cardiovascular mortality in 27 Brazilian cities. Silveira et al. 2019 Brazil (80)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL
<i>Impact of ambient temperature on clinical visits for cardio-respiratory diseases in rural villages in northwest China. Zhao et al. 2018 China (81)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	PL	P H	P H	PH
<i>Physiological Equivalent Temperature Index and mortality in Tabriz (The northwest of Iran). Sharafkhani et al. 2018 Iran (82)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	PL	L	L	L
<i>Effect of different temperatures on hospital admissions for cardiovascular and cerebrovascular diseases: A case study. Xiong et al. 2015 China (83)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	P H	L	L	PL
<i>Short-term effect of extreme air temperature on hospital emergency room visits for cardiovascular diseases from 2009 to 2012 in Beijing, China. Ma et al. 2020 China (84)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, PM2.5), humidity	P H	L	L	PL
<i>Impact of extreme temperature on hospital admission in Shanghai, China. Ma et al. 2011 China (85)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	PL	PL
<i>Extreme temperature episodes and mortality in Yakutsk, East</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	P H	P H	PH

<i>Siberia. Revich et al. 2010 Russia (86)</i>												
<i>The lag effects and vulnerabilities of temperature effects on cardiovascular disease mortality in a subtropical climate zone in China. Huang et al. 2014 China (87)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	PL	PL
<i>Effects of extreme temperatures on cerebrovascular mortality in Lisbon: a distributed lag non-linear model. Rodrigues et al. 2019 Portugal (88)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10), humidity	P H	L	L	PL
<i>Heat or cold: Which One Exerts Greater Deleterious Effects on Health in a Basin Climate City? Impact of Ambient Temperature on Mortality in Chengdu, China. Cui et al. 2016 China (89)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	P H	L	L	PL
<i>Comparative assessments of mortality from and morbidity of circulatory diseases in association with extreme temperatures. Lin et al. 2020 Taiwan (90)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10), humidity	PL	L	L	L
<i>The impact of heat, cold, and heat waves on hospital admissions in eight cities in Korea. Son et al. 2014 South Korea (91)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL
<i>The impact of heat waves and cold spells on mortality rates in the Dutch population. Huynen et al. 2001 Netherlands (92)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	P H	PH

<i>Mortality Risk Attributed to Ambient Temperature in Nanjing, China. Zhang et al. 2019 China (93)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	PL	PL
<i>Temperature-related mortality in 17 large Chinese cities: How heat and cold affect mortality in China. Ma et al. 2014 China (94)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, SO2, NO2), humidity	P H	L	L	PL
<i>Increased coronary heart disease and stroke hospitalisations from ambient temperatures in Ontario. Bai et al. 2017 Canada (95)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, NO2, O3), humidity	PL	L	L	L
<i>Temperature, myocardial infarction, and mortality: Effect modification by individual-and area-level characteristics. Madrigano et al. 2013 United States (96)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, O3), humidity	P H	L	L	PL
<i>Short - term effects of temperature on hospital admissions for acute myocardial infarction: A comparison between two neighboring climate zones in Vietnam. Thu Dang et al. 2019 Vietnam (97)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	PL	L	PL
<i>Short-term effects of extreme temperatures on cause specific cardiovascular admissions in Beijing, China. Aklilu et al. 2020 China (98)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, SO2, NO2), humidity	P H	L	L	PL
<i>Association between ambient temperature and mortality risk and burden: time series study in 272 main Chinese cities. Chen et al. 2018 China (99)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	PL	L	P H	PL

<i>Impact of extreme temperatures on daily mortality in Madrid (Spain) among the 45-64 age-group. Díaz et al. 2006 Spain (100)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (NO _x , SO ₂ , O ₃), pollution	P H	L	L	PL
<i>Short-term exposure to extreme temperature and risk of hospital admission due to cardiovascular diseases. Mohammadi et al. 2021 Iran (101)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (defined as dust pollution), humidity	P H	L	L	PL
<i>Effects of temperature on mortality in Chiang Mai city, Thailand: a time series study. Guo et al. 2012 Thailand (102)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM ₁₀ , O ₃), humidity	P H	L	L	PL
<i>Association of cold temperature and mortality and effect modification in the subtropical plateau monsoon climate of Yuxi, China. Ding et al. 2016 China (103)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	PL	PL
<i>Short-term effects of air temperature on cause-specific cardiovascular mortality in Bavaria, Germany. Breitner et al. 2014 Germany (104)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM ₁₀ , O ₃), humidity	P H	L	L	PL
<i>Contrasting patterns of temperature related mortality and hospitalization by cardiovascular and respiratory diseases in 52 Spanish cities. Iniguez et al. 2021 Spain (105)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	P H	L	L	PL
<i>Years of life lost and mortality risk attributable to non-optimum temperature in Shenzhen: a time-series study. Li et al. 2021 China (106)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM ₁₀ , SO ₂ , NO ₂ , CO), humidity.	P H	PL	L	PL

<i>Extremely cold and hot temperatures increase the risk of ischaemic heart disease mortality: Epidemiological evidence from China. Guo et al. 2012 China (107)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2), humidity	P H	L	PL	PL
<i>Burden of cause-specific mortality attributable to heat and cold: A multicity time-series study in Jiangsu Province, China. Ma et al. 2020 China (108)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, PM2.5, CO, NO2, SO2, O3), humidity	PL	L	L	L
<i>Effects of ambient temperature on stroke hospital admissions: Results from a time-series analysis of 104,432 strokes in Guangzhou, China. Guo et al. 2017 China (109)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, SO2, NO2, O3), humidity	P H	L	L	PL
<i>A time series analysis of the relationship between apparent temperature, air pollutants and ischemic stroke in Madrid, Spain. Royé et al. 2019 Spain (110)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, SO2, NO2, O3), humidity	PL	L	L	L
<i>Extreme temperatures and out-of-hospital coronary deaths in six large Chinese cities. Chen et al. 2014 China (111)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	P H	L	L	PL
<i>Both low and high temperature may increase the risk of stroke mortality. Chen et al. 2013 China (112)</i>	Yes	Yes	Yes	No	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	P H	L	L	PL
<i>The impact of temperature extremes on mortality: a time-series study in Jinan, China. Han et al. 2017 China (113)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL
<i>Effects of extreme temperatures on years of life</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10,	P H	L	PL	PL

<i>lost for cardiovascular deaths: A time series study in Brisbane, Australia. Huang et al. 2012 Australia (114)</i>								NO2, O3), humidity				
<i>High temperatures enhanced acute mortality effects of ambient particle pollution in the "oven" city of Wuhan, China. Qian et al. 2008 China (115)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2, O3), humidity	P H	L	L	PL
<i>Effect of the interaction between outdoor air pollution and extreme temperature on daily mortality in Shanghai, China. Cheng et al. 2012 China (116)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2, O3), humidity	P H	L	PL	PL
<i>Temperature modulation of the adverse consequences on human mortality due to exposure to fine particulates: A study of multiple cities in China. Zhang et al. 2020 China (117)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5), humidity	P H	L	PL	PL
<i>Two-way effect modifications of air pollution and air temperature on total natural and cardiovascular mortality in eight European urban areas. Chen et al. 2018 Finland, Sweden, Denmark, Germany, Italy, Spain (118)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (particle number concentration, PM10, PM2.5, ozone)	L	L	L	L
<i>Excess deaths during the 2004 heatwave in Brisbane, Australia. Tong et al. 2010 Australia (119)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Ozone	P H	L	L	PL
<i>Mortality related to air pollution with the Moscow heat wave and wildfire of</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, ozone), temperature,	L	L	L	L

2010. Shaposhnikov et al. 2014 Russia (120)								relative humidity				
Effect of Ambient Temperature on Australian Northern Territory Public Hospital Admissions for Cardiovascular Disease among Indigenous and Non-Indigenous Populations. Webb et al. 2014 Australia (121)	Yes	Yes	Yes	Yes	No	Yes	Yes	Humidity	L	L	P H	PL
Impact of high temperatures on hospital admissions: comparative analysis with previous studies about mortality (Madrid). Linares et al. 2008 Spain (122)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NOx, SO2, O3), humidity	P H	L	PL	PL
Heat- and cold-stress effects on cardiovascular mortality and morbidity among urban and rural populations in the Czech Republic. Urban et al. 2014 Czech Republic (123)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
Influence of temperature to the short-term effects of various ozone metrics on daily mortality in Suzhou, China. Chen et al. 2013 China (124)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2, O3), humidity	PL	L	PL	PL
Risk of congenital heart defects after ambient heat exposure early in pregnancy. Auger et al. 2017. Canada (125)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	PL	P H	PL
Maternal Ambient heart exposure during early pregnancy in summer and spring and congenital heart defects - A large US population-based, case-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	PL	L	L

<i>control study. Lin et al. 2018. United States (126)</i>												
<i>Summertime extreme heat events and increased risk of acute myocardial infarction hospitalizations. Fisher et al. 2017. United States (127)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	PL	PL
<i>Physiological Equivalent Temperature (PET) index and cardiovascular hospital admissions in Ahvaz, southwest of Iran. Dastoorpoor et al. 2021 Iran(128)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	P H	L	L	PL
<i>Extreme Weather Conditions and Cardiovascular Hospitalizations in Southern Brazil. Costa et al. 2021 Brazil(129)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	P H	P H	PH
<i>Individual socioeconomic status as a modifier of the association between high ambient temperature and hospital admissions: a time series study in Hong Kong, 2010–2019. Guo et al. 2022 Hong Kong(130)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, NO2, SO2, O3), humidity	P H	L	L	PL
<i>Temporal changes in associations between high temperature and hospitalizations by greenspace: Analysis in the Medicare population in 40 U.S. northeast counties. Heo et al. 2021 United States(131)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5)	L	L	L	L
<i>Association of Extreme Heat and Cardiovascular Mortality in the United States: A</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	P H	PL

<i>County-Level Longitudinal Analysis From 2008 to 2017. Khatana et al. 2022 United States(132)</i>												
<i>Excess out-of-hospital cardiac arrests due to ambient temperatures in South Korea from 2008 to 2018. Park et al. 2021 South Korea(133)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Relative humidity	L	PL	L	L
<i>Short-Term Effects of Apparent Temperature on Cause-Specific Mortality in the Urban Area of Thessaloniki, Greece. Parliari et al. 2022 Greece(134)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	PL	PL
<i>Extreme temperatures and cardiovascular mortality: assessing effect modification by subgroups in Ganzhou, China. Zhang et al. 2021 China(135)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, PM10, CO, NO2, SO2, O3), humidity	P H	L	L	PL
<i>Attributing hypertensive life expectancy loss to ambient heat exposure: A multicenter study in eastern China. Pan et al. 2022 China(136)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, O3)	L	L	L	L
<i>The effect of air temperature on mortality from cerebrovascular diseases in Brazil between 1996 and 2017. Mascarenhas et al. 2022 Brazil(137)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	L	L	H	PH
<i>Effect of extreme hot and cold weather on cause-specific hospitalizations in Sweden: A time series analysis. Fonesca-Rodriguez et al. 2021 Sweden(138)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL

<i>The role of extreme temperature in cause-specific acute cardiovascular mortality in Switzerland: A case-crossover study. Saucy et al. 2021 Switzerland(139)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, NO2), humidit	L	L	PL	L
<i>Cardiac dyspnea risk zones in the South of France identified by geo-pollution trends study. Simoes et al. 2022 France(140)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, O3)	PL	L	PL	PL
<i>The effect of high temperatures on risk of hospitalization in northern Vietnam. Talukder et al. 2021 Vietnam(141)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	L	PL
<i>Risk of Heat-Related Mortality, Disease, Accident, and Injury Among Korean Workers: A National Representative Study From 2002 to 2015. Yoon et al. 2021 South Korea (142)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	PL	L	P H	PL
<i>The effect of absolute versus relative temperature on health and the role of social care. Masiero et al. 2021 Italy (143)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, CO, NO2, O3)	PL	L	PL	PL
<i>A comparison of the effect of diurnal temperature range and apparent temperature on cardiovascular disease among farmers in Qingyang, Northwest China. Zhai et al. 2021 China (144)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, PM10, SO2), humidity	P H	L	L	PL
<i>The Effect of high temperature on cause-specific Mortality in England and Wales. Gasparrini et al.2012 England, Wales (145)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	PL	L	PL	PL

<i>Heat waves, ambient temperature, and risk of myocardial infarction: an ecological study in the Community of Madrid. Garcia-Liedo et al. 2020 Spain (146)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	PL	P H	PH
<i>Associations Between Extreme Temperatures and Cardiovascular Cause-Specific Mortality: Results From 27 Countries. Alahmad et. al. 2023 Vietnam, Philippines, Thailand, Taiwan, Japan, South Korea, Kuwait, Iran, Cyprus, Italy, Spain, Portugal, Moldova, Switzerland, United Kingdom, Estonia, Finland, South Africa, Brazil, Paraguay, Ecuador, Uruguay, Panama, Costa Rica, Guatemala, United States, Canada (147)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, PM2.5, NO2, SO2, O3), humidity	P H	PL	PL	PL
<i>The effect of extreme temperature and precipitation on cause-specific deaths in rural Burkina Faso: a longitudinal study. Arisco et al. 2023. Burkina Faso (148)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Precipitation	P H	L	P H	PH
<i>Urban heat island impacts on heat-related cardiovascular morbidity: A time series analysis of older adults in US metropolitan areas. Cleland et al. 2023 United States (149)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	PL	L	PL	PL
<i>The joint and interaction effect of high temperature and humidity on mortality in</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10), humidity	PL	L	L	L

<i>China. Fang et al. 2023 China (150)</i>												
<i>Association between thermal stress and cardiovascular mortality in the subtropics. Jingsi et al. China 2023 (151)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, PM2.5, NO2, SO2)	PL	L	L	L
<i>Effect of Meteorological Factors, Air Pollutants on Daily Hospital Admissions for Ischemic Heart Disease in Lanzhou, China. Meng et al. 2023 China(152)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM 10, PM2.5, NO2, SO2, CO, O3) humidity	P H	PL	PL	PL
<i>Association of low and high ambient temperature with mortality for cardiorespiratory diseases in Brazil. Requia et al. 2023 Brazil(153)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, O3), humidity	L	PL	L	L
<i>Association of high ambient temperature with daily hospitalization for cardiorespiratory diseases in Brazil: A national time-series study between 2008 and 2018. Requia et al. 2023 Brazil(154)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, O3), humidity	P H	L	PL	PL
<i>The influence of heat and cold waves on mortality in Russian subarctic cities with varying climates. Revich et al. 2022 Russia(155)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	H	PL	P H	PH
<i>Effects of Temperature and Air Pollution on Emergency Ambulance Dispatches: A Time Series Analysis in a Medium-Sized City in Germany. Schneider et al. 2023 Germany(156)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, O3)	P H	L	PL	PL

<i>Non-optimal apparent temperature and cardiovascular mortality: the association in Puducherry, India between 2011 and 2020. Shrikhande et al. 2023 India.(157)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity, wind speed	PL	PL	PL	PL
<i>Heat waves and mortality in the Brazilian Amazon: Effect modification by heat wave characteristics, population subgroup, and cause of death. Silveira et al. 2023 Brazil.(158)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	L	PL	L
<i>Warm-season temperatures and emergency department visits among children with health insurance. Stowell et al. 2023 United States.(159)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	L	PL	L
<i>Effects of ambient temperature on mortality among elderly residents of Chengdu city in Southwest China, 2016–2020: a distributed-lag non-linear time series analysis. Xia et al. 2023 China.(160)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, PM2.5, NO2, SO2, O3), humidity	PL	L	PL	PL
<i>Extreme Temperature Events, Fine Particulate Matter, and Myocardial Infarction Mortality. Xu et al. 2023 China(161)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, NO2, SO2, CO, O3), Humidity	L	L	L	L
<i>The prenatal weekly temperature exposure and neonatal congenital heart disease: a large population-based observational study in China. Xu et al. 2023 China.(162)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM 2.5), humidity	P H	PL	PL	PH

<i>Cardiovascular mortality risks during the 2017 exceptional heatwaves in China. Yan et al. 2023 China.(163)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, O3), humidity	PL	L	PL	PL
<i>Assessment of short-term heat effects on cardiovascular mortality and vulnerability factors using small area data in Europe. Zhang et al. 2023 Norway, England, Wales, Germany.(164)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, O3)	L	PL	L	L
<i>Daytime and nighttime high temperatures differentially increased the risk of cardiovascular disease: A nationwide hospital-based study in China. Tao et al. 2023 China(165)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5), humidity	L	PL	PL	PL
<i>The interactive effects of extreme temperatures and PM2.5 pollution on mortalities in Jiangsu Province, China. Zhou et al. 2023 China(166)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5), Humidity	P H	L	PL	PL
<i>Potential impact of ambient temperature on maternal blood pressure and hypertensive disorders of pregnancy: A nationwide multicenter study based on the China birth cohort. Sun et al. 2023 China(167)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air Pollution (PM2.5, O3)	L	L	L	L
<i>The role of insurance status in the association between short-term temperature exposure and myocardial infarction hospitalizations in New York State. Flores et al. 2023 United States(168)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	L	PL	L

<i>Large sex differences in vulnerability to circulatory-system disease under current and future climate in Bucharest and its rural surroundings. Chitu et al. 2023 Romania(169)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	PL	L	P H	PL
<i>Association of Daily Mean Temperature and Temperature Variability With Onset Risks of Acute Aortic Dissection. Yu et al. 2021 China(170)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	P H	P H	L	PH
<i>Ambient temperature and activation of implantable cardioverter defibrillators. McGuinn et al. 2013 England (171)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10)	L	L	PL	L
<i>Weather-related Mortality: How Heat, Cold, and Heat Waves Affect Mortality in the United States. Anderson et al. 2009. United States (172)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, O3), humidity	L	L	L	L
EXTREME COLD												
<i>Excess cardiovascular mortality associated with cold spells in the Czech Republic. Kysely et al. 2009 Czech Republic (173)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
<i>Health impact of the 2008 cold spell on mortality in subtropical China: the climate and health impact national assessment study (CHINAs). Zhou et al. 2014 China (174)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	L	PL	PL
<i>Who is more vulnerable to death from extremely cold temperatures? A case-only approach in Hong Kong with</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, O3), humidity	P H	L	L	L

<i>a temperate climate. Qiu et al. 2016 China (175)</i>												
<i>Effect of cold spells and their modifiers on cardiovascular disease events: evidence from two prospective studies. Sartini et al. 2016 United Kingdom (176)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	PL	P H	PL
<i>Short-term effects of the 2008 cold spell on mortality in three subtropical cities in Guangdong Province, China. Xie et al. 2013 China (177)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, SO2), humidity	P H	L	L	PL
<i>The impact of the 2008 cold spell on mortality in Shanghai, China. Ma et al. 2013 China (178)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	P H	PH
<i>Acute and prolonged adverse effects of temperature on mortality from cardiovascular diseases. Lin et al. 2013 Taiwan (179)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM10, NO2, O3), humidity	PL	L	L	L
<i>Cardiovascular Health Peaks and Meteorological Conditions: A Quantile Regression Approach. Chiu et al. 2021 Canada(180)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	L	P H	PL
<i>Association of ambient temperature and acute heart failure with preserved and reduced ejection fraction. Jimba et al. 2022 Japan(181)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	P H	PL	PH
<i>Weather Impact on Acute Myocardial Infarction Hospital Admissions With a New Model for Prediction: A Nationwide Study. Li et al. 2021 Taiwan(182)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	L	L	PL	L

<i>Atmospheric features and risk of ST-elevation myocardial infarction in Porto (Portugal): A temperate Mediterranean (Csb) city. Vieira et al. 2021 Portugal(183)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Humidity	P H	PL	P H	PH
<i>Extreme cold weather and circulatory diseases of older adults: A time-stratified case-crossover study in jinan, China. Du et al. 2022. China (184)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, NO2, SO2, O3), humidity	P H	L	L	PL
<i>Cold Spells and the Onset of Acute Myocardial Infarction: A Nationwide Case-Crossover Study in 323 Chinese Cities. Jiang et al. China 2023(185)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, NO2, SO2, CO, O3), humidity	P H	P H	PL	PH
<i>Impacts of birthplace and complications on the association between cold exposure and acute myocardial infarction morbidity in the Migrant City: A time-series study in Shenzhen, China. Peng et al. 2022 China(186)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, NO2, SO2, O3), humidity	PL	L	PL	PL
<i>Low ambient temperature increases the risk and burden of atrial fibrillation episodes: A nationwide case-crossover study in 322 Chinese cities. Zhu et al. 2023 China(187)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air pollution (PM2.5, NO2, SO2, CO), humidity	P H	P H	L	PH
GROUND-LEVEL OZONE												
<i>Acute Effects of Ozone on Mortality from the “Air Pollution and Health: A European Approach” Project.</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity,	PL	L	L	L

<i>Gryparis et al. 2004 Greece, Spain, Switzerland, United Kingdom, Hungary, Finland, Germany, Slovenia, France, Italy, Netherlands, Czech Republic, Sweden, Israel (188)</i>								SO2, NO2, CO				
<i>Seasonal variation in the acute effects of ozone on premature mortality among elderly Japanese. Ng et al. 2013 Japan(189)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature SO2, NO2, PM2.5	L	L	L	L
<i>Temporal trends in associations between ozone and circulatory mortality in age and sex in Canada during 1984– 2012. Shin et al. 2020 Canada(190)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>Seasonal association between ambient ozone and mortality in Zhengzhou, China. Qin et al. 2017 China(191)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Associations between air pollution and outpatient visits for arrhythmia in Hangzhou, China. Wang et al. 2020 China(192)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	P H	L	PL
<i>Air pollution and daily mortality in London: 1987-92. Anderson et al. 1996 United Kingdom (193)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L
<i>Short-term associations between emergency hospital admissions for respiratory and cardiovascular disease and outdoor air pollution in London. Atkinson et al. 1999 United Kingdom (194)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Long-Term Exposure to Outdoor Air Pollution and</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	L	L

<i>Incidence of Cardiovascular Diseases. Atkinson et al. 2013 United Kingdom (195)</i>												
<i>Air pollution and cardiovascular admissions association in Spain: results within the EMECAS project. Ballester et al. 2006 Spain (196)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, barometric pressure	L	L	L	L
<i>Air pollution and emergency hospital admissions for cardiovascular disease in Valencia, Spain. Ballester et al. 2001 Spain (197)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Ozone and short-term mortality in 95 US urban communities, 1987-2000. Bell et al. 2004 United States (198)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point	L	L	L	L
<i>The effects of hourly differences in air pollution on the risk of myocardial infarction: Case crossover analysis of the MINAP database. Bhaskaran et al. 2011 United Kingdom (199)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	PL	L	L
<i>Mortality and ambient fine particles in southwest Mexico City, 1993-1995. Borja-Aburto et al. 1998 Mexico (200)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, rainfall	PL	L	L	L
<i>Air pollution and the incidence of ischaemic and haemorrhagic stroke in the South London Stroke Register: a case-cross-over analysis. Butland et al. 2017 United Kingdom (201)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	PL	L	PL
<i>Do gender, education, and income modify the effect of air</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative	L	L	L	L

<i>pollution gasses on cardiac disease? Cackmak et al. 2006 Canada (202)</i>								humidity, barometric pressure				
<i>Air pollution and hospital admissions for cardiovascular disease in Taipei, Taiwan. Chang et al. 2005 Taiwan (203)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Air pollution and hospital admissions for myocardial infarction in a tropical city: Kaohsiung, Taiwan. Cheng et al. 2009 Taiwan (204)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Short-term effects of ozone air pollution on hospital admissions for myocardial infarction: A time-stratified case-crossover study in Taipei. Chiu et al. 2017 Taiwan (205)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Airborne pollutants and lacunar stroke: A case cross-over analysis on stroke unit admissions. Corea et al. 2012 Italy (206)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , barometric pressure	L	PL	L	L
<i>Short-term association between exposure to ozone and mortality in Oporto, Portugal. deAlmeida et al. 2011 Portugal (207)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>Short-term effect of tropospheric ozone on daily mortality in Spain. Diaz et al. 2018 Spain (208)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>A case-crossover analysis of out-of-hospital cardiac arrest and air pollution. Ensor et al. 2013 United States (209)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Apparent temperature	L	PL	L	L

<i>Short-term effect of fine particulate matter (PM_{2.5}) and ozone on daily mortality in Lisbon, Portugal. Garrett et al. 2011 Portugal (210)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>Ozone exposure and cardiovascular-related mortality in the Canadian Census Health and Environment Cohort (CANHEC) by spatial synoptic classification zone. Cakmak et al. 2016 Canada (211)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Climate zone	L	L	L	L
<i>Lag time structure of cardiovascular deaths attributed to ambient air pollutants in Ahvaz, Iran, 2008-2015. Dastoorpoor, et al. 2018 Iran (212)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature, relative humidity	L	L	L	L
<i>Estimating short-term mortality benefits associated with a reduction in tropospheric ozone. Farzad, et al. 2021 Iran (213)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature, relative humidity	L	PL	L	L
<i>Air pollution and mortality in The Netherlands: are the elderly more at risk? Fischer et al. 2003 The Netherlands (214)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature, relative humidity	L	L	L	L
<i>Associations between daily cause-specific mortality and concentrations of ground-level ozone in Montreal, Quebec. Goldberg et al. 2001 Canada (215)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Visibility, barometric pressure, temperature, total precipitation (distinguishing snow from rain),	L	L	L	L

								relative humidity, and dew point temperature				
<i>The association between air pollution and mortality in Thailand. Guo et al. 2014 Thailand (216)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Short-term effects of ozone air pollution on ischaemic stroke occurrence: A case-crossover analysis from a 10-year population-based study in Dijon, France. Henrotin et al. 2007 France (217)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	PL	L	L
<i>Evidence of the role of short-term exposure to ozone on ischaemic cerebral and cardiac events: The Dijon Vascular project (DIVA). Henrotin et al. 2010 France (218)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	PL	L	PL
<i>Air pollution and hospitalization due to angina pectoris in Tehran, Iran: A time-series study. Hosseinpour et al. 2005 Iran (219)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Air pollution and hospital admissions for myocardial infarction in a subtropical city: Taipei, Taiwan. Hsieh et al. 2010 Taiwan (220)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Gaseous air pollution and the risk for stroke admissions: A case-crossover study in Beijing, China. Huang et al. 2017 China (221)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L

<i>A case-crossover study on the effects of short-term exposure to moderate levels of air pollution on the risk of heart failure. Huschmann et al. 2020 Germany (222)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	L	L
<i>Association between long-term exposure to air pollutants and cardiopulmonary mortality rates in South Korea. Hwang et al. 2020 South Korea (223)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	L	L	P H	PL
<i>Long-Term Ozone Exposure and Mortality. Jarrett et al. 2009 United States and Canada (224)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
<i>Season, sex, age, and education as modifiers of the effects of outdoor air pollution on daily mortality in Shanghai, China: The Public Health and Air Pollution in Asia (PAPA) Study. Kan et al. 2008 China (225)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Long-term ozone exposures and cause-specific mortality in a US Medicare cohort. Kazemiparkouhi et al. 2020 United States (226)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , NO2, PM2.5	L	L	L	L
<i>Association of short- and long-term exposure to air pollution with atrial fibrillation. Kwon et al. 2019 South Korea (227)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Short-term effects of air pollution on mortality in nine French cities: A quantitative summary. LaTertre et al. 2002 France (228)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L

<i>Ambient ozone pollution and years of life lost: Association, effect modification, and additional life gain from a nationwide analysis in China. Li et al. 2020 China (229)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Gaseous air pollution and acute myocardial infarction mortality in Hong Kong: A time-stratified case-crossover study. Lin et al. 2013 China (230)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Ambient air pollution and risk for ischemic stroke and transient ischemic attack. Lisabeth et al. 2008 United States (231)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	PL	L	L
<i>Air pollution and mortality in the Canary Islands: a time-series analysis. Lopez-Villarrubia et al. 2010 Spain (232)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, barometric pressure	L	L	L	L
<i>Association of air quality with respiratory and cardiovascular morbidity rate in Delhi, India. Maji et al. 2018 India (233)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	P H	L	PL
<i>Association of long-term exposure to particulate matter and ozone with health status and mortality in patients after myocardial infarction. Malik et al. 2019 United States (234)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
<i>Impact of Obesity and Ozone on the Association Between Particulate Air Pollution and Cardiovascular Disease and Stroke Mortality Among US</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L

<i>Adults. Mazidi et al. 2018 United States (235)</i>												
<i>Short-term exposure to ambient ozone and stroke hospital admission: A case- crossover analysis. Montresor-Lopez et al. 2016 United States (236)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	PL	L	L	L
<i>Ambient air pollution and hospitalization for congestive heart failure among elderly people in seven large US cities. Morris et al. 1995 United States (237)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>Environmental pollutants and stroke-related hospital admissions. Nascimento et al. 2012 Brazil(238)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	PL	P H	L	PL
<i>Ozone short-term exposure and acute coronary events: A multicities study in Tuscany 5/21/2024 12:35:00 PM(Italy). Nuvolone et al. 2013 Italy (239)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Apparent temperature	L	L	L	L
<i>Estimation of short-term effects of air pollution on stroke hospital admissions in Southern Sweden. Oudin et al. 2010 Sweden (240)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	PL	L	L
<i>Ozone air pollution and daily mortality in Genoa, Italy between 1993 and 1996. Parodi et al. 2005 Italy(241)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Ozone and short-term mortality in nine French cities: Influence of temperature and season. Pascal et al. 2012 France (242)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L

<i>Ambient air pollution and cardiovascular emergency department visits in potentially sensitive groups. Peel et al. 2007 United States (243)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point	L	L	L	L
<i>Ambient Air Pollution and Cardiovascular Emergency Department Visits. Metzger et al. 2004 United States (244)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point	L	PL	L	L
<i>Mortality and air pollution in Helsinki. Ponka et al. 1998 Finland (245)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Low-level air pollution and hospital admissions for cardiac and cerebrovascular disease in Helsinki. Ponka et al. 1996 Finland (246)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Short-Term Effects of Gaseous Pollutants on Cause-Specific Mortality in Wuhan, China. Qian et al. 2007 China (247)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Gender-specific differences of interaction between obesity and air pollution on stroke and cardiovascular diseases in Chinese adults from a high pollution range area: A large population based cross sectional study. Qin et al. 2015 China (248)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	H	P H	PH
<i>Inverse probability weight distributed lag effects of short-term exposure to PM(2.5) and ozone on CVD hospitalizations in New England Medicare participants – Exploring the</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L

<i>causal effects. Qiu et al. 2020 United States (249)</i>												
<i>Susceptibility to short-term ozone exposure and cardiovascular and respiratory mortality by previous hospitalizations. Raza et al. 2018 Sweden (250)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Modifiers of short-term effects of ozone on mortality in eastern Massachusetts—a case-crossover analysis at individual level. Ren et al. 2010 United States (251)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>Temperature enhanced effects of ozone on cardiovascular mortality in 95 large US communities, 1987-2000: Assessment using the NMMAPS data. Ren et al. 2009 United States (252)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>Ozone modifies associations between temperature and cardiovascular mortality: Analysis of the NMMAPS data. Ren et al. 2008 United States (253)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>The effects of particulate and ozone pollution on mortality in Moscow, Russia. Revich et al. 2010 Russia (254)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , PM10	L	L	L	L
<i>A case-crossover analysis of particulate air pollution and cardiac arrhythmia patients with implantable cardiac defibrillators. Rich et al. 2004 Canada (255)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , barometric pressure, wind speed, relative humidity	L	PL	L	L

<i>Association of ozone and particulate air pollution with out-of-hospital cardiac arrest in Helsinki, Finland: Evidence for two different etiologies. Rosenthal et al. 2013 Finland (256)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	PL	L	PL
<i>Ozone Air Pollution Is Associated With Acute Myocardial Infarction. Ruidavets et al. 2005 France (257)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	PL	L	L
<i>A Combined Analysis of the Short-Term Effects of Photochemical Air Pollutants on Mortality within the EMECAM Project. Saez et al. 2002 Spain (258)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	PL	L	L
<i>Association between ambient air pollution and hospitalization caused by atrial fibrillation. Salfipour et al. 2019 Iran (259)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point, windspeed	L	PL	L	L
<i>The Temporal Pattern of Mortality Responses to Ambient Ozone in the APHEA project. Samoli et al. 2009 Greece, Spain, Switzerland, United Kingdom, Hungary, Finland, Slovenia, France, Italy, Netherlands, Czech Republic, Sweden (260)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Long-Term Effect of Outdoor Air Pollution on Mortality and Morbidity: A 12-Year Follow-Up Study for Metropolitan France. Sanyal et al. 2018 France (261)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	NO2, PM2.5, PM10	L	L	P H	PL

<i>Ambient particulate air pollution and cardiac arrhythmia in a panel of older adults in Steubenville, Ohio. Sarnat et al. 2016 United States (262)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Apparent temperature	PL	L	L	L
<i>Air Pollution and Hospital Admissions for Cardiovascular Disease in Tucson. Schwartz, 1997 United States (263)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Air Pollution and Hospital Admissions for Cardiovascular Disease in Detroit, Michigan. Schwartz et al. 1995 United States (264)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>The Effects of Air Pollution on Cardiovascular and Respiratory Causes of Emergency Admission. Shahi et al. 2014 Iran (265)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature, wind speed, humidity	L	H	L	PH
<i>Air Health Trend Indicator: Association between Short-Term Exposure to Ground Ozone and Circulatory Hospitalizations in Canada for 17 Years, 1996–2012. Shin et al. 2018 Canada (266)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>Ambient air pollution and the risk of atrial fibrillation and stroke: A population based cohort study. Shin et al. 2019 Canada (267)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	PL	PL	PL
<i>Modification Effects of Temperature on the Ozone-Mortality Relationship: A Nationwide Multicounty Study in China. Shi et al. 2020 China (268)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L

<i>Association between outdoor air pollution and daily mortality in Brisbane, Australia. Simpson et al. 1997 Australia (269)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Ambient air pollutants and risk of fatal coronary heart disease among kidney transplant recipients. Spencer-Huang et al. 2011 United States (270)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PM10	PL	L	PL	PL
<i>Short-term effects of air pollutants on daily mortality in the Stockholm county - A spatiotemporal analysis. Stafoggia et al. 2020 Sweden (271)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	PL	L	L	L
<i>Susceptibility factors to ozone-related mortality: A population-based case-crossover analysis. Stafoggia et al. 2010 Italy (272)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Apparent temperature, barometric pressure	L	L	L	L
<i>Acute effect of multiple ozone metrics on mortality by season in 34 Chinese counties in 2013-2015. Sun et al. 2018 China (273)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Short-term exposure to air pollution and incidence of stroke in the Women's Health Initiative. Sun et al. 2019 United States (274)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point temperature	L	L	L	L
<i>Air pollutants and outpatient visits for cardiovascular disease in a severe haze-fog city: Shijiazhuang, China. Tan et al. 2019 China (275)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>An outbreak of cardiovascular syndromes requiring urgent</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Air temperature,	PL	L	L	L

<i>medical treatment and its association with environmental factors: an ecological study. Turnet et al. 2007 Australia (276)</i>								dew point temperature, relative humidity, pressure, wind speed and direction, precipitation , solar radiation				
<i>Risk assessment for cardiovascular and respiratory mortality due to air pollution and synoptic meteorology in 10 Canadian cities. Vanos et al. 2014 Canada (277)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
<i>Air Pollution and Daily Mortality in a City with Low Levels of Pollution. Vedral et al. 2003 Canada (278)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, barometric pressure, rainfall	L	L	L	L
<i>Ambient Air Pollution Is Associated With Increased Risk of Hospital Cardiac Readmissions of Myocardial Infarction Survivors in Five European Cities. Von Klot et al. 2005 Germany, Spain, Finland, Italy, Sweden (279)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, barometric pressure	L	L	L	L
<i>Air Pollution and Acute Myocardial Infarction Hospital Admission in Alberta, Canada: A Three-Step Procedure Case-Crossover Study. Wang et al. 2015 Canada (280)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , apparent temperature, dew point temperature wind speed	L	L	L	L

<i>Particulate Air Pollution and the Rate of Hospitalization for Congestive Heart Failure among Medicare Beneficiaries in Pittsburgh, Pennsylvania. Wellenius et al. 2005 United States (281)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , apparent temperature, barometric pressure	L	L	L	L
<i>Ethnic Differences in Ambient Air Pollution and Risk of Acute Ischemic Stroke. Wing et al. 2015 United States (282)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L
<i>The Effects of Air Pollution on Mortality in Socially Deprived Urban Areas in Hong Kong, China. Wong et al. 2008 China (283)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>A national case-crossover study on ambient ozone pollution and first-ever stroke among Chinese adults: Interpreting a weak association via differential susceptibility. Xue et al. 2019 China (284)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, PM2.5	L	PL	L	L
<i>Association between Ozone Exposure and Onset of Stroke in Allegheny County, Pennsylvania, USA, 1994–2000. Xu et al. 2013 United States (285)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L
<i>Air Pollution and Hospital Admissions for Congestive Heart Failure in a Subtropical City: Taipei, Taiwan. Yang et al. 2008 Taiwan (286)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L

<i>Relationship Between Ambient Air Pollution and Hospital Admissions for Cardiovascular Diseases in Kaohsiung, Taiwan. Yang et al. 2004 Taiwan (287)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Particulate air pollution on cardiovascular mortality in the tropics: impact on the elderly. Yap et al. 2019 Singapore (288)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Ambient Ozone Pollution and Daily Mortality: A Nationwide Study in 272 Chinese Cities. Yin et al. 2017 China (289)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Air pollution and emergency admissions in Boston, MA. Zanobetti et al. 2006 United States (290)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point temperature	L	L	L	L
<i>Short-Term Effects of Air Pollution on Mortality in the Cities of Rouen and Le Havre, France, 1990-1995. Zeghnoun et al. 2001 France (291)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point temperature	L	L	L	L
<i>Short-term exposure to ambient air pollution and acute myocardial infarction attack risk. Zheng et al. 2020 China (292)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Time-Series Analysis of Air Pollution and Cause-Specific Mortality. Zmirou et al.1998 United Kingdom, France, Spain, Italy, Poland, Slovakia (293)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Short-Term Effects of PM10, NO2, SO2 and O3 on Cardio-Respiratory Mortality in Cape Town, South Africa, 2006–</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L

2015. Adebayo-Ojo et al. 2022 South Africa(294)												
Impact of environmental pollution and weather changes on the incidence of ST-elevation myocardial infarction. Biondi-Zoccai et al. 2020 Italy(295)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , atmospheric pressure, humidity, rainfall	PL	PL	L	PL
Ambient Air Pollution and Risk for Stroke Hospitalization: Impact on Susceptible Groups. Chang et al. 2022 Taiwan(296)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
Temperature-Modified Acute Effects of Ozone on Human Mortality — Beijing Municipality, Tianjin Municipality, Hebei Province, and Surrounding Areas, China, 2013–2018. Chen et al. 2021 China(297)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
Hourly air pollution exposure and emergency department visit for acute myocardial infarction: Vulnerable populations and susceptible time window. Cheng et al. 2021 Australia(298)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
Ambient Air Pollution and Hospitalizations for Ischemic Stroke: A Time Series Analysis Using a Distributed Lag Nonlinear Model in Chongqing, China. Chen et al. 2021 China(299)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
Ambient gaseous pollutants and emergency ambulance calls for all-cause and cause-specific diseases in China:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	P H	L	PL

<i>a multicity time-series study. Chen et al. 2021 China(300)</i>												
<i>Particulate matter and ozone might trigger deaths from chronic ischemic heart disease. Chen et al. 2022 China(301)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature, humidity, PM2.5, PM10, sulfur dioxide, nitrogen dioxide, carbon monoxide	L	L	L	L
<i>Hourly Air Pollutants and Acute Coronary Syndrome Onset in 1.29 Million Patients. Chen et al. 2022 China(302)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature, humidity	L	L	L	L
<i>Short-term ambient air pollution exposure and risk of atrial fibrillation in patients with intracardiac devices. Dahlquist et al. 2022 Sweden(303)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	P H	PL	L	PL
<i>Long-Term Association of Air Pollution and Hospital Admissions Among Medicare Participants Using a Doubly Robust Additive Model. Danesh Yazdi et al. 2021 United States(304)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PM2.5, nitrogen dioxide	L	L	L	L
<i>The effect of long-term exposure to air pollution and seasonal temperature on hospital admissions with cardiovascular and respiratory disease in the United States: A difference-in-differences analysis. Danesh Yazdi et al. 2022 United States(305)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PM2.5, sulfur dioxide, nitrogen dioxide	L	L	L	L

<i>Long-term exposure to PM2.5 and ozone and hospital admissions of Medicare participants in the Southeast USA. Danesh Yazdi et al. 2019 United States (306)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	L	L
<i>Out-of-hospital cardiac arrest and ambient air pollution: A dose-effect relationship and an association with OHCA incidence. Gentile et al. 2021 Italy(307)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	PL	L	L
<i>Disentangling the effects of air pollutants with many instruments. Godzinski et al. 2021 France(308)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, rainfall, wind strength, sunshine, presence of snow	L	PL	L	L
<i>Air pollution and outpatient visits for cardiovascular and cerebrovascular diseases: A time-series analysis in Luoyang, China. Guo et al. 2021 China(309)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, pressure and wind speed)	L	L	L	L
<i>Long-Term Exposure to Air Pollution and Incidence of Venous Thromboembolism in the General Population: A Population-Based Retrospective Cohort Study. Gwon et al. 2022 South Korea(310)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Interactive short-term effects of meteorological factors and air pollution on hospital admissions for cardiovascular</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L

<i>diseases. He et al. 2021 China(311)</i>												
<i>Association of ambient air pollution with risk of hemorrhagic stroke: A time-stratified case crossover analysis of the Singapore stroke registry. Ho et al. 2022 Singapore(312)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, rainfall	L	L	L	L
<i>Association of air pollution with acute ischemic stroke risk in Singapore: a time-stratified case-crossover study. Ho et al. 2021 Singapore(313)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, rainfall	L	L	L	L
<i>Correlation between air temperature, air pollutants, and the incidence of coronary heart disease in Liaoning Province, China: a retrospective, observational analysis. Huang et al. 2021 China(314)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , sulfur dioxide, nitrogen dioxide	L	L	L	L
<i>The association between ambient air pollution and birth defects in five major ethnic groups in Liuzhou, China. Huang et al. 2021 China(315)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PM2.5, PM10, sulfur dioxide, nitrogen dioxide, carbon monoxide	L	PL	L	L
<i>Effects of Short-Term Air Pollution Exposure on Venous Thromboembolism. Johnson et al. United States(316)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	PL	L	L
<i>Short and long term exposure to air pollution increases the risk of ischemic heart disease. Kim et al. 2021 South Korea(317)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, PM10, sulfur	L	L	L	L

								dioxide, nitrogen dioxide, carbon monoxide				
<i>Air pollution and cardiovascular disease hospitalization – Are associations modified by greenness, temperature and humidity? Klompaker et al. 2021 United States(318)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Air pollution and risk of respiratory and cardiovascular hospitalizations in a large city of the Mekong Delta Region. Le et al. 2022 Vietnam (319)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, rainfall	L	L	L	L
<i>Short-term exposure to air pollution and hospital admission for heart failure among older adults in metropolitan cities: a time-series study. Lee et al. 2020 South Korea (320)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Association between Particulate Matter Pollution Concentration and Hospital Admissions for Hypertension in Ganzhou, China. Li et al. 2022 China(321)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, PM2.5, PM10, sulfur dioxide, nitrogen dioxide, carbon monoxide	L	L	L	L
<i>Short-term exposure to six air pollutants and cause-specific cardiovascular mortality of nine counties or districts</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L

<i>in Anhui Province, China. Li et al. 2022 China(322)</i>												
<i>Synergistic effects of gaseous pollutants on hospital admissions for cardiovascular disease in Liuzhou, China. Liu et al. 2021 China (323)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L
<i>Ambient air pollution and the risk of acute myocardial infarction and stroke: A national cohort study. Olaniyan et al. 2021 Canada(324)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	PL
<i>Association between short-term exposure to ambient air pollution and hospital admissions for transient ischemic attacks in Beijing, China. Zhang et al. 2020 China(325)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Associations between congenital heart disease and air pollutants at diferent gestational weeks: a time-series analysis. Zhang et al. 2022 China(326)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>Associations between ambient air pollution, meteorology, and daily hospital admissions for ischemic stroke: a time-stratified case-crossover study in Beijing. Zhao et al. 2021 China(327)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, atmospheric pressure (only included in multi-pollutant models)	L	L	PL	L
<i>Short-term exposure to ambient air pollution and atrial fibrillation</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L

<i>hospitalization: A time-series study in Yancheng, China; Fang et al. 2021 China(328)</i>												
<i>Short-Term Effects of Air Pollution on Cardiovascular Hospitalizations in the Pisan Longitudinal Study. Fasola et al. 2021 Italy(329)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>The association between ozone and ischemic stroke morbidity among patients with type 2 diabetes in Beijing, China. Liu et al. 2021 China(330)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	PL	L	L	L
<i>Short-Term Exposure to Ambient Air Pollution and Mortality From Myocardial Infarction. Liu et al. 2021 China(331)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point temperature	L	L	L	L
<i>ST-elevation myocardial infarction associated with air pollution levels in Mexico City. Lozano-Sabido et al. 2021 Mexico(332)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , atmospheric pressure	L	PL	L	L
<i>The Impact of Air Quality on Cardiovascular Disease in Shanghai. Lu et al. 2022 China(333)</i>	Yes	Yes	Yes	Yes	No	Yes	Yes	Temperature , atmospheric pressure	L	P H	PL	PL
<i>Association between Atrial Fibrillation Incidence and Temperatures, Wind Scale and Air Quality: An Exploratory Study for Shanghai and Kunming. Lu et al. 2021 China(334)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , wind force	L	L	L	L
<i>Short-term effects of main air pollutants exposure on LOS and costs of CVD hospital admissions from 30,959 cases</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, air pressure,	PL	L	L	L

<i>among suburban farmers in Pingliang, Northwest China. Zha et al. 2022 China(335)</i>								precipitation , air velocity				
<i>Long-Term Exposure to Ozone and Fine Particulate Matter and Risk of Premature Coronary Artery Disease: Results from Genetics of Atherosclerotic Disease Mexican Study. Posadas-Sánchez et al. 2022 Mexico(336)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, PM2.5, wind velocity	L	L	L	L
<i>Emergency hospital admissions for cardiovascular diseases attributed to air pollution in Tehran during 2016-2019. Sepandi et al. 2021 Iran(337)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, windspeed	L	L	L	L
<i>Sex-difference in air pollution-related acute circulatory and respiratory mortality and hospitalization. Shin et al. 2021 Canada(338)</i>	Yes	Yes	Yes	Yes	No	Yes	Yes	Temperature	L	L	L	L
<i>Association between long-term exposure to ambient air pollution and clinical outcomes among patients with heart failure: Findings from the China PEACE Prospective Heart Failure Study. Zhang et al. 2021 China(339)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	P H	PL
<i>Short-term exposure to air pollution and occurrence of emergency stroke in Chongqing, China. Tang et al. 2020 China(340)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , wind speed, rainfall	L	L	L	L

<i>Outpatient Department Visits and Mortality with Various Causes Attributable to Ambient Air Pollution in the Eastern Economic Corridor of Thailand. Thongphunchung et al. 2022 Thailand(341)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Short term exposure to ambient air pollutants and cardiovascular emergency department visits in Mexico City. Ugalde-Resano et al. 2022 Mexico(342)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Impact of weather and pollution on the rate of cerebrovascular events in a large metropolitan area. Versaci et al. 2022 Italy(343)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, atmospheric pressure, rainfall, and pollution (carbon monoxide, nitrogen dioxide, nitrogen oxides, ozone, PM2.5, PM10	PL	PL	L	PL
<i>Short-Term Association of Air Pollutant Levels and Hospital Admissions for Stroke and Effect Modification by Apparent Temperature: Evidence From Shanghai, China. Weng et al. 2021 China(344)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Long-term exposure to low-level ambient air pollution and incidence of stroke and</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	L	L

<i>coronary heart disease: a pooled analysis of six European cohorts within the ELAPSE project. Wolf et al. 2021 Germany(345)</i>												
<i>A Time-Series Study for Effects of Ozone on Respiratory Mortality and Cardiovascular Mortality in Nanchang, Jiangxi Province, China. Wu et al. 2022 China(346)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Association of short-term exposure to air pollution with recurrent ischemic cerebrovascular events in older adults. Xu et al. 2022 China(347)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Association of short-term exposure to ambient air pollution with mortality from ischemic and hemorrhagic stroke. Xu et al. 2022 China (348)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L
<i>Ambient air pollution and cerebrovascular disease mortality: an Ecological time-series study based on 7-year death records in central China. Yan et al. 2021 China(349)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Rural-urban differences in associations between air pollution and cardiovascular hospital admissions in Guangxi, southwest China. Zhang et al. 2022 China(350)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Air pollution and recurrence of cardiovascular events after</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	P H	L	PL

<i>ST-segment elevation myocardial infarction. Zhang et al. 2021 China(351)</i>												
<i>Acute effect of air pollutants' peak-hour concentrations on ischemic stroke hospital admissions among hypertension patients in Beijing, China, from 2014 to 2018. Zhao et al. 2022 China(352)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Association between ambient air pollution and daily hospital visits for cardiovascular diseases in Wuhan, China: a time-series analysis based on medical insurance data. Meng et al. 2022 China(353)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	PL	L	L
<i>Long-term ozone exposure and mortality in a large prospective study. Turner et al. 2016 United States(354)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>Exposure to ambient air pollution and the incidence of congestive heart failure and acute myocardial infarction: A population-based study of 5.1 million Canadian adults living in Ontario. Bai et al. 2019 Canada(355)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
<i>Short-term effects of ambient ozone exposure on daily hospitalizations for circulatory diseases in Ganzhou, China: A time-series study. Cao et al. 2023 China(356)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, NO ₂ , PM2.5, PM10, CO, SO ₂	L	L	L	L

<i>Short-term residential exposure to air pollution and risk of acute myocardial infarction deaths at home in China. Cheng et al. 2023 China(357)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	PL	L	L	L
<i>Short-term association between ambient air pollution and cardio-respiratory mortality in Rio de Janeiro, Brazil. Cortes et al. 2023. Brazil(358)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Acute Gaseous Air Pollution Exposure and Hospitalizations for Acute Ischemic Stroke: A Time-Series Analysis in Tianjin, China. Cui et al. 2022. China(359)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Assessment of Low-Level Air Pollution and Cardiovascular Incidence in Gdansk, Poland: Time-Series Cross-Sectional Analysis. Czernych et al. 2023. Poland(360)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, atmospheric pressure, rainfall, wind strength	L	L	L	L
<i>Short-term effects of air pollution on hospital admissions for cardiovascular diseases and diabetes mellitus in Sofia, Bulgaria (2009–2018). Dzhambov et al. 2023. Bulgaria(361)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	P H	L	L	PL
<i>Association between air pollution exposure and coronary heart disease hospitalization in a humid sub-tropical region of China: A time-series study. Feng et al. 2022 China (362)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity NO2, CO, SO2, PM2.5, PM10,	L	L	L	L

<i>Effect of short-term exposure to air pollution on daily cardio- and cerebrovascular hospitalisations in areas with a low level of air pollution. Hasnain et al. 2023 Australia (363)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , rainfall	L	L	L	L
<i>Association between Air Pollution and Short-Term Outcome of ST-Segment Elevation Myocardial Infarction in a Tropical City, Kaohsiung, Taiwan. Huang et al. 2023 China (364)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, PM10, PM2.5, NO2	L	L	L	L
<i>Association between air pollutants and birth defects in Xiamen, China. Huang et al. 2023 China (365)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	SO2, PM2.5, NO2, CO	L	PL	L	L
<i>Short-term effects of ambient oxidation and its interaction with fine particles on first-ever stroke: A national case-crossover study in China. Jiang et al. 2023 China (366)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, PM2.5	PL	PL	L	PL
<i>Ozone pollution and hospital admissions for cardiovascular events. Jiang et al. 2023 China(367)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, PM2.5, PM10, NO2, SO2, CO	L	L	L	L
<i>Associations between long-term air pollution exposure and the incidence of cardiovascular diseases among American older adults. Jin et al. 2022 United States (368)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Air pollution impacts on in-hospital case-fatality rate of</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	L	L

<i>ischemic stroke patients. 2023 Keller et al. Germany (369)</i>												
<i>Long-term exposure to ambient ozone and cardiovascular diseases: Evidence from two national cohort studies in China. Liang et al. 2023 China (370)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	PM2.5	P H	PL	L	PL
<i>Air pollution and stroke hospitalization in the Beibu Gulf Region of China: A case-crossover analysis. Li et al. 2023 China (371)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	PL	L	L	L
<i>Joint Associations of Short-Term Exposure to Ambient Air Pollutants with Hospital Admission of Ischemic Stroke. Liu et al. 2023 China.(372)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	PL	L	L
<i>Causal Associations of Air Pollution With Cardiovascular Disease and Respiratory Diseases Among Elder Diabetic Patients. Li et al. 2023 China.(373)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, PM1, PM2.5, PM10, SO2, NO2, CO	PL	L	L	L
<i>Hourly Air Pollution Exposure and Emergency Hospital Admissions for Stroke: A Multicenter Case-Crossover Study. Lv et al. 2023 China (374)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, season, PM2.5, PM10, NO2, SO2, CO	L	L	L	L
<i>Long-term air pollution exposure and incident stroke in American older adults: A national cohort study. Ma et al. 2022 United States(375)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, NO2, PM2.5	L	L	L	L
<i>Early prenatal exposure to air pollutants and congenital heart disease: a nested case-</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	PL	PL	PL

<i>control study. Ma et al. 2023 China.(376)</i>												
<i>Effects of Air Pollutant Exposure on Acute Myocardial Infarction. Mohammadian-Khoshnoud et al. 2023 Iran(377)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	P H	P H	P H	PH
<i>Effect modification by temperature on the association between O₃ and emergency ambulance dispatches in Japan: A multi-city study. Phosri et al. 2023 Japan(378)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	P H	P H	L	PH
<i>Effects of ambient air pollutants on cardiovascular disease hospitalization admission. Salvaraji et al. 2023 Malaysia (379)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	L	L
<i>Effects of low-level air pollution exposures on hospital admission for myocardial infarction using multiple causal models. Schwartz et al. 2023 United States(380)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	L	L
<i>Circulatory health risks from additive multi-pollutant models: short-term exposure to three common air pollutants in Canada. Shin et al. 2023 Canada(381)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , NO2, PM2.5	L	L	L	L
<i>Long-term exposure to PM2.5 and O3 with cardiometabolic multimorbidity: Evidence among Chinese elderly population from 462 cities. Su et al. 2023 China(382)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L

<i>Long-term exposure to air pollution and increased risk of atrial fibrillation prevalence in China. Sun et al. 2023 China(383)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	P H	L	PL
<i>Ambient Air Pollution and Acute Ischemic Stroke—Effect Modification by Atrial Fibrillation. Tan et al. 2022 Singapore (384)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, rainfall	L	L	L	L
<i>A time-series analysis of short-term ambient ozone exposure and hospitalizations from acute myocardial infarction in Henan, China. Wei et al. 2023 China(385)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Association of long-term exposure to air pollutant mixture and incident cardiovascular disease in a highly polluted region of China. Wen et al. 2023 China(386)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	PL	L	L	L
<i>Short-term effects of air pollution and weather changes on the occurrence of acute aortic dissection in a cold region. Zhang et al. 2023 China(387)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point temperature, atmospheric pressure, cloud cover	L	PL	L	L
<i>Short-term ambient air pollution risk for ischemic stroke hospitalization and related economic burden: A multi-city time-series study in southwest China. Yang et al. 2023 China(388)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	L	L	L
<i>Long-term cardiometabolic effects of ambient ozone pollution in a large Chinese</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, PM2.5	PL	PL	L	PL

<i>population. Yang et al. 2023 China(389)</i>												
<i>Short-term exposure to ambient air pollution and readmissions for heart failure among 3660 post-discharge patients with hypertension in older Chinese adults. Xu et al. 2022 China(390)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	PL	P H	L	PL
<i>Hourly air pollution exposure and the onset of symptomatic arrhythmia: an individual-level case–crossover study in 322 Chinese cities. Xue et al. 2023 China(391)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	L	P H	L	PL
EXTREME WEATHER												
<i>Drought and the risk of hospital admissions and mortality in older adults in western USA from 2000 to 2013: a retrospective study. Berman et al. 2017 United States (392)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point , particulate pollution	PL	L	L	L
<i>Drought effects on specific-cause mortality in Lisbon from 1983 to 2016: Risks assessment by gender and age groups. Salvador et al. 2021 Portugal (393)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature of heatwave, PM10, Ozone, NO2	PL	L	L	L
<i>Short-term effects of drought on daily mortality in Spain from 2000 to 2009. Salvador et al. 2020 Spain (394)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature of heatwave, PM10, Ozone, NO2	PL	L	L	L
<i>Effects on daily mortality of Droughts in Galicia (NW Spain) from 1983 to 2013. Salvador et al. 2019 Spain (395)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature of heatwave, PM10, Ozone, NO2	PL	L	L	L

<i>Community-wide Mortality Rates in Beijing, China, During the July 2012 Flood Compared with Unexposed Periods. Yan et al. 2020 China (396)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , PM2.5 (in sensitivity analyses)	PL	L	L	L
<i>Association between floods and acute cardiovascular diseases: A population-based cohort study using a geographic information system approach. Vanasse et al. 2016 Canada (397)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	P H	PL
<i>Effects of the July 1997 floods in the Czech Republic on cardiac mortality. Obrová et al. 2014 Czech Republic (398)</i>	Yes	Yes	No	Yes	Yes	Yes	Yes	None	PL	L	H	PH
<i>Heart attacks triggered by huge mud slides in mountain regions and severe flooding in inhabited areas. Nagayoshi et al. 2015 Japan (399)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	PL	H	PH
<i>Cardiovascular disease hospitalizations in Louisiana parishes' elderly before, during and after hurricane Katrina. Becquart et al. 2019 United States(400)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
<i>Hurricane Sandy (New Jersey): Mortality Rates in the Following Month and Quarter. Kim et al. 2017 United States (401)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	L	L
<i>Direct and indirect mortality in Florida during the 2004 hurricane season. McKinney et al. 2011 United States (402)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	P H	PL
<i>The effect of hurricane sandy on cardiovascular events in</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	PL	PL

<i>New Jersey. Swerdel et al. 2020 United States (403)</i>												
<i>Association of Post-Traumatic Stress Disorder Symptoms Following Hurricane Katrina With Incident Cardiovascular Disease Events Among Older Adults With Hypertension. Lenane et al. 2019 United States (404)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	PL	PL
<i>Causes of Excess Deaths in Puerto Rico After Hurricane Maria: A Time-Series Estimation. Cruz-Cano et al. 2019 United States (405)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	P H	PL
<i>After the Storm: Short-term and Long-term Health Effects Following Superstorm Sandy Among Elderly. Lawrence et al. 2019 United States (406)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	PL	PL
<i>Effect of Hurricane Katrina on incidence of acute myocardial infarction in New Orleans three years after the storm. Jiao et al. 2012 United States (407)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	H	PH
<i>Natural disasters and myocardial infarction: The six years after hurricane Katrina. Peters et al. 2014 United States (408)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	H	PH
<i>Acute post-disaster medical needs of patients with diabetes: Emergency department use in New York City by diabetic adults after Hurricane Sandy. Lee et al. 2016 United States (409)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	PL	PL

<i>Emergency Department Use Among Assisted Living Residents After Hurricane Irma. Hua et al. 2021 United States (410)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	P H	PL
<i>Tropical cyclone exposures and risks of emergency Medicare hospital admission for cardiorespiratory diseases in 175 urban United States counties, 1999-2010. Yan et al. 2021 United States (411)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
<i>Association of posttraumatic stress disorder and depression with all-cause and cardiovascular disease mortality and hospitalization among Hurricane Katrina survivors with end-stage renal disease. Edmondson et al. 2013 United States (412)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	PL	PL
<i>Effect of Hurricane Katrina on the incidence of acute coronary syndrome at a primary angioplasty center in New Orleans. Gautam et al. 2009 United States (413)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	H	PH
<i>Emergency room visits associated with particulate concentration and Asian dust storms in metropolitan Taipei. Lin et al. 2016 Taiwan (414)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature, relative humidity, wind speed, NO2, ozone,	L	L	L	L

Mortality associated with particulate concentration and Asian dust storms in Metropolitan Taipei. Wang and lin. 2015 Taiwan(415)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, windspeed	L	L	L	L
<i>Asian dust and daily all-cause or cause-specific mortality in western Japan. Kashima et al. 2012 Japan (416)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Are People With a History of Disease More Susceptible to a Short-term Exposure to Asian Dust?: A Case-Crossover Study Among The Elderly in Japan. Kashima et al. 2017 Japan (417)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Asian dust and daily emergency ambulance calls among elderly people in Japan: an analysis of its double role as a direct cause and as an effect modifier. Kashima et al. 2014 Japan (418)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Asian dust effect on cause-specific mortality in five cities across South Korea and Japan. Kashima et al. 2016 Japan and South Korea (419)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Effects of Asian dust-derived particulate matter on ST-elevation myocardial infarction: retrospective, time series study. Lee et al. 2021 Korea (420)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	PL	L	L
<i>Particulate matter concentrations during desert dust outbreaks and daily mortality in Nicosia, Cyprus.</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L

<i>Neophytou et al. 2013 Cyprus (421)</i>												
<i>Short-term effects of desert and non-desert PM(10) on mortality in Sicily, Italy. Renzi et al. 2018 Italy (422)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point temperature	L	L	L	L
<i>Desert dust is a risk factor for the incidence of acute myocardial infarction in western Japan. Matsukawa et al. 2014 Japan (423)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, NO2, SO2	PL	PL	L	PL
<i>Short-term exposure to desert dust and the risk of acute myocardial infarction in Japan: a time-stratified case-crossover study. Ishii et al. 2020 Japan (424)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, atmospheric pressure, NO2, SO2, photochemical oxidants	L	L	L	L
<i>Effects of Asian dust storm events on daily mortality in Taipei, Taiwan. Chen et al. 2004 Taiwan (425)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
<i>Effects of Asian dust storm events on daily hospital admissions for cardiovascular disease in Taipei, Taiwan. Chen and Yang et al. 2005 Taiwan (426)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	PL	L
<i>Saharan dust and association between particulate matter and case-specific mortality: a case-crossover analysis in Madrid (Spain). Díaz et al. 2012 Spain (427)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, atmospheric pressure, NO2, SO2, ozone	L	L	L	L
<i>Individual effect modifiers of dust exposure effect on cardiovascular morbidity.</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	PL	L	PL	PL

<i>Vodanos et al. 2015 Israel (428)</i>												
<i>Effect of dust storm events on daily emergency admissions for cardiovascular diseases. W.S. Tam et al. 2012 China (429)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, atmospheric pressure, NO2, SO2, ozone, PM2.5	L	L	L	L
<i>A case-crossover analysis of Asian dust storms and mortality in the downwind areas using 14-year data in Taipei. Chan et al. 2011 Taiwan (430)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature SO2, ozone, PM2.5	L	L	L	L
<i>Asian dust storm events are associated with an acute increase in stroke hospitalisation. Kang et al. 2012 Taiwan (431)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature carbon monoxide, SO2, ozone, PM2.5	L	L	L	L
<i>The effects of dust-haze on mortality are modified by seasons and individual characteristics in Guangzhou, China. Liu et al. 2014 China (432)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, wind speed	L	L	L	L
<i>Impact of Saharan dust on the incidence of acute coronary syndrome. Rodriguez et al. 2021 Spain (433)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, PM2.5-10, PM2.5, NO2, SO2 , ozone	L	L	L	L
<i>Saharan dust and associations between particulate matter and daily mortality in Rome, Italy. Mallone et al. 2011 Italy (434)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature ,relative humidity, barometric pressure	PL	L	L	L

<i>Saharan dust, particulate matter and cause-specific mortality: a case-crossover study in Barcelona (Spain). Perez et al. 2012 Spain (435)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , heat waves, relative humidity	L	L	L	L
<i>Saharan dust and daily mortality in Emilia-Romagna (Italy). Sajani et al. 2011 Italy (436)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Apparent temperature, heat wave days	PL	L	L	L
<i>Role of Saharan dust in the relationship between particulate matter and short-term daily mortality among The Elderly in Madrid (Spain). Jiménez et al. 2010 Spain (437)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , ozone, SO ₂ , NO ₂ , sound levels	L	L	L	L
<i>The Association Between Dust Storms and Daily Non-Accidental Mortality in the United States, 1993-2005. Crooks et al. 2016 United States(438)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , precipitation , heat waves, and ambient PM _{2.5} , PM ₁₀ , and ozone concentrations	L	L	L	L
<i>Sandstorm weather is a risk factor for mortality in ischemic heart disease patients in the Hexi Corridor, northwestern China. Li et al. 2020 China (439)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Wind speed	PL	L	P H	PL
<i>Burden of dust storms on years of life lost in Seoul, South Korea: A distributed lag analysis. Jung et al. 2021 South Korea(440)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, air pressure, wind speed	L	L	L	L
<i>Impact of Flood Due to Typhoon Hagibis on</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	H	PH

<i>Cardiovascular and Cerebrovascular Events in the Disaster Area of Nagano City: A Sub-Analysis Using Data From the SAVE Trial. Komatsu et al. 2022 Japan(441)</i>												
<i>Exploring Meteorological Conditions and Human Health Impacts during Two Dust Storm Events in Northern Cape Province, South Africa: Findings and Lessons Learnt. Nkosi et al. 2022 South Africa(442)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	H	H	L	H
<i>Association of Tropical Cyclones With County-Level Mortality in the US. Parks et al. 2022 United States(443)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	L	L
<i>The independent and synergistic impacts of power outages and floods on hospital admissions for multiple diseases. Deng et al. 2022 United States(444)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, PM2.5, ozone	PL	L	L	L
<i>Relationship between the flood disaster caused by the Reiwa first year east Japan typhoon and cardiovascular and cerebrovascular events in Nagano City: The SAVE trial. Sunohara et al. 2021 Japan(445)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	PL	L	H	PH
<i>HDialysis Care for US Military Veterans in Puerto Rico during the 2017 Atlantic Hurricane Season. Lukowsky et al. 2022 United States(446)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	PL	PL

<i>Association Between Hurricane Sandy and Emergency Department Visits in New York City by Age and Cause. Weinberger et al. 2021 United States(447)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	P H	PL
<i>Increased risk of multiple pregnancy complications following large-scale power outages during Hurricane Sandy in New York State. Xiao et al. 2021 United States(448)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , Pm2.5	PL	L	PL	PL
<i>Health disparities among older adults following tropical cyclone exposure in Florida. Burrows et al. 2023 United States(449)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	L	L
<i>Incidence of acute myocardial infarction and hurricane Katrina: Fourteen years after the storm. Rawal et al.2023 United States(450)</i>	Yes	Yes	Yes	No	No	No	Yes	None	H	PL	H	H
<i>Time Series Analysis of Congestive Heart Failure Discharges in Florida (USA) Post Tropical Cyclones. Kim et al. 2022 United States(451)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Average temperature, cyclone frequency, maximum cyclone wind speed	PL	L	L	L
<i>Differences in county-level cardiovascular disease mortality rates due to damage caused by hurricane Matthew and the moderating effect of social capital: a natural experiment. McCann et al. 2023 United States(452)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	L	L
<i>Impact of desert dust storms, PM10 levels and</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , Air	PL	P H	L	PL

<i>daily temperature on mortality and emergency department visits due to stroke. Oktay et al. 2023 Türkiye (453)</i>								pollution (PM10)				
WILDFIRES												
<i>Cardiorespiratory hospitalizations associated with smoke exposure during the 1997, Southeast Asian Forest fires. Mott et al. 2005 Malaysia (454)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	H	L	H	H
<i>Wildfire air pollution and daily mortality in a large urban area. Vedal et al. 2006 United States (455)</i>	Yes	Yes	Yes	Yes	No	Yes	Yes	None	P H	L	H	PH
<i>Vegetation fire smoke, indigenous status and cardio-respiratory hospital admissions in Darwin, Australia, 1996-2005: a time-series study. Hanigan et al. 2008 Australia (456)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, rainfall	PL	L	L	L
<i>Extreme air pollution events from bushfires and dust storms and their association with mortality in Sydney, Australia 1994-2007. Johnston et al. 2011 Australia (457)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperatur, humidity	L	L	L	L
<i>The relationship of respiratory and cardiovascular hospital admissions to the southern California wildfires of 2003. Delfino et al. 2009 California (458)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, surface pressure gradient,	PL	L	L	L
<i>Mortality in US Hemodialysis Patients Following Exposure</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Heat index, seasonality	PL	L	L	L

<i>to Wildfire Smoke. Xi et al. 2020 United States (459)</i>												
<i>Air pollution from bushfires and their association with hospital admissions in Sydney, Newcastle and Wollongong, Australia 1994-2007. Martin et al. 2013 Australia (460)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, ozone (sensitivity analysis)	L	L	L	L
<i>Ambient particulate matter, landscape fire smoke, and emergency ambulance dispatches in Sydney, Australia. Salimi et al. 2017 Australia (461)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, ozone	PL	PL	L	PL
<i>Short-term effects of particulate matter on mortality during forest fires in Southern Europe: results of the MED-PARTICLES Project. Faustini et al. 2015 Spain, France, Italy, Greece (462)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , seasonality	L	L	PL	L
<i>Cardiovascular and Cerebrovascular Emergency Department Visits Associated With Wildfire Smoke Exposure in California in 2015. Wettstein et al. 2018 United States (463)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity	P H	L	L	PL
<i>Wildfire particulate matter in Shasta County, California and respiratory and circulatory disease-related emergency department visits and mortality, 2013-2018. Casey et al. 2021 United States (464)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	PL	L	PL	PL
<i>Forest fires are associated with elevated mortality in a</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , wind direction	L	L	L	L

<i>dense urban setting. Analitis et al. 2012 Greece (465)</i>												
<i>Risk factors associated with clinic visits during the 1999 forest fires near the Hoopa Valley Indian Reservation, California, USA. Lee et al. 2009 United States (466)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	H	PH
<i>Ambient biomass smoke and cardio-respiratory hospital admissions in Darwin, Australia. Johnston et al. 2007 Australia (467)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, rainfall,	P H	L	L	PL
<i>Triggering of ST-elevation myocardial infarction by ambient wood smoke and other particulate and gaseous pollutants. Evans et al. 2017 United States (468)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, seasonality, pollutants including NO2, SO2, ozone, and carbon monoxide	P H	L	L	PL
<i>Risk of respiratory and cardiovascular hospitalization with exposure to bushfire particulates: New evidence from Darwin, Australia. Crabbe et al. 2012 Australia (469)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, dew point, precipitation , visibility, occurrence of haze, mist, or smoke	L	L	L	L
<i>Peat Bog Wildfire Smoke Exposure in Rural North Carolina Is Associated with Cardiopulmonary Emergency Department Visits Assessed through Syndromic</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	P H	L	H	PH

<i>Surveillance. Rappold et al. 2011 United States (470)</i>												
<i>Health outcomes associated with smoke exposure in Albuquerque, New Mexico, during the 2011 Wallow fire. Resnick et al. 2015 United States (471)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	L	L	H	PH
<i>The association of wildfire smoke with respiratory and cardiovascular emergency department visits in Colorado in 2012; a case crossover study. Alman et al. 2016 United States (472)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , ozone	L	L	PL	L
<i>Effects of long-range transported air pollution from vegetation fires on daily mortality and hospital admissions in the Helsinki Metropolitan, Finland. Kollanus 2016 Finland (473)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, pollen count	PL	L	L	L
<i>Wildfire-Specific Fine Particulate Matter and Risk of Hospital Admissions in Urban and Rural Counties. Liu et al. 2017 United States (474)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point temperature	PL	L	L	L
<i>Repeating cardiopulmonary health effects in rural North Carolina population during a second large peat wildfire. Tinling et al. 2016 United States(475)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L

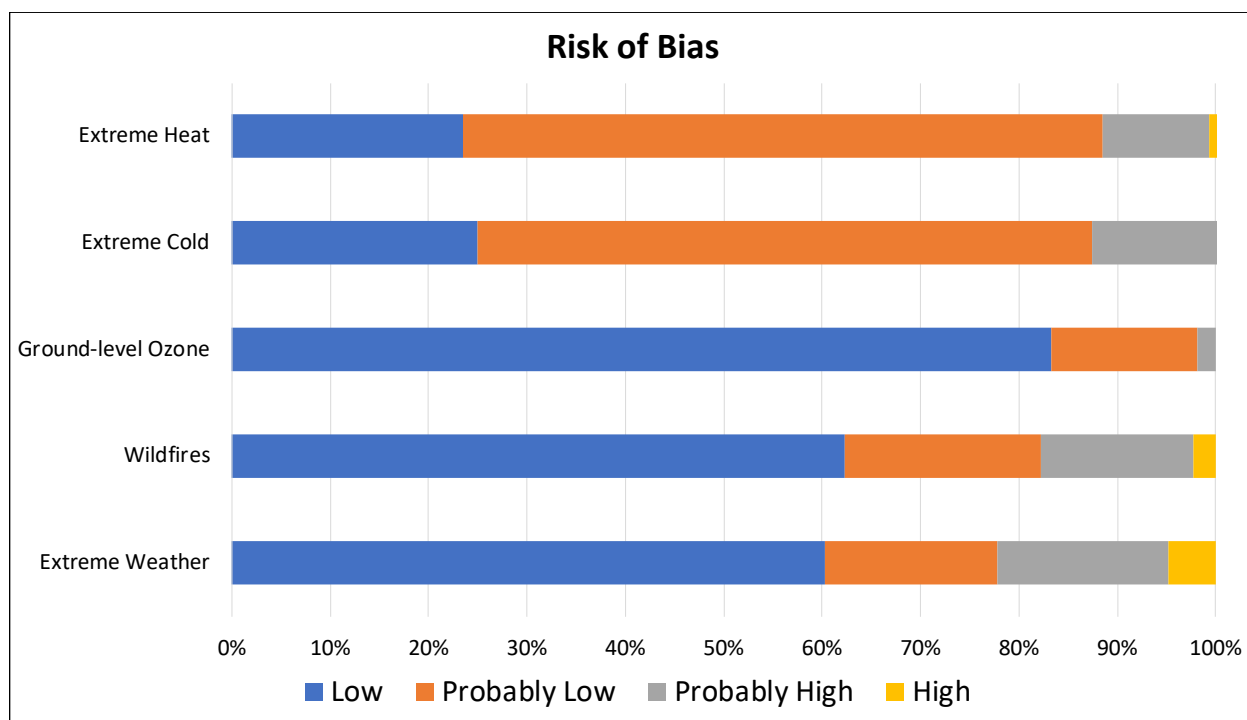
<i>Canadian Forest Fires and the Effects of Long-Range Transboundary Air Pollution on Hospitalizations among the Elderly. Le et al. 2014 United States (476)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point temperature	L	L	L	L
<i>Benefits of the fire mitigation ecosystem service in The Great Dismal Swamp National Wildlife Refuge, Virginia, USA. Parthum et al. 2017 United States (477)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	PL	L	H	PH
<i>Three measures of forest fire smoke exposure and their associations with respiratory and cardiovascular health outcomes in a population-based cohort, Henderson et al. 2011. Canada (478)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature	L	L	P H	PL
<i>Population health effects of air quality changes due to forest fires in British Columbia in 2003: estimates from physician-visit billing data. Moore et al. 2006 Canada (479)</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	None	L	L	H	PH
<i>Effects of bushfire smoke on daily mortality and hospital admissions in Sydney, Australia. Morgan et al. 2010 Australia (480)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>Evaluation of a spatially resolved forest fire smoke model for population-based epidemiologic exposure assessment. Yao et al. 2016 Canada (481)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , seasonality	L	L	L	L

<i>Forest Fire Smoke Exposures and Out-of-Hospital Cardiac Arrests in Melbourne, Australia: A Case-Crossover Study. Dennekamp et al. 2015 Australia (482)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L
<i>Impact of Fine Particulate Matter (PM2.5) Exposure During Wildfires on Cardiovascular Health Outcomes. Haikerwal et al. 2015 Australia (483)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L
<i>Differential respiratory health effects from the 2008 northern California wildfires: A spatiotemporal approach. Reid et al. 2016 United States (484)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, ozone	L	L	L	L
<i>Forest Fires, Air Pollution, and Mortality in Southeast Asia. Sastry et al. 2009. Malaysia (485)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , humidity, seasonality	PL	L	PL	PL
<i>Associations of wildfire smoke PM_{2.5} exposure with cardiorespiratory events in Colorado 2011–2014. Stowell et al. 2019 United States (486)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , seasonality	PL	L	L	L
<i>Ambient Particulate Matter and Biomass Burning: An Ecological Time Series Study of Respiratory and Cardiovascular Hospital Visits in Northern Thailand. Mueller et al. 2020 Thailand (487)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity, seasonality	L	L	L	L

<i>Cardiopulmonary Effects of Fine Particulate Matter Exposure among Older Adults, during Wildfire and Non-Wildfire Periods, in the United States 2008–2010. DeFlorio-Barker et al. 2019 United States (488)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L
<i>The San Diego 2007 wildfires and Medi-Cal emergency department presentations, inpatient hospitalizations, and outpatient visits: An observational study of smoke exposure periods and a bidirectional case-crossover analysis. Hutchinson et al. 2018 United States (489)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L
<i>Out-of-Hospital Cardiac Arrests and Wildfire-Related Particulate Matter During 2015–2017 California Wildfires. Jones et al. 2020 United States (490)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	P H	L	L	PL
<i>Blowing Smoke: Health Impacts of Wildfire Plume Dynamics (Working Paper), Miller et al. 2017 United States (491)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature ,precipitation	L	L	L	L
<i>Air pollution events from forest fires and emergency department attendances in Sydney, Australia 1996–2007: a case-crossover analysis. Johnston et al. 2014. Australia (492)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , dew point	L	L	L	L
<i>The Summer 2019–2020 Wildfires in East Coast Australia and Their Impacts</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None	L	L	H	PH

<i>on Air Quality and Health in New South Wales, Australia. Nguyen et al. 2021 Australia(493)</i>												
<i>Risk and burden of hospital admissions associated with wildfire-related PM2.5 in Brazil, 2000–15: a nationwide time-series study. Ye et al. 2021 Brazil(494)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	PL	L	L	L
<i>Excess emergency department visits for cardiovascular and respiratory diseases during the 2019–20 bushfire period in Australia: A two-stage interrupted time-series analysis. Wen et al. 2021 Australia(495)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	P H	L	L	PL
<i>‘Bushfire Season’ in Australia: Determinants of Increases in Risk of Acute Coronary Syndromes and Takotsubo Syndrome. Ong et al. 2023 Austrlia(496)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , PM2.5	L	L	L	L
<i>Mortality risk attributable to wildfire-related PM2.5 pollution: a global time series study in 749 locations. Chen et al. 2021 Canada, China, Colombia, Costa Rica, Czech Republic, Ecuador, Finland, Greece, Iran, Ireland, Japan, Kuwait, Mexico, Norway, Panama, Paraguay, Philippines, Portugal, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, United Kingdom, United States, Vietnam(497)</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Temperature , relative humidity	L	L	L	L

eFigure. Summary of Risk of Bias in Included Studies, Stratified by Environmental Exposure. Bar plots indicate the percentage of the risk of bias judgements in reviewed studies, stratified by environmental exposure. See manuscript and appendix text for additional details on our approach to evaluating risk of bias in individual studies, quality of evidence across studies, and strength of evidence across studies.



SUMMARY OF INCLUDED STUDIES: STUDY DESIGN AND FINDINGS

Studies that examined more than one exposure (e.g., extreme heat and extreme cold) are shown in each of the relevant exposure categories. As some studies evaluated more than one environmental exposure (e.g., both extreme heat and extreme cold), they may appear more than once in the results tables below.

eTable 4. Extreme Heat. Abbreviations: CVD=Cardiovascular Disease, IHD=Ischemic Heart Disease, OR=Odds Ratio, RR=Relative Risk, Tmax=Maximum Temperature, Tmean=Mean Temperature, Tmin=Minimum Temperature.

A. Extreme Heat: Cardiovascular Mortality

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Comments
<i>Ahmadnezhad et al. 2013 Iran</i> (9)	Longitudinal (Ecological)	Temperature > 90 th percentile for 3 consecutive days	RR per 1°C increase in temperature= 1.03 (0.98 to 1.08) for cerebrovascular disease mortality; 1.07 (1.04 to 1.11) for CVD mortality.	Lags not assessed. Lag 0-7 days assessed. Female sex and age > 65 years were associated with increased susceptibility.
<i>Achebak et al. 2018 Spain</i> (10)	Longitudinal (Ecological)	Temperature threshold = 90 th percentile (“heat”), 97.5 th percentile (“moderate heat”), and 99 th percentile (“extreme heat”), compared with non-extreme heat periods	Attributable fraction of death for circulatory disease= 8.94% (8.32% to 9.61%) for heat; 8.00% (7.34% to 8.62%) for moderate heat; 0.94% (0.87% to 0.99%) extreme heat.	Lags not assessed. Female sex was associated with increased susceptibility of drying from heat exposure.
<i>Basagana et al. 2011 Spain</i> (12)	Longitudinal (Ecological)	Temperature > 95 th percentile	RR for CVD mortality (0-2 days after exposure) = 1.22 (1.18 to 1.27).	Lags not assessed. Older adults (age > 60) were associated with increased risk of CVD. No risk difference by sex after stratifying by age.

<i>Phung et al. 2017 Vietnam</i> (14)	Longitudinal (Ecological)	Temperature > 90 th percentile for 3 consecutive days	Proportional increase in CVD hospitalization= 0.8% (-1.6% to 3.3%)	Lag 0-3 days assessed. Results were not statistically significant at any lag evaluated. No significant effect among age >60. Risk of hospitalization for CVD was significantly higher in the north than in the south
<i>Hoffmann et al. 2008 Germany</i> (15)	Cross-Sectional (Ecological)	Temperature > 32°C for at least 3 consecutive days	Proportional increase in CVD mortality= 1.23% (1.15 to 1.32%)	Lag 0-3 days assessed. Subgroup analysis not reported.
<i>Roye et al. 2017 Spain</i> (16)	Longitudinal (Ecological)	Extreme heat: Temperature > 95 th percentile	Proportional increase in CVD mortality= 10.3% (3.3% to 17.7%)	Lag 0-4 days assessed. Subgroup analysis not reported.
<i>Kysely et al. 2004 Czech Republic</i> (17)	Longitudinal (Ecological)	Temperature > 30°C for at least 3 consecutive days	Proportional increase in CVD mortality= 13.6%	Lag 0-1 days assessed. Female sex was associated with increased susceptibility to heatwaves.
<i>Åström et al. 2020 Sweden</i> (18)	Longitudinal (Case-Crossover)	Class 1= daily Tmax>30°C for 3 consecutive days; Class 2= daily Tmax > 30°C for 5 consecutive days; Class 3= daily Tmax > 33°C for 3 consecutive days assessed.	Proportional increase in CVD mortality= 15%	Lags not assessed. Subgroup analysis not reported.
<i>Dong et al. 2016 China</i> (19)	Longitudinal (Ecological)	Tmean> 93 th percentile for at least 2,3,4, or 5 consecutive days	Proportional increase in CVD mortality for a heatwave lasting= ≥2 days: 3%(-4% to 11%); ≥3 days: 3% (-5% to 11%); ≥4 days: 10% (0% to 21%); ≥5 days 18% (6% to 31%)	Lags not assessed. Female sex and older adults (age>65) were associated with increased susceptibility to heatwaves

<i>Miron et al. 2015 Spain (20)</i>	Longitudinal (Ecological)	Temperature 99 th compared with 90 th percentile	Proportional increase in CVD mortality= 19.3% (17.3% to 21.3%) in 1975 to 1985; 30.3% (28.3% to 32.3%) in 1986 to 1996; 7.3% (6.2% to 8.4%) in 1997 to 2008.	Lags not assessed. Subgroup analysis not reported.
<i>Zeng et al. 2014 China (21)</i>	Longitudinal (Ecological)	Temperature > 95 th percentile for 2 consecutive days	Proportional increase in CVD mortality= 19.3% (9.5% to 30.1%)	Lags not assessed. Older adults (age > 75) were more associated with increased susceptibility to heatwaves.
<i>Sun et al. 2020 China (22)</i>	Longitudinal (Ecological)	Temperature > 99 th percentile for at least 2 consecutive days	Proportional increase in CVD mortality= 22.02% (16.91% to 27.35%)	Lags not assessed. Subgroup analysis not reported.
<i>Zafeiratou et al. 2019 Greece (23)</i>	Longitudinal (Ecological)	Temperature > 31.5°C	Proportional increase in CVD mortality= 5.34% (4.74% to 5.93%).	Lags not assessed. Heat wave effects were found to be positively associated with several socioeconomic status variables such as area coverage of buildings, population density, and length of roads/km ² .
<i>Yin et al. 2017 China (24)</i>	Longitudinal (Ecological)	Temperature exceeding various thresholds (32°C, 33°C, 34°C, 35°C)	Proportional increase in CVD mortality= 51.0% (21.3% to 88.1%) when Temperature > 35°C for at least 5 days assessed.	Lags not assessed. Female sex, age > 65 years, and employment in outdoor work were associated with increased susceptibility to heatwaves.
<i>Rowland et al. 2020 United States (25)</i>	Longitudinal (Case-Crossover)	Temperature 95 th vs 50 th percentile	Proportional increase in incidence rate of acute myocardial infarction= 7.9% (5.2% to 10.6%).	Lag 0-2.5 days assessed. Male sex, age <65, and history of myocardial infarction were more susceptible to heatwaves.

<i>Ma et al. 2015 China (26)</i>	Longitudinal (Ecological)	Temperature > 95 th percentile for at least 2 consecutive days	Cumulative excess risk= 6.2% (1.9% to 10.7%) for cerebrovascular disease mortality; 7.7% (4.7% to 10.7%) for CVD mortality.	Lags not assessed. Female sex and age > 75 years were associated with increased susceptibility to heatwaves.
<i>Sun et al. 2014 China (28)</i>	Longitudinal (Ecological)	At least three consecutive days with Tmax exceeding 35°C	Net excess cardiovascular mortality rate = 4.002 per 100,000.	Lags not assessed. Female sex was associated with increased susceptibility to heatwaves.
<i>Jun et al. 2013 China (30)</i>	Longitudinal (Case-Crossover)	Temperature > 95 th percentile for at least 6 consecutive days	OR for CVD mortality= 1.37 (1.17 to 1.62) for 2005 heatwave.	Lags not assessed. Age > 75 years, female sex, blue-collar workers, and individuals with less than secondary education were associated with increased susceptibility to heatwaves.
<i>Wang et al. 2012 Australia (31)</i>	Longitudinal (Case-Crossover)	Temperature > 37°C for at least 2 consecutive days	OR for CVD mortality= 2.01 (1.53 to 2.64) 1 day after exposure.	Lag 1-3 days assessed. Results were statistically significant at all lags evaluated. Age 65-74 years was associated with increased susceptibility to heatwaves.
<i>Tian et al. 2013 China (32)</i>	Longitudinal (Ecological)	Two or more days with Tmean >97.5 th percentile (30.5°C) or >99 th percentile (31.3°C)	Tmean > 97.5 th percentile: Proportional increase in coronary heart disease mortality for a heat wave of ≥ 2 days: 31% (18.5% to 45.9%); ≥ 3 days: 23.2% (5.2% to 41.2%); ≥ 4 days: 21% (3% to 41.7%) Tmean > 97.5 th percentile: Proportional increase in coronary heart disease mortality for a heat wave of ≥ 2 days: 10.2% (-20.5% to 40.9%); ≥ 3 days: 22.9% (-9.6% to 55.4%); ≥ 4 days: 12.6% (- 31.6% to 57.7%)	Lags not assessed. Age > 65 years and female sex were associated with increased susceptibility to heatwaves, though these differences were not statistically significant.

<i>Fouillet et al. 2006 France</i> (33)	Longitudinal (Ecological)	The number of days on which Tmin and Tmax simultaneously exceeded the corresponding 30-year averages by 5 and 9°C.	Relative circulatory disease mortality ratio (observed/expected deaths) = 1.4 (1.4 to 1.4)	Lags not assessed. Age > 75 years, female sex, residence in urban areas were associated with increased susceptibility to heatwaves.
<i>Chen et al. 2015 China</i> (35)	Cross-Sectional (Case-Control)	Temperature > 97.5 th percentile for at least 3 consecutive days assessed. The average Tmax had to be above 97.5 th percentile. And in each day during the period, the Tmax has to be above the 81 st percentile.	Risk ratio for stroke mortality= 1.34 (1.21 to 1.47).	Lags not assessed. Individuals outside of the urban area had an increased susceptibility to heatwaves.
<i>Yin et al. 2018 China</i> (37)	Longitudinal (Ecological)	Temperature > 90 th /92.5 th /95 th /97.5 th percentile for at least 2/3/4 consecutive days	RR= 1.17 (1.05 to 1.30) for coronary heart disease mortality; 1.16 (1.07 to 1.25) for stroke mortality; 1.21 (1.04 to 1.40) for ischemic stroke mortality; 1.14 (1.00 to 1.31) for hemorrhagic stroke mortality; 1.18 (1.11 to 1.24) for CVD mortality.	Lags not assessed. Subgroup analysis not reported.
<i>Huang et al. 2010 China</i> (38)	Cross-Sectional (Ecological)	Temperature > 35°C for at least 3 consecutive days	RR= 1.20 (1.02 to 1.40) for coronary heart disease mortality; 1.21 (1.06 to 1.39) for stroke mortality; 1.19 (1.08 to 1.32) for CVD mortality.	Lags not assessed. Female sex and age > 65 years were associated with increased susceptibility to heatwaves.
<i>Heo et al. 2019 Korea</i> (42)	Longitudinal (Ecological)	Tmax > 90 th percentile for at least 2 consecutive days	RR for CVD mortality per 1 °C increases in Tmax = 1.051 (1.012 to 1.091) for temperature cutoff of the 90 th percentile and 1.093 (0.996 to 1.199) for temperature cutoff of the 95 th percentile. RR for CVD hospitalization per 1 °C increases in Tmax = 0.979(0.893 to 1.073) for temperature	Lags not assessed. Subgroup analysis not reported.

			cutoff of the 90 th percentile and 1.029 (0.900 to 1.324) for temperature cutoff of the 95 th percentile.	
<i>Hertel et al. 2009 Germany</i> (43)	Longitudinal (Ecological)	Temperature > 32°C for at least 3 consecutive days	RR for CVD mortality= 1.25 (0.95 to 1.65).	Lags not assessed. Subgroup analysis not reported.
<i>Li et al. 2019 United States</i> (44)	Longitudinal (Ecological)	Temperature > 95 th percentile for more than 2 consecutive days	RR for CVD mortality on lag day 5= 1.25 (1.01 to 1.55).	Lag 0-6 days assessed. Results were statistically significant on lag 3-lag 6. No significant difference was observed in regard to race, socioeconomic status, or location of residence.
<i>Royé et al. 2020 Spain</i> (45)	Longitudinal (Ecological)	Temperature > 95 th percentile	RR for CVD mortality= 1.79 (1.51 to 2.13) in Barcelona; 1.68 (1.16 to 2.45) in Bilbao; 1.93 (1.73 to 2.15) in Madrid; 4.61 (3.67 to 5.78) in Seville.	Lag 0-7 days assessed. Subgroup analysis was not performed.
<i>Murage et al. 2017 United Kingdom</i> (46)	Longitudinal (Ecological)	Temperature 99 th vs 80 th percentile	RR= 1.75 (1.37 to 2.25) for heart failure mortality; 1.70 (1.32 to 2.19) for stroke mortality; 1.46 (1.16 to 1.84) for chronic ischemic disease mortality.	Lag 0-5 days assessed. Results were statistically significant for all lags evaluated.
<i>Isaksen et al. 2016 United States</i> (49)	Longitudinal (Ecological)	Temperature > 99 th percentile	RR= 1.06 (0.97 to 1.16) for IHD mortality; 1.4 (1.15 to 1.69) for cerebrovascular disease mortality; 1.07 (0.99 to 1.15) for CVD mortality.	Lags not assessed. Age > 85 years was associated with increased susceptibility to heatwaves.
<i>Zhou et al. 2017 China</i> (50)	Longitudinal (Ecological)	Temperature 99 th vs 75 th percentile	RR (0-6 days after exposure) = 1.54(1.44 to 1.65) for stroke mortality; 1.63(1.48 to 1.80) for ischemic stroke mortality; 1.36(1.26 to 1.48) for hemorrhagic stroke mortality.	Lag 0-20 days assessed but did not assess outcomes at different lag days assessed. Age > 65 years, female sex, and low education level (defined as illiterate or primary school only) were associated with increased susceptibility to heatwaves.

<i>Lázaro et al.</i> 2018 Puerto Rico (United States) (51)	Longitudinal (Ecological)	Temperature > 95 th percentile for more than 2 consecutive days	RR= 16.80 (6.81 to 41.4) for stroke mortality; 16.63 (10.47 to 26.42) for CVD mortality.	Lags not assessed. No significant difference was observed.
<i>Nitschke et al.</i> 2007 France (52)	Longitudinal (Ecological)	Daily Tmax >35°C for 3 or more consecutive days vs non-heatwaves	IRR= 0.91 (0.83 to 0.99) for IHD mortality; 0.84 (0.74 to 0.96) for stroke mortality; 0.95 (0.84 to 0.96) for CVD mortality.	Lags not assessed. Age 15-64 years was associated with an increased risk of hospital admissions and emergency department presentations for IHD.
<i>Michelozzi et al.</i> 2003 Italy (54)	Cross-Sectional (Ecological)	Days with maximum apparent temperature above the 90 th annual centile and for the first day, an increase of 2°C compared with the previous day.	Proportion of excess circulatory mortality= 24% (19.1% to 29.2%) for Rome; 25% (17.9% to 33.1%) for Milan; 41% (32.1% to 50.6%) for Turin.	Lag 0-2 days assessed. Female sex and age >75 years were associated with increased susceptibility to heatwaves.
<i>Åström et al.</i> 2015 Italy, Sweden (55)	Longitudinal (Ecological)	Tmax > 95 th percentile for 2 consecutive days	RR for congestive heart failure mortality= 1.11 (0.99 to 1.24) for Rome; 1.10 (1.02 to 1.19) for Stockholm. RR for myocardial infarction mortality= 1.07 (0.83 to 1.39) for Rome; 1.23 (1.02 to 1.50) for Stockholm.	Lags not assessed. Individuals from rome age >75 years had higher RR for mortality from congestive heart failure. There was no specific modification by sex.
<i>Kim et al.</i> 2015 Korea (58)	Longitudinal (Ecological)	Tmean > 99 th percentile	Proportional increase in CVD mortality per 10 µg/m ³ increase in PM10= 5.53% (0.4% to 10.91%) for individuals under 65 years old.	Lag 0-5 days assessed. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Alahmad et al.</i> 2020 Kuwait (59)	Longitudinal (Ecological)	Temperature 99 th percentile (42.7°C) vs 66 th percentile (34.7°C)	RR for CVD mortality: 3.09 (1.72 to 5.55).	Lag 0-30 days assessed, but did not assess outcomes at different lag days. Subgroup analysis not reported.

<i>Bai et al. 2014 China (62)</i>	Longitudinal (Ecological)	Temperature > 99 th percentile	RR for CVD mortality in Jiangzi (0-2 days after exposure) = 2.318 (1.026 to 5.238).	Lag 0-14 days assessed. Results were only significant at lag 0-2 days assessed. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Deng et al. 2019 China (63)</i>	Longitudinal (Ecological)	Temperature > 97.5 th percentile	Attributable fraction of mortality= -1.23% (-8.59% to 5.46%) for coronary heart disease; 0.49% (-6.18% to 6.15%) for stroke; -0.21% (-5.04% to 4.33%) for CVD.	Lag 0-28 days assessed. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Moghadamnia et al. 2018 Iran (64)</i>	Longitudinal (Ecological)	Temperature 95 th vs 75 th percentile	RR for CVD mortality= 1.09 (1.02 to 1.12).	Lag 0-20 days assessed. Results were only significant at day 0. Female sex and age > 65 years were associated with increased susceptibility to heatwaves.
<i>Revich et al. 2008 Russia (65)</i>	Longitudinal (Ecological)	Temperature > 95 th percentile	Proportional increase in mortality= 32% (16% to 48%) for coronary heart disease; 51% (29% to 73%) for cerebrovascular disease.	Lags not assessed. Age > 75 years was associated with increased susceptibility to heatwaves.
<i>Wang et al. 2015 China (69)</i>	Longitudinal (Ecological)	Temperature 99 th vs 90 th percentile	Beijing RR (0-14 days after exposure) = 1.33 (1.08 to 1.62) for IHD mortality; 1.31 (1.09 to 1.57) for cerebrovascular disease mortality; 1.32 (1.16 to 1.51) for CVD mortality; 3.04 (1.42 to 6.48) for hypertension mortality. Shanghai RR (0-14 days after exposure)= 0.99 (0.71 to 1.38) for IHD mortality; 1.14 (0.87 to 1.50) for cerebrovascular disease mortality; 1.14 (0.93 to 1.40) for CVD mortality; 1.56 (0.50 to 4.83) for hypertension mortality.	Lag 0-21 days assessed. In Beijing, results were significant for increased mortality at all lags for IHD, cerebrovascular disease, and CVD, and were not significant at all lags for hypertension. In Shanghai, results were not significant for any outcome at any lag.

<i>Ballester et al. 1997 Spain</i> (71)	Longitudinal (Ecological)	Temperature >24°C	RR for CVD mortality (0 day after exposure) = 1.037 (1.003 to 1.071) from November to April; 0.999 (0.964 to 1.035) from May to October.	Lag 0-14 days assessed. During the cold months, results were only significant at lag 0. Older age (> 70 years) was associated with increased susceptibility to heatwaves.
<i>Sharafkhani et al. 2020 Iran</i> (72)	Longitudinal (Ecological)	Temperature > 95 th percentile for 2 consecutive days	Cumulative excess risk for CVD mortality= 19% (-19% to 74%).	Lag 0-10 days assessed. Older age (> 75 years) and female sex were associated with increased susceptibility to heatwaves.
<i>Son et al. 2016 Brazil</i> (77)	Longitudinal (Ecological)	Temperature 99 th vs 90 th percentile	Proportional increase in CVD mortality= 5.0% (2.7% to 7.4%)	Lag 0-1 days assessed. Female sex and age > 75 years were associated with increased susceptibility to heatwaves.
<i>Silveira et al. 2019 Brazil</i> (80)	Longitudinal (Ecological)	Temperature 99 th percentile vs Tmean	RR for CVD mortality= 1.07 (1.01 to 1.13).	Lag 0-21 days assessed. Results were significant up to lag day 5. Subgroup analysis not reported.
<i>Sharafkhani et al. 2018 Iran</i> (82)	Longitudinal (Ecological)	Temperature 99 th vs 75 th percentile	RR for CVD mortality= 1.78 (1.15 to 2.77) at lag 0-30.	Lag 0-30 days assessed. Results were significant at all Lag periods. Age > 75 years and female sex were associated with increased susceptibility to heatwaves.
<i>Revich et al. 2010 Russia</i> (86)	Longitudinal (Ecological)	Daily Tmean > 97 th percentile of the historic distribution of daily Tmean for 9 consecutive days or more, of which at least 3 days had Tmean > 99 th percentile.	RR for IHD mortality= 1.42 (1.06 to 1.79) for 30 to 64 years old; 1.08 (0.69 to 1.46) for 65+ years old. RR for CVD mortality= 1.22 (0.62 to 1.83) for 30 to 64 years old; 1.31 (0.80 to 1.82) for 65+ years old.	Lag 0-16 days assessed. Individuals age 30-64 experienced an increased susceptibility to heatwaves.

<i>Huang et al. 2014 China</i> (87)	Longitudinal (Ecological)	Temperature > 29°C	Proportional increase in CVD mortality= 4.9% (2.0% to 7.9%).	Lags not assessed. Female sex was associated with increased susceptibility to heatwaves.
<i>Rodrigues et al. 2019 Portugal</i> (88)	Longitudinal (Ecological)	Temperature > 99 th percentile	RR for cerebrovascular disease mortality= 1.65 (1.37 to 1.98).	Lag 0-30 days assessed. Unclear significance by lag date, but RR was positive until a point between lag day 15 and lag day 20.
<i>Cui et al. 2016 China</i> (89)	Longitudinal (Ecological)	Temperature > 97.5 th percentile	Attributable mortality for CVD death: 0.69% (-1.69% to 2.89%).	Lag 0-21 days assessed. Subgroup analysis not reported.
<i>Lin et al. 2020 Taiwan</i> (90)	Longitudinal (Ecological)	Temperature 99 th percentile vs average temperature	RR= 1.13 (1.06 to 1.2) for IHD mortality; 1.06 (1.00 to 1.12) for cerebrovascular disease mortality; 1.09 (1.05 to 1.12) for circulatory disease mortality; 1.12 (1.07 to 1.18) for CVD mortality.	Lag 0-25 days assessed. Did not report specific values at individual lags, but results appear significant at lag <5-10 days and then become insignificant. Subgroup analysis not reported.
<i>Huyenen et al. 2001 Netherlands</i> (92)	Longitudinal (Ecological)	At least 5 days, each of which has a Tmax of at least 25°C, including at least 3 days with a Tmax of at least 30°C.	Proportional increase in CVD mortality= 1.86%.	Lag 0-30 days assessed. Results were positive for lag 0, 1-2, 3-6 days assessed. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Zhang et al. 2019 China</i> (93)	Longitudinal (Ecological)	Temperature > 97.5 th percentile	Attributed fractions for CVD mortality= 1.35% (1.18% to 1.52%).	Lag 0-21 days assessed. Subgroup analysis not reported.
<i>Ma et al. 2014 China</i> (94)	Longitudinal (Ecological)	Temperature 99 th vs 75 th percentile	Proportional increases in cardiovascular mortality per 1 °C increase from the 75 th to 99 th percentile of temperature= 3.02% (1.33% to 4.71%).	Lag 0-14 days assessed and reported in the main analysis. Subgroup analysis not reported.

<i>Bai et al. 2017 Canada (95)</i>	Longitudinal (Ecological)	Temperature 99 th percentile vs 75 th	RR= 1.06 (1.01 to 1.11) for coronary heart disease mortality; 0.99 (0.92 to 1.06) for acute myocardial infarction mortality; 1.07 (0.96 to 1.19) for ischemic stroke mortality; 1.08 (0.99 to 1.17) for stroke mortality.	Lag 0-21 days assessed. Age > 65 years and low literacy levels were associated with increased susceptibility to heatwaves.
<i>Chen et al. 2018 China (99)</i>	Longitudinal (Ecological)	Temperature > 97.5 th percentile	RR= 1.19 (1.11 to 1.28) for coronary heart disease mortality; 1.24 (1.16 to 1.32) for stroke mortality; 1.41 (1.26 to 1.59) for ischemic stroke mortality; 1.10 (1.02 to 1.19) for hemorrhagic stroke mortality; 1.22 (1.16 to 1.28) for CVD mortality.	Lag 0-25 days assessed. Although individual results are not reported, results appear elevated at lag <5 days assessed. Age > 75 years, female sex, and less than 9 years of education were associated with increased susceptibility to heatwaves.
<i>Díaz et al. 2006 Spain (100)</i>	Longitudinal (Ecological)	Temperature > 36.5°C	RR for CVD death= 1.14 (1.06 to 1.21).	Lag 0-8 days assessed. Male sex was associated with increased susceptibility to heatwaves.
<i>Guo et al. 2012 Thailand (102)</i>	Longitudinal (Ecological)	Temperature 99 th vs 75 th percentile	RR for CVD mortality= 0.78 (0.56 to 1.09).	Lag 0-20 days assessed. Results were not significant at any lag. Subgroup analysis not reported.
<i>Ding et al. 2016 China (103)</i>	Longitudinal (Ecological)	Temperature 99 th vs 90 th percentile	RR for CVD mortality (0-3 days after exposure) = 1.08 (1.02 to 1.15).	Lag 0-21 days assessed. Results were significant for lag 0-3 and 0-14 days, but not 0-21 days assessed. Subgroup analysis not reported.
<i>Breitner et al. 2014 Germany (104)</i>	Longitudinal (Ecological)	Temperature 99 th vs 90 th percentile	RR for CVD mortality (2 days after exposure) = 1.10 (1.05 to 1.15)	Lag 0-14 days assessed. Age > 75 years was associated with increased susceptibility to heatwaves.
<i>Iniguez et al. 2021 Spain (105)</i>	Longitudinal (Ecological)	Temperature > 97.5 th percentile	RR= 1.15 (1.08 to 1.23) for CVD mortality; 1.02 (1.00 to 1.04) for CVD hospital admission.	Lag 0-21 days assessed. Subgroup analysis not reported.

<i>Li et al. 2021</i> <i>China</i> (106)	Longitudinal (Ecological)	Temperature > 97.5 th percentile	RR for CVD mortality= 1.31 (1.00 to 1.70).	Lag 0-21 days assessed. Temperature effects were most pronounced in the first 5 days assessed. Age > 65 years were associated with increased susceptibility to heatwaves.
<i>Guo et al. 2012</i> <i>China</i> (107)	Longitudinal (Ecological)	Temperature 99 th vs 90 th percentile	RR for IHD mortality (0-2 days after exposure) = 1.17 (1.10 to 1.25).	Lag 0-20 days assessed. Results were only significant at lag 0-2 and 0-13, but not 0-20. Subgroup analysis not reported.
<i>Ma et al. 2020</i> <i>China</i> (108)	Longitudinal (Ecological)	Temperature > 90 th percentile	RR= 1.49 (1.32 to 1.68) for IHD mortality; 1.40 (1.22 to 1.60) for myocardial infarction mortality; 1.62 (1.39 to 1.88) for stroke mortality; 1.77 (1.35 to 2.31) for hypertensive disease mortality; 1.89 (1.41 to 2.54) for hypertensive heart disease mortality.	Lag 0-21 days assessed. Subgroup analysis not reported.
<i>Royé et al. 2019</i> <i>Spain</i> (110)	Longitudinal (Ecological)	Temperature > 95 th percentile	RR for ischemic stroke mortality= 1.09 (0.91 to 1.29).	Lags not assessed. Subgroup analysis not reported.
<i>Chen et al. 2014</i> <i>China</i> (111)	Longitudinal (Ecological)	Temperature 99 th vs 75 th percentile	RR for out-of-hospital coronary death= 1.53 (1.27 to 1.84).	Lag 0-28 days assessed. Results were significant at all lags assessed. Age > 65 years, male sex, and less than middle school education were associated with increased susceptibility to heatwaves.
<i>Chen et al. 2013</i> <i>China</i> (112)	Longitudinal (Ecological)	Temperature 99 th vs 75 th percentile	RR for stroke mortality through the third day after exposure= 1.14 (1.05 to 1.24)	Assessed lag 0-28 days. Results were only significant at lag 0-3 and 0-7. Subgroup analysis not reported.
<i>Han et al. 2017</i> <i>China</i> (113)	Longitudinal (Ecological)	Temperature > 95 th percentile	RR= 1.06 (1.00 to 1.13) for stroke mortality; 1.03 (1.00 to 1.06) for CVD mortality.	Lags not assessed. Age > 65 years was associated with increased susceptibility to heatwaves.

<i>Huang et al. 2012 Australia</i> (114)	Longitudinal (Ecological)	Temperature > 99 th percentile for 2 to 4 consecutive days	Years of life lost for CVD mortality= 45 (22 to 67).	Lag 0-10 days assessed. Subgroup analysis not reported.
<i>Qian et al. 2008 China</i> (115)	Longitudinal (Ecological)	Temperature > 95 th percentile	Heat + ozone: Proportional change in daily stroke mortality= 1.09% (-0.77% to 2.98%) Heat + ozone: Proportional change in daily CVD mortality= 1.39% (-0.25% to 3.06%)	Lag 0-4 days assessed. Subgroup analysis not reported.
<i>Cheng et al. 2012 China</i> (116)	Longitudinal (Ecological)	Temperature>85 th percentile Air pollution: 24-hour average ambient level (µg/m ³)	Proportional increase in CVD mortality= 0.30% (-0.17% to 0.79%).	Lags not assessed. Subgroup analysis not reported.
<i>Zhang et al. 2020 China</i> (117)	Longitudinal (Ecological)	Temperature>90 th percentile Air pollution: 24-hour average PM2.5 level (µg/m ³)	Proportional change in CVD mortality= 1.78% (1.32% to 2.24%).	Lag 0-5 days assessed. Subgroup analysis not reported.
<i>Chen et al. 2018 Finland, Sweden, Denmark, Germany, Italy, Spain</i> (118)	Longitudinal (Ecological)	High temperature defined as at or above the 99 th percentile (compared with 90 th percentile) High pollution was defined as greater than the 75 th percentile of a pollutant	Proportion increase in CVD mortality associated with 99 th percentile temperature relative to 90 th percentile = 3.90% (0.69, 7.22) during low ozone levels (lag 1 day) and 14.83 (2.35, 28.83) during high ozone levels.	Lag 1 day after exposure to ozone included in the main analysis. No significant difference was observed in different age groups or sex.

<i>Tong et al. 2010 Australia</i> (119)	Cross-Sectional (Ecological)	Heatwave defined as a prolonged period of excessive heat per the Australian Bureau of Meteorology. The heatwave of this study had above-average temperatures from 7 th –26 th February 2004, with particularly high temperatures at the end of that period (i.e. 17–26 February 2004). Ozone: daily average (ppb)	Excess deaths due to CVD = 41 (-2 to 84). After adjusting for ozone, 22 (8 to 46) of the deaths were due to heat alone.	Lags not assessed. Subgroup analysis not reported.
<i>Shaposhnikov et al. 2014 Russia</i> (120)	Cross-Sectional (Ecological)	Temperature > 98 th percentile Wildfire: 24-hour average ambient PM10 level (µg/m ³)	Increase in mortality during heat waves: RR= 2.29 (2.18 to 2.40) for IHD mortality; 2.37 (2.24 to 2.52) for cerebrovascular disease mortality. This increase was partially attributable to the high levels of pollutants due to wildfires.	Lags not assessed. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Urban et al. 2014 Czech Republic</i> (123)	Longitudinal (Ecological)	Tmean >90 th percentile	Prague: Relative excess mortality at 0-7 days for: CVD= 11.4 (8.1 to 14.8); MI= -1.9 (-10.0 to 6.9); IHD= 7.9 (2.9 to 13.1); Chronic IHD= 12.4 (6.1 to 19.0); Atherosclerotic Vascular disease= 21.3 (13.4 to 9.7); Cerebrovascular disease= 9.8 (3.5 to 16.4) Bohemia: Relative excess mortality at 0-7 days for: CVD = 8.3 (4.9 to 11.9); myocardial infarction = 2.4	Lags not assessed. Heat stress appeared to have a greater impact on individuals in the more urban region.

			(-11.8 to 18.9) IHD= 7.4 (2.5 to 12.6); Chronic IHD= 12.4 (6.1 to 19); Atherosclerotic Vascular disease= 12.3 (2.7 to 22.8); Cerebrovascular disease= 8.3 (1.9 to 15.1)	
<i>Chen et al. 2013 China</i> (124)	Longitudinal (Ecological)	Temperature: >75 th percentile Air pollution: 1, 8, 24-hr average ozone level	Proportional increase in CVD mortality related to an interquartile range increase in ozone concentrations for: 1-hr ozone average= 6.14 (-17.35 to 36.31); 8-hr ozone average= 6.88 (-14.87 to 34.18); 24-hr ozone average= 6.55(-0.44 to 14.02)	Lag 0-2 days assessed. Subgroup analysis not reported.
<i>Khatana et al. 2022 United States</i> (132)	Longitudinal (Ecological)	Daily maximum heat index: an extreme-heat day was defined if the maximum heat index was $\geq 90^{\circ}\text{F}$ (32.2°C) and in the 99 th percentile of the maximum heat index for that day	Excess deaths from cardiovascular mortality associated with extreme heat during the study period = 5958 (1847 to 10069) Proportional increase in cardiovascular mortality associated with 1 additional extreme-heat day per month = 0.12% (0.04% to 0.21%) Proportional increase in ischemic heart disease mortality associated with extreme heat = 0.19% (0.07% to 0.31%) Stroke mortality associated with extreme heat = 0.04% (-0.12% to 0.20%)	Lags not assessed. Extreme heat was associated with a greater relative increase in mortality rates among men compared with women (0.20% [0.07% to 0.33%]), non-Hispanic Black compared with non-Hispanic White adults (0.19% [0.01% to 0.37%]), and elderly adults compared with nonelderly adults (16.6 [14.6 to 31.8])
<i>Parliari et al. 2022 Greece</i> (134)	Longitudinal (Ecological)	Daily Tmax>35°C	RR of mortality associated with extreme heat compared to minimum mortality temperature for CVD= 1.20 (1.08 to 1.31) and cerebrovascular disease= 1.08 (0.93 to 1.24)	Lag 0-20 days assessed. Subgroup analysis not reported.
<i>Zhang et al. 2021 China</i> (135)	Longitudinal (Ecological)	Tmax>99 th percentile	Risk of cardiovascular mortality related to exposure to extreme heat was not significant ($p > 0.05$)	Lag 0-21 days assessed. There were no significant differences in mortality when evaluating by sex, marital status, or age

<i>Pan et al. 2022 China (136)</i>	Cross-Sectional (Ecological)	Tmean>97.5 th percentile	Years of life lost (YLL) due to heat for essential hypertension = 5.1 years (4.1 to 5.8); hypertensive heart and renal disease with heart failure =4.4 years (0.9 to 5.9); hypertensive heart and renal disease= 3.5 years (1.8 to 4.5)	Lag 0-3 days assessed. Risk was higher for the unmarried and those age <65
<i>Mascarenhas et al. 2022 Brazil (137)</i>	Longitudinal (Ecological)	Tmean>97.5 th percentile	RR for cerebrovascular mortality when exposed to extreme heat compared to the local minimum mortality temperature ranged from 1.03 to 1.75 in the 10 examined micro-regions. 6/10 regions had statistically significant increased cerebrovascular mortality.	Lags not assessed. Subgroup analysis not reported.
<i>Saucy et al. 2021 Switzerland (139)</i>	Case-crossover (Ecological)	Tmax>99 th percentile	OR for CVD mortality associated with extreme heat= 1.28 (1.11 to 1.49)	Lag 0-14 days assessed. Older women (>75 years) with lower socioeconomic position and education are at higher risk for heat-related CVD mortality. With respect to mortality, the strongest associations were found for hypertension-related deaths and myocardial infarction.
<i>Gasparrini et al. 2012 England, Wales (145)</i>	Longitudinal (Ecological)	Region specific daily temperature > 93 rd percentile	Proportional increase in mortality associated with a 1°C increase in temperature above the region-specific threshold for CVD= 1.8% (1.2% to 2.5%); myocardial infarction= 1.1% (0.7% to 1.5%); arrhythmias= 5% (3.2% to 6.9%); pulmonary heart disease= 8.3% (2.7% to 14.3%)	Lags not assessed. Subgroup analysis not reported.
<i>Alahmad et al. 2023 Vietnam, Philippines, Thailand, Taiwan, Japan, South Korea, Kuwait, Iran, Cyprus, Italy, Spain,</i>	Longitudinal (case-crossover)	Temperature > 99th percentile	RR for mortality from CVD mortality = 1.11 (1.07 to 1.14), IHD = 1.07 (1.04 to 1.1); stroke = 1.10 (1.06 to 1.15); heart failure = 1.12 (1.05 to 1.19); arrhythmia = 1.05 (0.98 to 1.12) Per 1,000 deaths, extreme temperatures above the 97.5th percentile accounted for 2.2 (2.1 to 2.3) excess all-cause CVD deaths and 2.6 (2.4 to 2.8) excess heart failure deaths.	Lag 0-14 days assessed. Subgroup analysis not reported.

Portugal, Moldova, Switzerland, United Kingdom, Estonia, Finland, South Africa, Brazil, Paraguay, Ecuador, Uruguay, Panama, Costa Rica, Guatemala, United States, Canada (147)				
Arisco et al. 2023 Burkina Faso(148)	Longitudinal (Ecological)	Temperature >99th percentile (42.8°C)	RR for CVD mortality = 1.74 (0.87 to 3.48)	Lag 1-7 days assessed. Elevated risk of death from CVD over a cumulative 7-day lag period. RR for CVD mortality in patients <65 years was 0.82 (2.9 to 2.33); RR for CVD mortality in patients ≥65 years was 3.68 (1.46 to 9.25).
Fang et al. 2023 China(150)	Longitudinal (Ecological)	Temperature ≥ 75th percentile	Excess rate of CVD mortality attributed to hot events = 13.70% (11.50% to 15.94%); dry-hot events = 14.30% (12.01% to 16.64%); wet-hot events = 7.80% (2.42% to 13.46%). Excess rate of cerebrovascular disease mortality attributed to hot events = 11.96% (9.83% to 14.13%); dry-hot events = 12.87% (10.65% to 15.14%); wet-hot events = 3.02% (-2.04% to 8.35%).	Lags not assessed. Subgroup analysis not reported.

			Attributable fraction of CVD mortality attributed to hot events = 12.95% (12.82% to 13.09%); dry-hot events = 13.51% (13.38% to 13.66%); wet-hot events = 7.41% (7.01% to 7.91%). Attributable fraction of cerebrovascular disease mortality attributed to hot events = 11.37% (11.24% to 11.51%); dry-hot events = 12.21% (12.08% to 12.36%); wet-hot events = 2.92% (2.53% to 3.40%).	
<i>Jingesi et al. 2023</i> <i>China</i> (151)	Longitudinal (Ecological)	Temperature > 99th percentile (34.1°C)	RR of cardiovascular mortality on first day of exposure (lag 0) = 1.10 (1.05 to 1.15). RR of cardiovascular mortality on first four days (lag 0-3 days)= 1.28 (1.15 to 1.43).	Lag 0-21 days assessed. Statistically significant findings for lag 0-21 days across a range of definitions of cold wave. Females and individuals > 65 years were more vulnerable to heat stress.
<i>Requia et al. 2023</i> <i>Brazil</i> (153)	Longitudinal (Ecological)	Temperature >99th percentile	RR for cardiovascular mortality = 1.11 (1.01 to 1.21).	Lag 0-20 days assessed. Results report lag 20 as the primary model. Increased circulatory mortality seen in overall cumulative lag 0-20 days assessed.
<i>Revich et al. 2022</i> <i>Russia</i> (155)	Longitudinal (Ecological)	≥5 days with daily mean temperatures ≥ 97th percentile	There was association with mortality from heat was seen in patients with IHD, cerebrovascular disease, diseases of the circulatory system.	Lag 0-3 days assessed. There was no significant difference in those younger or older than 65 years old.
<i>Shrikhande et al. 2023</i> <i>India</i> (157)	Longitudinal (Case-crossover)	95th percentile of the apparent temperature	Attributable fraction of CVD deaths attributed to heat = 9.1% (0.9% to 15.8%).	Lag 0-21 days assessed. No statistical significance seen with change of lag days assessed. Subgroup analysis not reported.
<i>Silveira et al. 2023</i> <i>Brazil</i> (158)	Longitudinal (Case-crossover)	Temperature > 99th percentile for ≥2 days	RR of CVD mortality at associated with heat waves over lag 0-5 days= 1.27 (1.13 to 1.42)	Lag 0-5 days assessed. Subgroup analysis not reported.

<i>Xia et al. 2023 China(160)</i>	Longitudinal (Ecological)	Temperature 99th percentile (28 °C)	RR for CVD mortality over lags 0-3 days = 1.40 (1.30 to 1.50); cerebrovascular mortality = 1.33 (1.20 to 1.47); IHD = 1.38 (1.20 to 1.58).	Lag 0-14 days assessed. Significant cumulative lag seen at lag0-1, 0-3, 0-7 and 0-14 day for cardiovascular and cerebrovascular mortality. Significant cumulative lag seen for IHD at lag 0-1, 0-3 and 0-7 days assessed. Ozone effects were greater in those >85 years, women, individuals with low education levels, widowed, divorced, and never married.
<i>Xu et al. 2023 China(161)</i>	Longitudinal (Case-crossover)	Temperature 97.5th percentile	OR for MI mortality = 1.74 (1.66 to 1.83)	Lag 0-1 days assessed. Subgroup analysis not reported.
<i>Yan et al. 2023 China(163)</i>	Cross-Sectional (Ecological)	Temperature >99th percentile	Proportional increase in mortality risk for total circulatory disease = 27.8% (14.8% to 42.3%); cerebrovascular disease = 26.7% (8.0% to 48.5%); ischemic heart disease = 30.1% (10.2% to 53.7%); acute ischemic heart disease = 27.3% (1.4% to 59.9%); chronic ischemic heart disease = 32.2% (3.4% to 68.4%); myocardial infarction = 25.2% (1.0% to 57.7%).	Lag 0-4 days assessed. Subgroup analysis not reported.
<i>Zhang et al. 2023 Norway, England, Wales, and Germany (164)</i>	Longitudinal (Case-crossover)	Increase in daily mean air temperature from the 75th to the 99th percentile	RR for CVD mortality = 1.14 (1.03 to 1.26).	Lag 0-1 days assessed. Heat effects were stronger among women (RR for women = 1.18 (1.08 to 1.28); men = 1.12 (1.00 to 1.24)). Heat effects were similar between the general population and the elderly (RR = 1.15 (1.05 to 1.27) for age ≥65 years and 1.16 (1.06 to 1.28) for age ≥75 years).
<i>Zhou et al. 2023 China(166)</i>	Longitudinal (Ecological)	Temperature >95th percentile	Significantly increased RR for CVD, stroke, IHD and MI mortality seen in the northern, middle, and southern regions of Jiangsu.	Lag 0-7 days assessed. Subgroup analysis not reported.

<i>Chitu et al. 2023 Romania</i> (169)	Longitudinal (Ecological)	High Temperature >32°C	Urban areas: Attributable fraction (%) of mortality associated with high temperature exposure for all circulatory disease = 2.2 (1.9 to 2.6); ischemic heart disease = 2.1 (1.4 to 2.6); cerebrovascular disease = 2.5 (1.9 to 3.0); and hypertensive disease = 2.5 (1.5 to 3.3). Rural areas: Attributable fraction (%) of mortality associated with high temperature exposure for all circulatory disease = 1.2 (0.8 to 1.7); ischemic heart disease = 1.3 (0.6 to 2.1); cerebrovascular disease = 1.3 (0.6 to 1.9); and hypertensive disease = 1.4 (0.2 to 2.4)	Lag 0-21 days assessed. There was a significant relative increase in cerebrovascular and hypertensive mortality attributable to extreme temperature exposure in urban vs rural areas.
<i>Anderson et al. 2009. United States</i> (172)	Longitudinal (Ecological)	Temperature >99 th percentile	Cardiovascular mortality adjusted for PM10 at lag1 = 3.2% (2.1% to 4.4%). Cardiovascular mortality adjusted for ozone at lag 0 = 3.2% (2.5% to 3.9%). Percentage increase in cardiovascular mortality risk for heat waves of ≥2 days = 8.8% (5.5% to 12.2%).	Lag 0-28 days was assessed. Strongest heat-related mortality association was at lag 0 and lag 1 day. Significantly elevated cardiovascular mortality in all ages, 65 – 74 years and >75 years. Results were not significant for individuals <65 years.

B. Extreme Heat: Cardiovascular Morbidity

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Comments
<i>Nitschke et al. 2011 Australia</i> (6)	Cross-Sectional (Case-series)	Temperature > 35°C for 3 consecutive days	Incidence rate ratio in 2008 heatwave= 1.03 (0.84 to 1.25) for IHD hospital admission; 0.96 (0.81 to 1.13) for IHD emergency department presentations. Incidence rate ratio in 2009 heatwave= 1.09 (0.88 to 1.33) for IHD hospital	Lags not assessed. Individuals age 15-64 had increased risk of IHD during the 2009 heat wave.

			admission; 1.03 (0.86 to 1.23) for IHD emergency department presentations.	
<i>Ge et al. 2018</i> <i>China</i> (7)	Longitudinal (Ecological)	Temperature > 99 th percentile	RR for rheumatic heart disease hospitalization = 2.55 (1.14 to 5.73).	Lag 0-5 days assessed. Results were statistically significant for all lags evaluated. Female sex and older adults (age > 65) were associated with increased susceptibility to heatwaves.
<i>Brunetti et al. 2014</i> <i>Italy</i> (8)	Cross- Sectional (Ecological)	Temperature >2 standard deviations above Tmean	Proportional increase in atrial fibrillation diagnosis rate= 50.0%.	Lags not assessed. Individuals with hypertension or prior history of CVD were associated with increased rates of calling emergency services 48 hours after heatwaves.
<i>Basu et al. 2012</i> <i>United States</i> (11)	Longitudinal (Ecological)	Temperature > 90 th percentile	Excess risk for emergency room visits per 10°F increase= 1.7% (0.2% to 3.3%) for IHD; 1.7% (−0.5% to 4.0%) for AMI; −8.4% (−14. 9% to −1.4%) for hemorrhagic stroke; −13.6% (−22.5% to −3.8%) for aneurysm; 2.8% (0.9% to 4.7%) for ischemic stroke; 0.2% (−0.9% to 1.3%) for CVD; −1.5% (−4.2% to 1.3%) for heart failure; 2.8% (0.9% to 4.9%) for cardiac dysrhythmias; −10.0% (−13.1% to −6.7%) for essential hypertension; 12.7% (8.3% to 17.4%) for hypotension.	Lags not assessed. Hispanic individuals were associated with increased risk for ischemic stroke compared with white individuals. Black individuals were associated with a lower risk for dysrhythmias compared with white individuals.
<i>Rowland et al. 2020</i> <i>United States</i> (25)	Longitudinal (Case- Crossover)	Temperature 95 th vs 50 th percentile	Proportional increase in incidence rate of acute myocardial infarction= 7.9% (5.2% to 10.6%).	Lags not assessed.

				Male sex, age <65, and history of myocardial infarction were more susceptible to heatwaves.
<i>Semenza et al. 1999 United States (27)</i>	Cross-Sectional (Ecological)	Known heat wave from July 13-19, 1995, temperature threshold not specified. Heat index reaching all-time high of 119°F.	Proportional increase in hospitalizations= 19% for IHD; -3% for acute myocardial infarction; 22% for angina; 23% for heart failure; 23% for cerebrovascular disease 23% for CVD; 24% for hypertension; 34% for dysrhythmias; 15% for thrombosis	Lags not assessed. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Qu et al. 2021 China (29)</i>	Longitudinal (Case-Crossover)	Temperature > 90 th percentile	OR for CVD emergency department visit= 0.68 (0.42 to 1.09) in May; 1.07 (0.84 to 1.38) in June to August; 0.96 (0.60 to 1.54) in September. OR for CVD hospital admission= 0.96 (0.59 to 1.54) in May; 0.84 (0.66 to 1.09) in June to August; 0.99 (0.63 to 1.54) in September	Lag 0-6 days assessed. Subgroup analysis not reported.
<i>Empana et al. 2009 France (34)</i>	Longitudinal (Ecological)	Known heat wave on August 1-14, 2004; temperature threshold not specified	Relative rate= 2.34 (1.60 to 3.41) for out-of-hospital cardiac arrest; 1.09 (0.58 to 2.03) for acute myocardial infarction.	Lags not assessed. Age > 60 years was associated with increased susceptibility to heatwaves.
<i>Knowlton et al. 2009 United States (36)</i>	Cross-Sectional (Ecological)	Known heat wave on July 15-August 1, 2006; temperature threshold not specified	RR = 1.02 (0.96 to 1.07) for acute myocardial infarction emergency department visit; 1.02 (0.97 to 1.06) for acute myocardial infarction hospitalization; 0.98 (0.95 to 1.01) for cerebrovascular disease emergency department visit; 0.98 (0.95 to 1.02) for cerebrovascular disease hospitalization; 1.02 (1.01 to 1.03) for CVD emergency department visit; 1.01 (1.00 to 1.02) for CVD hospitalization.	Lags not assessed. Subgroup analysis not reported.

<i>Toloo et al. 2014 Australia (39)</i>	Longitudinal (Ecological)	Temperature > 95 th percentile for at least 2 consecutive days	RR for CVD emergency department visits= 0.98 (0.79 to 1.20) for the most disadvantaged group; 0.92 (0.83 to 1.02) for the least disadvantaged group. There was a statistically significant increased in CVD emergency department visits in the second least disadvantaged group (4 th decile of Index of Relative Socioeconomic Disadvantage) on lag 1 = 1.10 (1.01, 1.19).	Lag 0-3 days assessed. Results were only significant for the 4 th decile of Index of Relative socioeconomic disadvantage on lag 1 and 2. No significant difference between sociodemographic levels was noted.
<i>Bobb et al. 2014 United States (40)</i>	Longitudinal (Ecological)	Temperature > 99 th percentile for at least 2 consecutive days	RR for CVD hospital admission= 0.979 (0.970 to 0.987).	Lag 0-7 days assessed. Subgroup analysis not reported.
<i>Phung et al. 2016 Vietnam (41)</i>	Longitudinal (Ecological)	Temperature > 99 th percentile for at least 2 consecutive days	RR for CVD hospital admission= 1.129 (0.972 to 1.311).	Lag 0-21 days assessed. Results were highest at lag 0 and returned to normal at lag 4. No significant difference was noted among age or gender groups.
<i>Heo et al. 2019 Korea (42)</i>	Longitudinal (Ecological)	Tmax > 90 th percentile for at least 2 consecutive days	RR for CVD hospitalization per 1 °C increases in Tmax = 0.979 (0.893 to 1.073) for temperature cutoff of the 90 th percentile and 1.029 (0.900 to 1.324) for temperature cutoff of the 95 th percentile.	Lags not assessed. Subgroup analysis not reported.
<i>Chen et al. 2017 United States (47)</i>	Longitudinal (Ecological)	Tmin > 98 th percentile for 2 consecutive days	RR per 1°C increase= 1.0008 (1.0000 to 1.0015) for IHD emergency department visit; 1.0011 (0.9994 to 1.0027) for ischemic stroke emergency department visit; 1.0003 (0.9999 to 1.0007) for hypertension emergency department visit.	Lags not assessed. Subgroup analysis not reported.

<i>Sherbakov et al. 2018 United States (48)</i>	Longitudinal (Ecological)	Temperature > 95 th percentile for at least 2 consecutive days	RR= 0.98 (0.95 to 1.01) for IHD hospitalization; 1.03 (0.99 to 1.08) for acute myocardial infarction hospitalization; 1.00 (0.96 to 1.05) for ischemic stroke hospitalization; 0.99 (0.97 to 1.01) for CVD hospitalization; 0.99 (0.94 to 1.03) for cardiac dysrhythmias hospitalization; 0.91 (0.78 to 1.07) for essential hypertension hospitalization.	Lags not assessed. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Nitschke et al. 2007 France (52)</i>	Longitudinal (Ecological)	Daily Tmax >35°C for 3 or more consecutive days vs non-heatwaves	IRR= 1.01 (0.94 to 1.08) for IHD admissions; 0.94 (0.87 to 1.01) for stroke admission; 0.98 (0.94 to 1.02) for CVD ambulance calls; 0.99 (0.92 to 1.07) for CVD admissions.	Lags not assessed. Age 15-64 years was associated with an increased risk of hospital admissions and emergency department presentations for IHD.
<i>Ha et al. 2014 United States (53)</i>	Longitudinal (Ecological)	Temperature > 95 th percentile; Heat waves: Temperature > 95 th percentile for at least 2 consecutive days	OR for stroke admission= 0.993 (0.885 to 1.114) 0 day after exposure; 1.008 (0.896 to 1.133) 1 day after exposure; 1.173 (1.047 to 1.315) 2 days after exposure; 1.115 (0.995 to 1.249) 3 days after exposure.	Lag 0-3 days assessed. Results were only significant on lag 2. Male sex and age >65 years were associated with increased susceptibility to heatwaves.
<i>Bao et al. 2019 China (56)</i>	Longitudinal (Ecological)	Temperature > 85 th percentile	Attributable fraction of events associated with extreme temperature= 1.95% (0.63% to 3.2%) for stroke; 0.46% (-1.77% to 2.28%) for intracerebral hemorrhage; 2.32% (0.75% to 3.59%) for cerebral infarction.	Lag 0-7 days assessed. Individuals age >40years experienced an increased susceptibility to heatwaves.
<i>Parry et al. 2019 Australia (57)</i>	Longitudinal (Case-Crossover)	Temperature > 90 th percentile High PM10: ambient level >90 th percentile	OR= 1.01 (0.93 to 1.09) for IHD hospital admission; 0.93 (0.80 to 1.07) for heart failure hospital admission; 1.24 (0.75 to 2.07) for cardiac arrest hospital admission; 0.96 (0.85 to 1.09) for heart arrhythmia hospital admission; 0.86 (0.57 to 1.30) for conduction disorder hospital admission;	Lag 0-1 days assessed. The results were not statistically significant at either lag day. Age > 65 years was associated with increased susceptibility to the joint effect of PM10 and heatwaves.

			1.30 (0.90 to 1.89) for hypertensive disease hospital admission.	
<i>Tian et al. 2016 China</i> (60)	Longitudinal (Ecological)	Temperature > 99 th percentile	RR (0-21 days after exposure) = 0.90 (0.78 to 1.05) for IHD hospitalization; 0.98 (0.77 to 1.25) for acute myocardial infarction hospitalization; 0.89 (0.76 to 1.03) for heart failure hospitalization; 0.91 (0.80 to 1.02) for stroke hospitalization; 0.92 (0.86 to 0.99) for circulatory disease hospitalization.	Lag 0-21 days assessed. IHD, acute myocardial infarction, and heart failure exacerbations were not positive at any lag. Circulatory disease hospitalizations were elevated on lag 0-1: 1.04 (1.01 to 1.07) and stroke hospitalizations were elevated on lag 0-1: 1.07 (1.01 to 1.11)
<i>Borghei et al. 2020 Iran</i> (61)	Longitudinal (Ecological)	Temperature 95 th vs 75 th percentile	RR for cardiac arrest= 1.12 (1.001 to 1.454).	Lag 0-21 days assessed. For Lag 2-4 days, extreme heat was associated with an increased risk of unsuccessful CPR (RR= 1.12; CI: 1.001 to 1.454). Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Lu et al. 2020 Australia</i> (66)	Longitudinal (Case-crossover)	Temperature 99 th vs 90 th percentile	RR for CVD hospitalization= 1.01 (1.00 to 1.02).	Lag 0-21 days assessed but did not report results by lag day. Age < 70 years was associated with increased susceptibility to heatwaves.
<i>Guo et al. 2018 China</i> (67)	Longitudinal (Ecological)	Temperature > 99 th percentile	RR for CVD emergency incidence= 0.98 (0.97 to 0.99).	Lag 0-21 days assessed. Male sex and age>65 years were associated with increased

				susceptibility to extreme temperatures.
<i>Giang et al. 2014 Vietnam (68)</i>	Longitudinal (Ecological)	99 th vs 90 th percentile	RR for CVD hospital admission= 1.17 (0.90 to 1.52) for 1 °C increase above the threshold.	Lag 0-30 days assessed. Subgroup analysis not reported.
<i>Lam et al. 2018 China (70)</i>	Longitudinal (Ecological)	Temperature 99 th vs 75 th percentile	RR for acute myocardial infarction admission (0-4 days after exposure) = 1.14 (1.00 to 1.31) among individuals with diabetes; 1.00 (0.91 to 1.10) among individuals without diabetes.	Lag 0-22 days assessed. During the cold season, extreme heat was associated with myocardial infarction admission until day 15 and day 20 for patients with and without diabetes, respectively. Younger age (<75 years) and Diabetes was associated with increased susceptibility to heatwaves.
<i>Ponjoan et al. 2017 Spain (73)</i>	Cross-Sectional (Case-Control)	Temperature > 95 th percentile	IRR (0 day after exposure) = 0.96 (0.78 to 1.17) for heart failure hospitalization; 0.92 (0.75 to 1.13) for coronary heart disease hospitalization; 1.01 (0.81 to 1.25) for stroke hospitalization; 0.96 (0.85 to 1.08) for CVD hospitalization.	Lags not assessed. No significant differences were observed when stratifying by sex, age, or cardiovascular type categories for effects of heatwaves.
<i>Mohammadi et al. 2018 Iran (74)</i>	Cross-sectional (Case-Control)	Temperature 95 th vs 75 th percentile	RR for acute myocardial infarction = 1.08 (1.01 to 1.16).	Lag 0-28 days assessed. Results were only significant through lag 0-3 days assessed. Male sex and age > 65 years were associated with increased susceptibility to heatwaves.

<i>Kwon et al. 2015 Korea (75)</i>	Longitudinal (Ecological)	Heat index > 41°C	RR for acute myocardial infarction hospital admission= 1.05 (0.98 to 1.12).	Lags not assessed. Female sex, age > 75 years, residence in urban areas, and low socioeconomic level were associated with increased susceptibility to heatwaves.
<i>Pourshaikhian et al. 2019 Iran (76)</i>	Longitudinal (Ecological)	Temperature 99 th vs 75 th percentile	RR for CVD ambulance attendance= 1.02 (0.85 to 1.20) 0 day after exposure; 0.99 (0.97 to 1.04) 0-7 days after exposure.	Lag 0-20 days assessed. The results were not statistically significant at any of the Lag periods. The differences among groups were not statistically significant.
<i>Xu et al. 2021 Australia (78)</i>	Cross-Sectional (Case-Control)	Temperature > 99 th percentile of 10 days' moving average temperature vs Tmean	OR for stroke hospitalization= 1.85 (1.07 to 3.19)	Lag 0-10 days assessed. Results were only significant on lag 0 and lag 1. Male sex was associated with increased susceptibility to heatwaves.
<i>Lavigne et al. 2014 Canada (79)</i>	Longitudinal (Ecological)	Temperature 99 th vs 75 th percentile	RR for CVD emergency room visits= 1.13 (1.01 to 1.26) for individuals with diabetes.	Lag 0-13 days assessed. Results were only significant at lag 0-1 days assessed. Subgroup analysis not reported.
<i>Zhao et al. 2018 China (81)</i>	Longitudinal (Ecological)	Temperature 99 th percentile vs Tmean	RR for CVD clinical visits= 1.28 (1.11 to 1.48).	Lag 0-28 days assessed. Results were significant from lag 6 to lag 26. Subgroup analysis not reported.

<i>Xiong et al. 2015 China (83)</i>	Longitudinal (Ecological)	Temperature > 99 th percentile	RR (0-5 days after exposure) = 1.13 (0.69 to 1.83) for cerebrovascular disease hospital admission; 1.71 (1.08 to 2.72) for CVD hospital admission.	Lag 0-30 days but did not report results by individual lag periods. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Ma et al. 2020 China (84)</i>	Longitudinal (Ecological)	Temperature > 90 th percentile	Increase in hospital visits for CVD per 1°C increase in Tmin= 1.03 (0.99 to 1.06) for men; 1.14 (0.98 to 1.50) for women.	Lag 0- 7 days assessed. The lag day on which the strongest association was noted varied by subgroup and season. Age > 75 years was associated with increased susceptibility to heat.
<i>Ma et al. 2011 China (85)</i>	Cross- Sectional (Ecological)	Daily maximum temperature >35.0 °C and daily average temperature >97 th percentile for at least 7 consecutive days	RR for CVD hospital admission= 1.08 (1.05to 1.11).	Lag not assessed. Subgroup analysis not reported.
<i>Lin et al. 2020 Taiwan (90)</i>	Longitudinal (Ecological)	Temperature 99 th percentile vs average temperature	RR= 1.03 (0.99 to 1.07) for IHD emergency room visit; 1.06 (1.03 to 1.08) for IHD outpatient visit; 1.01 (0.99 to 1.03) for cerebrovascular disease emergency room visit; 1.07 (1.05 to 1.09) for cerebrovascular disease outpatient visit; 1.02 (1.00 to 1.03) for circulatory disease emergency room visit; 1.02 (0.98 to 1.07) for CVD emergency room visit; 1.01 (0.98 to 1.03) for circulatory disease outpatient visit; 1.06 (1.04 to 1.09) for CVD outpatient visit.	Lag 0-25 days assessed. For emergency visits, did not report specific values at individual lags, but if positive, results appear significantly elevated at lag <5 days assessed. For outpatient visits, results appear significantly elevated at all lag days except for circulatory disease at lag 0 and heart disease and IHD at lag 5.

<i>Son et al. 2014 Korea (91)</i>	Longitudinal (Ecological)	Temperature 99 th vs 90 th percentile	Proportional increase in CVD hospitalization= 3.2% (-0.5% to 7.1%) 0 day after exposure.	Lags not assessed. Female sex and age 65-74 years were associated with increased susceptibility to heatwaves.
<i>Madrigano et al. 2013 United States (96)</i>	Longitudinal (Case-Crossover)	Temperature > 95 th percentile	RR for acute myocardial infarction during the warm months at lag 0= 1.07 (0.86 to 1.33).	Lag 0-5 days assessed. Results were non-significant at all lags. Subgroup analysis not reported.
<i>Thu Dang et al. 2019 Vietnam (97)</i>	Longitudinal (Ecological)	Temperature > 95 th percentile	RR for acute myocardial infarction hospital admission= 1.36 (1.06 to 1.73).	Lag 0-20 days assessed. Age > 65 years and male sex were associated with increased susceptibility to heatwaves.
<i>Aklilu et al. 2020 China (98)</i>	Longitudinal (Case-Crossover)	Temperature > 99 th percentile	RR= 2.93 (2.08 to 4.12) for coronary heart disease hospital admissions; 2.89 (2.08 to 4.01) for CVD admissions; 6.61 (3.58 to 12.18) for atrial fibrillation; 1.78 (1.16 to 2.73) for heart failure hospital admissions.	Lag 0-27 days assessed. CVD admissions were elevated at lag 5,15,27; coronary heart disease admissions were elevated at lag 15,27; atrial fibrillation admissions were elevated at lag 5,15,27; heart failure admissions were elevated at lag 5,15,27. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Mohammadi et al. 2021 Iran (101)</i>	Longitudinal (Ecological)	Temperature > 99 th percentile	RR for CVD hospital admission= 1.34 (1.10 to 1.64).	Lag 0-7. Results were only significant at lag 0 and lag 1. Subgroup analysis not reported.
<i>Iniguez et al. 2021 Spain (105)</i>	Longitudinal (Ecological)	Temperature > 97.5 th percentile	RR= 1.02 (1.00 to 1.04) for CVD hospital admission.	Lag 0-21 days assessed.

				Subgroup analysis not reported.
<i>Guo et al. 2017 China</i> (109)	Longitudinal (Ecological)	Temperature > 97.5 th percentile	RR= 0.84 (0.43 to 1.65) for intracerebral hemorrhage; 0.87 (0.58 to 1.31) for cerebral infarction.	Lag 0-21 days assessed. Subgroup analysis not reported.
<i>Webb et al. 2014 Australia</i> (121)	Longitudinal (Ecological)	Temperature > 95 th percentile	Increase in Admission Rate for IHD =17% (p=0.015) for all individuals aged 25-64; 32% (10 to 56; p=0.002) for Indigenous women age 25-64. Decrease in Admission Rate for heart failure = -63% (-14 to -89; p=0.047) for indigenous women	Lag 0-21 days assessed. Indigenous women were more adversely affected by very hot days than the non-indigenous women
<i>Linares et al. 2008 Spain</i> (122)	Longitudinal (Ecological)	Tmax>36 C Ozone: 3-hour average level (µg/m3)	Ozone+Extreme Heat= Increase in absolute numbers of emergency hospital admissions for cardiovascular causes with exposure to elevated ozone per 1 C increase over 0-7 days= 0.84 (0.16 to 1.52)	Lag 0-9 days assessed. Older age (>75 years) was not associated with significantly higher risk of cardiovascular admission
<i>Auger et al. 2017. Canada</i> (125)	Longitudinal (Ecological)	Number of days with outdoor maximum temperature ≥ 30°C during the first trimester	Number of days with temperature ≥ 30°C between weeks 2 and 8 post-conception was not significantly associated with any specific critical heart defect in adjusted models but was associated with select noncritical defects, including atrial septal and other noncritical defects. Relative to 0 days, exposure to 15 days of temperature ≥ 30°C was associated with 1.37 times the risk of atrial septal defects (95% CI: 1.10, 1.70), and 1.54 times the risk of other noncritical defects (95% CI: 1.20, 1.97). The associations increased steadily with more days exposed.	Lags not assessed. No differences between singleton and multiple pregnancies, or in the group of women with co-morbidities compared with those without co-morbidities.

<i>Lin et al. 2018.</i> <i>United States</i> (126)	Cross-sectional (case-control)	Extreme heat events defined by using the 95 th or 90 th percentile of daily maximum temperature and its frequency and duration during weeks 3 through 8 post-conception	No significant relationships between maternal extreme heat exposure and congenital heart diseases in most regions during summer. However, 3-11 days of extreme heat defined as daily maximum temperature >90 th percentile during summer and spring was significantly associated with ventricular septal defects study wide.	Lags not assessed. Extreme heat defined as daily maximum temperature >95 th percentile in the spring was significantly associated with conotruncal defects and ventricular septal defects in the Southern US. Most extreme heat indicators in spring were significantly associated with increased septal defects (both ventricular and atrial) in the Northeast.
<i>Fisher et al. 2017.</i> <i>United States</i> (127)	Longitudinal (Case-crossover)	Tmax> location- and calendar day-specific 95 th percentile	Extreme heat events on the day of hospitalization were associated with an increased risk of AMI for= lag 0 OR 1.11 (1.05 to 1.17); lag 1 OR: 1.16 (1.09 to 1.22); and lag 2 OR: 1.14 (1.08 to 1.20).	Lag 0-2 days assessed. Results were statically significant for all lags evaluated. Among non-Hispanic whites, higher risk of AMI was found among those ≥ 65 years of age (OR = 1.14; 1.05 to 1.24) but not among those 18–64 years old (OR = 1.01; 0.91 to 1.13) in the lag 0 models. In contrast, among non-Hispanic blacks, higher risk was seen among those 18–64 years old (OR = 1.37; 1.16 to 1.62) compared with those aged ≥ 65 years (OR = 1.16; 0.96 to 1.40). However, in tests of model heterogeneity, differences in the effect estimates from these models were not statistically significant.

<i>Dastoorpoor et al. 2021</i> <i>Iran</i> (128)	Longitudinal (Ecological)	Physiologically Equivalent Temperature (PET) >99 th percentile	RR of hospitalization associated with extreme heat PET at lag 0 for= all CVD: 1.119 (0.993 to 1.261); hypertensive heart disease: 0.955 (0.533 to 1.712); IHD: 1.229 (1.05 to 1.439); other heart disease: 1.002 (0.803 to 1.249); cerebrovascular disease: 1.005 (0.738 to 1.369)	Lag 0-30 days assessed. Results were significant for the following lags: CVD= no Lag; Hypertensive heart disease = lag 0-13 ; IHD = lag 0; other heart disease = no assessed lag; cerebrovascular disease = no Lag There were no significant differences in hospitalizations between men and women. Patients age>75 were less likely to be hospitalized for CVD compared to younger patients, but only for lag 0-6 and 0-13.
<i>Costa et al. 2021</i> <i>Brazil</i> (129)	Longitudinal (Ecological)	3 or more consecutive days with minimum and maximum daily temperatures above 18.0 °C and 28.0 °C, respectively	Cardiovascular hospitalization rates during normal days = 0.714 hospitalizations per day; heat waves = 0.759 hospitalizations per day.	Lag 0-30 days assessed. Subgroup analysis not reported.
<i>Guo et al. 2022</i> <i>China</i> (130)	Longitudinal (Ecological)	Daily Tmean> 99 th percentile	RR of circulatory disease hospitalizations in patients age <75 relying on public assistance = 0.994 (0.941 to 1.050) compared to those not on public assistance 1.010 (0.965 to 1.057) RR of circulatory disease hospitalizations in patients age <75 relying on public assistance = 0.979 (0.942 to 1.017) compared to those not on public assistance 0.971 (0.955 to 0.988)	Lag 0-3 days assessed. Subgroup analysis not reported.

			RR of circulatory disease hospitalizations in patients age >75 relying on public assistance = 1.057 (1.008 to 1.109) compared to those not on public assistance 0.887 (0.845 to 0.930) RR of IHD hospitalizations in patients age >75 relying on public assistance = 1.219 (1.106 to 1.344) compared to those not on public assistance 0.963 (0.920 to 1.008)	
<i>Heo et al. 2021 United States (131)</i>	Longitudinal (Ecological)	Tmax>95 th percentile	RR of daily hospitalization associated with a 1°C increase in lag0-3 temperature above the county-specific threshold temperature for CVD: 1.000 (0.998 to 1.002) in 2000-2004, 1.000 (0.997 to 1.003) in 2005-2008, 1.000 (0.997 to 1.003) in 2009-2012, and 0.998 (0.995 to 1.002) in 2013-2016.	Lag 0-3 days assessed. Subgroup analysis not reported.
<i>Park et al. 2021 South Korea (133)</i>	Longitudinal (Ecological)	Tmean>99 th percentile	RR of out-of-hospital cardiac arrests (OHCA) on extreme heat days compared to the minimum morbidity temperature = 1.07 (0.95 to 1.21)	Lag 0-14 days assessed and included in the main analysis. The excess OHCA attributed to hot temperatures were highest in patients with heart disease (2.7%) and diabetes (2.7%), followed by those with hypertension (1.2%). There were no significant differences between age group and sex.
<i>Fonseca-Rodriguez et al. 2021 Sweden (138)</i>	Longitudinal (Ecological)	Days when morning and afternoon apparent temperature were > 84 th percentile	Extreme heat was associated with a non-statistically significant decrease in CVD hospitalizations during the summer.	Lags not assessed. There was no significant difference when stratified by age or sex.

<i>Simoes et al. 2022 France (140)</i>	Longitudinal (Ecological)	Daily tmax> 99 th percentile	RR of cardiac dyspnea events associated with extreme temperature (lag 10 - lag14) = 1.04 (1.00 to 1.06)	Lag 0-14 days assessed. Subgroup analysis not reported.
<i>Talukder et al. 2021 Vietnam (141)</i>	Longitudinal (Ecological)	Tmean> 24°C	Proportional increase in cardiovascular disease admission with 1°C rise in temperature (lag0) = 0.5% (0.1% to 0.9%).	Lag 0-6 days assessed. Results were only significant on day 0. Subgroup analysis not reported.
<i>Yoon et al. 2021 South Korea (142)</i>	Longitudinal (Ecological)	Tmax=26.6°C	Proportional increase in cardio- and cerebrovascular disease for every 1 °C rise above Tmax = 0.003127	Lag 0-14 days assessed. Subgroup analysis not reported.
<i>Masiero et al. 2021 Italy (143)</i>	Longitudinal (Ecological)	Daily Tmean >2 standard deviations above the local mean (82.5 °F)	Extreme heat was associated with a statistically significant increase in CVD admissions	Lags not assessed. Extremely hot days increased mortality rates of those aged 25 years or older.
<i>Zhai et al. 2022 China (144)</i>	Longitudinal (Ecological)	Attributable Tmax of 20°C	RR of CVD hospitalization with extreme heat exposure compared to Attributable temperature of 12°C= 1.595 for lag 0-30 (p<0.05)	Lag 0-30 days assessed. Results were significant at lag 0-30 and lag 14. Females were more effected by high AT than were males. Temperature effects were not significantly different between people above and below 65 years of age.
<i>Garcia-Lledo et al. 2020 Spain (146)</i>	Longitudinal (Ecological)	Heat wave: maximum temperature forecast above 38.5 °C or 3 or more consecutive days with a	Incidence rate ratio for STEMI during heat wave alert periods once adjusted for season= 1.14 (0.96 to 1.35)	Lag 0-4 days assessed. There was no significant effect of age or sex on incidence of STEMI.

		temperature above 36.5 °C.		
<i>Cleland et al. 2023 United States</i> (149)	Longitudinal (Ecological)	Temperature >99th percentile	RR for CVD hospitalizations across the US = 1.5% (0.4% to 2.6%). RR for CVD hospitalizations in high urban heat islands = 2.4% (0.4% to 4.3%); low urban heat island areas = 1% (-0.8% to 2.8%).	Lag 0-21 days assessed. Elevated risk of CVD hospitalization seen at lag 0, with a delayed association peaking at lag 5 and continuing until lag 12. Females, ages 75–114, and those with chronic conditions living in high urban heat island areas experienced the largest heat-related CVD impacts.
<i>Meng et al. 2023 China</i> (152)	Longitudinal (Ecological)	Maximum value of daily average temperature (30 °C) compared to temperature at the 75th percentile (20 °C)	RR of IHD hospitalization = 0.588 (0.362 to 0.953) in men; 1.312 (0.832 to 2.071) in women; 0.734 (0.435 to 1.240) for age <65; and 0.546 (0.337 to 0.884) for age >65. RR of coronary artery disease hospitalization = 0.498 (0.244 to 1.017) in men; 1.513(0.817 to 2.800) in women; 0.711(0.352 to 1.436) for age <65; and 0.475 (0.246 to 0.915) for age >65. RR for acute coronary syndrome hospitalization= 0.633 (0.391 to 1.024) in men; 1.222 (0.701 to 2.131) in women; 0.745 (0.418 to 1.329) for age <65; and 0.592 (0.339 to 1.033) for age >65.	Lag 0-30 days assessed. No significant difference by lag observed across all groups. Reduced risk of IHD hospitalization in patients ≥ 65 years observed at cumulative lag 0-31 days assessed.
<i>Requia et al. 2023 Brazil</i> (154)	Longitudinal (Ecological)	Temperature >99th percentile	RR for circulatory disease hospital admissions = 1.01 (0.99 to 1.02).	Lag 0-3 days assessed. Circulatory admissions suggested robust positive

				associations for people aged ≥ 15 years old; for men aged 15–45 years old; and women aged 15–65 years old.
<i>Stowell et al. 2023 United States</i> (159)	Longitudinal (Case-crossover)	Temperature > 95th percentile	OR of emergency department visit for cardiovascular diseases = 1.02 (0.86 to 1.21).	Lag 0-5 days assessed. Subgroup analysis not reported.
<i>Xu et al. 2023 China</i> (162)	Longitudinal (Ecological)	Temperature 95th percentile (29.26°C)	Cumulative risk ratios for congenital heart disease were significantly elevated with extreme heat exposure during the second trimester.	Lags not assessed. No statistical significance was observed between male and female embryonic sex.
<i>Tao et al. 2023 China</i> (165)	Cross-Sectional (Ecological)	Tmax>95th percentile during the day and Tmin>95th percentile during the night.	Cumulative relative risk for CVD due to hot day excess = 1.10 (1.05 to 1.15); hot night excess = 1.38 (1.18 to 1.61). Attributable fraction for CVD due to hot day excess = 4.63% (2.44% to 6.93%); hot night excess = 15.70% (7.59% to 25.01%).	Lag 0-6 days assessed. Males and those aged <45 years were more vulnerable to heat night excess.
<i>Sun et al. 2023 China</i> (167)	Longitudinal (Ecological)	Temperature >95th percentile	Adjusted OR of hypertensive disorder of pregnancy in the first trimester = 1.050 (0.961 to 1.147); second trimester = 1.000 (0.914 to 1.094); third trimester = 0.914 (0.841 to 0.993).	Lags not assessed. Significantly elevated risk of hypertensive disorders during pregnancy in women ≥ 35 years but risk is decreased in women <35 years.
<i>Flores et al. 2023 United States</i> (168)	Longitudinal (Case-crossover)	Temperature >95 th percentile	For uninsured individuals, there was a proportional increase in rate of hospitalization for acute myocardial infarction at 0-12 hours prior to the event, but not for 0-6 hours prior to the event. For insured individuals, there was a proportional increase in rate of hospitalization for acute myocardial	Lags not assessed. The rate of myocardial infarction increased at a steeper rate for high temperatures in uninsured vs insured individuals, but this result was not significant.

			infarction at 0-6 and 0-12 hours prior to the event.	
<i>Yu et al. 2021 China</i> (170)	Longitudinal (Ecological)	Daily Tmax>97.5th percentile	RR for acute aortic dissection associated with extreme heat exposure = 0.783 (0.513 to 1.193)	Lag 0-25 days assessed. Results were not significant at any lag. Men were more likely to develop acute aortic dissection compared to women. There was no interaction with age or underlying hypertension.
<i>McGuinn et al. 2013 England</i> (171)	Longitudinal (Ecological)	Heat waves in the summers of 1995 and 2003 (not defined)	There was no evidence of increased risk of ventricular arrhythmias as assessed by implantable cardiac defibrillator (ICD) activation with high temperatures, and specifically none during the heat-wave episodes in the summers of 1995 and 2003.	Lag 0-7 days assessed. There was an increased risk of temperature-related ICD activation in patients 65 years or over.

C. Extreme Heat: Other Cardiovascular Outcomes

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Comments
<i>Turner et al. 2013 Australia</i> (13)	Longitudinal (Ecological)	Extreme heat: Temperature > 37.8°C	Proportional increase in CVD ambulance use = 29.5% (0.4 to 67.0).	Lags not assessed. Older adults (age 65-74 years) were associated with increased susceptibility to heatwaves, although once separated,

				neither were statistically significant.
<i>Schneider et al. 2023 Germany</i> (156)	Longitudinal (Ecological)	Temperature > 99th percentile (38°C)	RR for CVD emergency ambulance dispatch = 1.14 (0.98 to 1.31).	Lag 0-10 days assessed. Significant increase in ambulance dispatch seen in overall cumulative lag 0-2 days assessed. Subgroup analysis not reported.

eTable 5. Extreme Cold. Abbreviations: CVD=Cardiovascular Disease, IHD=Ischemic Heart Disease, OR=Odds Ratio, RR=Relative Risk, Tmax=Maximum Temperature, Tmean=Mean Temperature, Tmin=Minimum Temperature.

A. Extreme Cold: Cardiovascular Mortality

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Alahmad et al. 2020 Kuwait</i> (59)	Longitudinal (Ecological)	Temperature 1 st percentile (10.9°C) vs 66 th percentile (34.7°C)	RR for CVD mortality= 1.45 (0.72 to 2.93).	Lags not assessed. Subgroup analysis not reported.
<i>Bai et al. 2014 China</i> (62)	Longitudinal (Ecological)	Extreme cold: Temperature < 1 st percentile	RR for CVD mortality in Jiangzi (0-2 days after exposure) = 1.410 (0.753 to 2.640).	Lag 0-14 days assessed. Results were not significant at any lag assessed.

				Age <65 was associated with increased susceptibility to extreme cold.
<i>Deng et al. 2019 China (63)</i>	Longitudinal (Ecological)	Temperature < 2.5 th percentile	Attributable fraction= 6.48% (-0.70% to 12.47%) for coronary heart disease mortality; 6.01% (-0.11% to 11.41%) for stroke mortality; 6.18% (1.89% to 10.31%) for CVD mortality.	Lag 0-28 days assessed. Ages 65-74 and > 75 years were associated with increased susceptibility to extreme cold.
<i>Moghadamnia et al. 2018 Iran (64)</i>	Longitudinal (Ecological)	Temperature 5 th vs 25 th percentile	RR for CVD mortality= 1.14 (1.05 to 1.23).	Lag 0-20 days assessed. Results were only significant on days 5-10. Female sex and age > 65 years were associated with increased susceptibility to extreme cold.
<i>Wang et al. 2015 China (69)</i>	Longitudinal (Ecological)	Temperature 1 st vs 10 th percentile	Beijing RR (0-27 days after exposure) 1.36 (0.74 to 3.38) for IHD mortality; 1.11 (0.52 to 2.36) for cerebrovascular disease mortality; 1.35 (0.80 to 2.26) for CVD mortality; 1.56 (0.02 to 8.70) for hypertension mortality. Shanghai RR (0-27 days after exposure) = 1.10 (0.42 to 2.86) for IHD mortality; 1.10 (0.49 to 2.45) for cerebrovascular disease mortality; 1.07 (0.60 to 1.90) for CVD mortality; 0.98 (0.10 to 5.60) for hypertension mortality.	Lag 0-27 days assessed. In Beijing, CVD, cerebrovascular disease, and ischemic heart disease mortality were not significant at lag 0, but was at all other lags assessed; Hypertensive mortality was significant at lag 0-27 days but not at other lag periods assessed. In Shanghai, CVD and ischemic heart disease mortality was significant at lag 0-27 days but not at other lag periods assessed, while hypertensive and cerebrovascular disease mortality were not significant at any Lag.

<i>Ballester et al. 1997</i> <i>Spain</i> (71)	Longitudinal (Ecological)	Temperature <15°C	RR for CVD mortality (0 day after exposure) = 1.021 (1.006 to 1.036) from November to April; 0.996 (0.978 to 1.015) from May to October.	Lag 0-14 days assessed. During the cold months, results were significant at lag 0, 1-2, and 7-14 days, but were not significant at 3-7 days assessed. During the hot months, results were only significant at 3-7 days assessed. Age > 70 years was associated with increased susceptibility to extreme cold.
<i>Sharafkhani et al. 2020</i> <i>Iran</i> (72)	Longitudinal (Ecological)	Temperature <5 th percentile for 2 consecutive days	Cumulative excess risk for CVD mortality= 5% (-13% to 26%).	Lag 0-30 days assessed. Results were not significant at any lag. Age > 75 years and female sex were associated with increased susceptibility to extreme cold.
<i>Son et al. 2014</i> <i>Brazil</i> (77)	Longitudinal (Ecological)	Temperature 1 st vs 10 th percentile	Proportional increase in CVD mortality= 11.8% (7.9% to 15.7%).	Lag 0-20 days assessed. Female sex and age > 75 years were associated with increased susceptibility to extreme cold.
<i>Silveira et al. 2019</i> <i>Brazil</i> (80)	Longitudinal (Ecological)	Temperature 1 st percentile vs Tmean	RR for CVD mortality= 1.26 (1.17 to 1.35).	Lag 0-21 days assessed. Results were significant at all Lag days assessed.
<i>Sharafkhani et al. 2018</i> <i>Iran</i> (82)	Longitudinal (Ecological)	Physiologic Equivalent Temperature (PET) 1 st vs 25 th percentile	RR for CVD mortality= 1.18 (0.85 to 1.64) at lag 0-30.	Lag 0-30 days assessed. Results were not significant at any lag periods. Age > 75 years and female sex was associated with increased susceptibility to extreme cold.

<i>Revich et al. 2010</i> <i>Russia</i> (86)	Longitudinal (Ecological)	At least 9 consecutive days with daily Tmean < 3 rd percentile, of which at least 3 days had daily Tmean < 1 st percentile temperature	RR for IHD mortality= 1.78 (1.19 to 2.37) for 30 to 64 years old; 1.60 (1.05 to 2.15) for 65+ years old. RR for CVD mortality= 0.65 (0.00 to 1.45) for 30 to 64 years old; 2.31 (1.63 to 2.99) for 65+ years old.	Lag 0-16 days assessed. Age > 65 years were associated with increased CVD mortality to extreme cold.
<i>Huang et al. 2014</i> <i>China</i> (87)	Longitudinal (Ecological)	Temperature < 10°C	Proportional increase in CVD mortality= 6.6% (5.2% to 8.2%).	Lags not assessed. Subgroup analysis not reported.
<i>Rodrigues et al. 2019</i> <i>Portugal</i> (88)	Longitudinal (Ecological)	Temperature < 1 st percentile	RR for cerebrovascular disease mortality= 2.09 (1.74 to 2.51).	Lag 0-30 days assessed. Unclear significance by lag date, but RR was positive starting after day 1. Subgroup analysis not reported.
<i>Cui et al. 2016</i> <i>China</i> (89)	Longitudinal (Ecological)	Temperature < 2.5 th percentile	Attributable mortality for cardiovascular deaths= 11.40% (6.29% to 16.01%).	Lag 0-21 days assessed. Subgroup analysis not reported.
<i>Lin et al. 2020</i> <i>Taiwan</i> (90)	Longitudinal (Ecological)	Temperature 1 st percentile vs average temperature	RR= 1.40 (1.27 to 1.58) for IHD mortality; 1.40 (1.27 to 1.54) for cerebrovascular disease mortality; 1.41 (1.34 to 1.49) for circulatory disease mortality; 1.38 (1.25 to 1.53) for heart disease mortality.	Lag 0-25 days assessed. Did not report specific values at individual lags, but results appear elevated after lag 0. Subgroup analysis not reported.
<i>Huynen et al. 2001</i> <i>Netherlands</i> (92)	Longitudinal (Ecological)	At least 9 days with a Tmin ≤ 5°C, of which at least 6 days have a Tmin ≤ 10°C	Proportional increase in CVD mortality= 1.69%.	Lag 0-30 days assessed. Results were positive for all lag durations except lag 0.

				Age > 65 years were associated with increased susceptibility to extreme cold.
<i>Zhang et al. 2019</i> <i>China</i> (93)	Longitudinal (Ecological)	Temperature < 2.5 th percentile	Attributed fractions for CVD mortality= 1.65% (1.21% to 2.09%).	Lag 0-21 days assessed. Subgroup analysis not reported.
<i>Ma et al. 2014</i> <i>China</i> (94)	Longitudinal (Ecological)	Temperature 1 st vs 25 th percentile	Proportional increases in CVD mortality per 1°C decrease from the 25 th to 1 st percentile of temperature over lag 0-14 days= 2.49% (1.53% to 3.46%).	Lag 0-14 days assessed and reported in the main analysis. Subgroup analysis not reported.
<i>Chen et al. 2018</i> <i>China</i> (99)	Longitudinal (Ecological)	Temperature < 2.5 th percentile	RR= 1.96 (1.74 to 2.22) for coronary heart disease mortality; 1.85 (1.63 to 2.09) for stroke mortality; 1.78 (1.46 to 2.16) for ischemic stroke mortality; 1.59 (1.34 to 1.89) for hemorrhagic stroke mortality; 1.92 (1.75 to 2.10) for CVD mortality.	Lag 0-25 days assessed. Although individual results are not reported, results appear elevated at lag >3 days and <15 days assessed. Age > 75 years, female sex, and less than 9 years of education were associated with increased susceptibility to extreme cold.
<i>Guo et al. 2012</i> <i>Thailand</i> (102)	Longitudinal (Ecological)	Temperature 1 st vs 25 th percentile	RR for cold CVD mortality= 1.45 (1.04 to 2.02).	Lag 0-20 days assessed. Results were only significant at lag 0 and lag 1. Subgroup analysis not reported.
<i>Ding et al. 2016</i> <i>China</i> (103)	Longitudinal (Ecological)	Temperature 1 st vs 10 th percentile	RR for CVD mortality (0-3 days after exposure) = 1.17 (1.05 to 1.30).	Lag 0-21 days assessed. Results were significant at all lags.

				Subgroup analysis not reported.
<i>Breitner et al. 2014 Germany</i> (104)	Longitudinal (Ecological)	Temperature 1 st vs 10 th percentile	RR for CVD mortality= 1.08 (1.02 to 1.14) 15 days after exposure.	Lag 0-14 days assessed. Age > 75 years was associated with increased susceptibility to extreme cold.
<i>Iniguez et al. 2021 Spain</i> (105)	Longitudinal (Ecological)	Temperature < 2.5 th percentile	RR= 1.32 (1.22 to 1.42) for CVD mortality.	Lag 0-21 days assessed. Subgroup analysis not reported.
<i>Li et al. 2021 China</i> (106)	Longitudinal (Ecological)	Temperature < 2.5 th percentile	RR for CVD mortality= 2.72 (1.96 to 3.77).	Lag 0-21 days assessed. Temperature effects were most pronounced in the first 10-15 days assessed. Age > 65 years was associated with increased susceptibility to extreme cold.
<i>Guo et al. 2012 China</i> (107)	Longitudinal (Ecological)	Temperature 1 st vs 10 th percentile	RR for IHD mortality (0-20 days after exposure) = 1.48 (1.31 to 1.66).	Lag 0-20 days assessed. Results were only significant at lag 0-13 and 0-20, but not 0-2. Subgroup analysis not reported.
<i>Ma et al. 2020 China</i> (108)	Longitudinal (Ecological)	Temperature < 10 th percentile	RR= 1.66 (1.27 to 2.17) for IHD mortality; 1.72 (1.21 to 2.47) for myocardial infarction mortality; 1.31 (1.09 to 1.57) for stroke mortality; 1.92 (1.23 to 3.02) for hypertensive disease mortality; 2.28 (1.40 to 3.71) for hypertensive heart disease mortality.	Lag 0-21 days assessed. Subgroup analysis not reported.
<i>Royé et al. 2019 Spain</i> (110)	Longitudinal (Ecological)	Temperature < 5 th percentile	RR for ischemic stroke mortality= 1.20 (1.05 to 1.37).	Lags not assessed.

				Subgroup analysis not reported.
<i>Chen et al. 2014 China</i> (111)	Longitudinal (Ecological)	Temperature 1 st vs 25 th percentile	RR for out-of-hospital coronary deaths= 1.49 (1.26 to 1.76).	Lag 0-28 days assessed. Results were significant at all lags assessed. Age > 65 years, male sex, and less than middle school education were associated with increased susceptibility to extreme cold.
<i>Chen et al. 2013 China</i> (112)	Longitudinal (Ecological)	1 st vs 25 th percentile	RR for stroke mortality through the third day after exposure= 1.18 (1.02 to 1.37)	Lag 0-28 days assessed. Results were significant at all lags assessed.
<i>Han et al. 2017 China</i> (113)	Longitudinal (Ecological)	Cold spell: Temperature < 5 th percentile for ≥3 days	RR= 1.11 (1.06 to 1.17) for stroke mortality; 1.06 (1.03 to 1.10) for CVD mortality.	Lags not assessed. Age <65 years was associated with increased susceptibility to extreme cold.
<i>Huang et al. 2012 Australia</i> (114)	Longitudinal (Ecological)	Temperature < 1 st percentile for 2 to 4 consecutive days	Years of life lost for CVD mortality= 31 (11 to 52).	Lag 0-10 days assessed. Subgroup analysis not reported.
<i>Qian et al. 2008 China</i> (115)	Longitudinal (Ecological)	Temperature < 5 th percentile	Cold + PM10: Proportional change in daily stroke mortality= 0.67% (-0.50% to 1.85%) Cold + PM10: Proportional change in daily CVD mortality= 0.72% (-0.25% to 1.70%) Cold + ozone: Proportional change in daily stroke mortality= 0.57% (-1.91% to 3.10%) Cold + ozone: Proportional change in daily CVD mortality= 0.09% (-1.94% to 2.15%)	Lag 0-4 days assessed. Subgroup analysis not reported.

<i>Cheng et al. 2012</i> <i>China</i> (116)	Longitudinal (Ecological)	Temperature<15 th percentile Air pollution: 24- hour average ambient level ($\mu\text{g}/\text{m}^3$)	Proportional increase in CVD mortality= 0.49% (0.13% to 0.86%).	Lags not assessed. Subgroup analysis not reported.
<i>Zhang et al. 2020</i> <i>China</i> (117)	Longitudinal (Ecological)	Temperature<10 th percentile Air pollution: 24- hour average PM2.5 level ($\mu\text{g}/\text{m}^3$)	Proportional increase in CVD mortality= 0.42% (0.27% to 0.57%).	Lag 0-5 days assessed. Subgroup analysis not reported.
<i>Chen et al. 2018</i> <i>Finland, Sweden,</i> <i>Denmark, Germany,</i> <i>Italy, Spain</i> (118)	Longitudinal (Ecological)	25 th percentile Air pollution: PNC, PM2.5, PM10, and ozone	Proportion increase in CVD mortality associated with cold exposure (1 st percentile of temperature relative to the 10 th percentile) = 6.58% (1.17% to 12.29%) during low ozone levels (lag 1 day) and 25.75% (-51.47% to 225.85%) during high ozone levels.	Lag 1 day after exposure to ozone included in the main analysis. No significant difference was observed in different age groups or sex.
<i>Urban et al. 2013</i> <i>Czech Republic</i> (123)	Longitudinal (Ecological)	Tmean<10 th percentile	Prague: Relative excess mortality at 0-7 days for: CVD=1.5 (-1.8 to 4.9); myocardial infarction = 2.4(-4.1 to 9.4); IHD = 1.5(- 3.8 to 7.0); Chronic IHD = -0.1(-6.5 to 6.8); Atherosclerotic Vascular disease=2.9(-4.0 to 10.2); Cerebrovascular disease= 2.4(-4.1 to 9.4) Bohemia: Relative excess mortality at 0-7 days for: CVD= 2.4 (-1.1 to 5.9); MI= 11.9 (3.6- 20.8); IHD= 2.9 (-2.2 to 8.3); Chronic IHD = -3.6 (-10.0 to 3.2); Atherosclerotic Vascular disease= 1.0 (-8.5 to 11.4);	Lags not assessed. Cold stress appeared to have greater effect on myocardial infarction in the rural Bohemian population

			Cerebrovascular disease= 3.4 (−3.0 to 10.3)	
<i>Chen et al. 2013</i> <i>China</i> (124)	Longitudinal (Ecological)	Temperature: <25 th percentile Air pollution: 1, 8, 24-hr average ozone level	Proportional increase in CVD mortality related to an interquartile range increase in ozone concentrations during extreme cold temperatures for: 1-hr ozone average= 18.77 (0.09 to 40.95); 8-hr ozone average= 18.58 (1.51 to 38.51); 24-hr ozone average= 10.10 (-8.07 to 31.86)	Lag 0-2 days assessed. Subgroup analysis not reported.
<i>Parliari et al. 2022</i> <i>Greece</i> (134)	Longitudinal (Ecological)	Tmin<2.5°C	RR of mortality associated with extreme cold compared to minimum mortality temperature for CVD= 1.18 (0.93 to 1.52) and cerebrovascular disease= 1.41 (0.97 to 2.04)	Lags not assessed. Subgroup analysis not reported.
<i>Zhang et al. 2021</i> <i>China</i> (135)	Longitudinal (Ecological)	Daily temperature <1 st percentile	RR of mortality associated with exposure to extreme cold temperatures compared to daily median temperature for lag 0-21 for = CVD: 1.384 (1.087 to 1.764); IHD: 1.332 (0.947 to 1.873); cerebrovascular disease: 1.428 (1.051 to 1.940) RR of cardiovascular mortality in patients with cerebrovascular disease exposed to extreme cold temperatures compared to daily median temperature= 1.282 (1.020 to 1.611)	Lag 0-21 days assessed. CVD mortality was significant at all lags except day 0; ischemic heart disease was significant at lag 0-14; cerebrovascular disease was significant at lag 0-14 and 0-21 days assessed. Extremely low temperatures affected cardiovascular mortality differently in males (RR= 1.492 (1.175 to 1.896)), married people (RR = 1.590 (1.224 to 2.064)), and people above the age of 65 years (RR = 1.641 (1.106 to 2.434))

<i>Mascarenhas et al. 2022</i> <i>Brazil</i> (137)	Longitudinal (Ecological)	Tmean<2.5 th percentile	RR for cerebrovascular mortality when exposed to extreme cold compared to the local minimum mortality temperature ranged from 1.04 to 1.53 in the 10 examined micro-regions. 6710 regions had statistically significant increased cerebrovascular mortality.	Lags not assessed. Subgroup analysis not reported.
<i>Saucy et al. 2021</i> <i>Switzerland</i> (139)	Case- crossover (Ecological)	Daily Tmean< 5 th percentile	OR for CVD mortality at Tmin = 1.15 (0.95 to 1.39)	Lags not assessed. Cold temperatures were not significantly associated with increased mortality. Individuals with low socio-economic status, low education and those not married had increased OR associated with increased CVD.
Alahmad et al. 2023 Kuwait (147)	Longitudinal (case- crossover)	Temperature < 1st percentile	RR for mortality from CVD = 1.32 (1.27 to 1.38) IHD = 1.33 (1.26 to 1.41); stroke = 1.32 (1.26 to 1.38); heart failure = 1.37 (1.28 to 1.47); arrhythmia = 1.19 (0.17 to 1.33) Per 1,000 deaths, extreme temperatures below the 2.5th percentile accounted for 9.1 (8.9 to 9.2) excess all-cause CVD deaths and 12.8 (12.2 to 13.1) excess heart failure deaths.	Lag periods 0-14 days and 0-21 days were assessed. Higher risk of death from CVD was seen when lag was extended to 21 days assessed. Subgroup analysis not reported.
Jingesi et al. 2023 China(151)	Longitudinal (Ecological)	Temperature > 1st percentile (3.5°C)	RR of cardiovascular mortality = 1.00(1.00 to 1.12). RR of cardiovascular mortality on first four days (lag 0-3 days)= 1.12 (1.02 to 1.25).	Lag 0-21 days assessed. Similar effects in males and females. Individuals > 65 years were more vulnerable to cold stress.

Requia et al. 2023 Brazil(153)	Longitudinal (Ecological)	Temperature < 1st percentile	RR for cardiovascular mortality = 1.27 (1.16 to 1.37).	Lag 0-20 days assessed. Results report lag 20 as the primary model. Significant increase in circulatory mortality seen in overall cumulative lag 0-20 days assessed. Subgroup analysis not reported.
Revich et al. 2022 Russia(155)	Longitudinal (Ecological)	≥5 days with daily mean temper atures ≤ 3rd percentile	RR for mortality in individuals ≥65 years due to IHD = 1.20 (1.11 to 1.29) and all diseases of the circulatory system = 1.14 (1.08 to 1.20).	Lag 0-3 weeks. Subgroup analysis not reported.
Shrikhande et al. 2023 India(157)	Longitudinal (Case- crossover)	5th percentile of the apparent temperature	Attributable fraction of CVD deaths attributed to cold = 8.3% (-2.5% to 16.6%).	Lag 0-21 days assessed. No statistical significance seen with change of lag days assessed. Subgroup analysis not reported.
Xia et al. 2023 China(160)	Longitudinal (Ecological)	Temperature 1st percentile (3.0 °C)	RR for CVD mortality over lags 0-14 days = 1.44 (1.24 to 1.68); cerebrovascular mortality = 1.36 (1.09 to 1.70); IHD = 1.26 (0.95 to 1.68).	Lag 0-14 days assessed. Significant cumulative lag seen at lag 0-7 and 0-14 for cardiovascular and cerebrovascular mortality. No difference by cumulative lag seen in IHD mortality. Ozone effects were greater in those >85 years, women, individuals with low education levels, widowed, divorced, and never married.

Xu et al. 2023 China(161)	Longitudinal (Case-crossover)	Temperature 2.5th percentile	OR for MI mortality = 1.12 (1.07 to 1.18).	Lag 01 days assessed. Subgroup analysis not reported.
Zhou et al. 2023 China(166)	Longitudinal (Ecological)	Temperature <5th percentile	Significantly increased RR for CVD, stroke, IHD and MI mortality seen in the northern and southern regions of Jiangsu. Middle regions showed no significance across all cardiovascular causes of mortality.	Lag 0-7 days assessed. Subgroup analysis not reported.
<i>Chitu et al. 2023 Romania(169)</i>	Longitudinal (Ecological)	Low Temperature < -13°C	Urban areas: Attributable fraction (%) of mortality associated with low temperature exposure for all circulatory disease = 14.7 (10.2 to 18.7); ischemic heart disease = 13.4 (5.2 to 20.4); cerebrovascular disease = 13.6 (5.7 to 20.5); and hypertensive disease = 20.5 (9.4 to 30.2)). Rural areas: Attributable fraction (%) of mortality associated with low temperature exposure for all circulatory disease = 18.5 (12.5 to 24.0); ischemic heart disease = 17.8 (6.6 to 26.7); cerebrovascular disease = 17.1 (6.6 to 25.7); and hypertensive disease = 17.1 (4.2 to 28.2)	Lag 0-21 days assessed. There was no significant difference between urban and rural populations.
<i>Kysely et al. 2009 Czech Republic (173)</i>	Longitudinal (Ecological)	Extreme cold: Temperature < -3.5°C	Proportional increase in CVD mortality= 6.3% (4.2% to 8.3%) for male; 6.3% (4.4% to 8.2%) for female.	Lag 0-20 days assessed. Female sex was associated with increased susceptibility to extreme cold.
<i>Zhou et al. 2014 China (174)</i>	Longitudinal (Ecological)	Extreme cold: Tmean < 5 th percentile for 5 consecutive days	Cumulative excess risk= 54.3% (36.5% to 74.4%) for cerebrovascular disease mortality; 52.9% (42.1% to 64.5%) for CVD mortality.	Lag 0-25 days assessed. Age > 75 years and female sex were associated with increased susceptibility to extreme cold.

<i>Qiu et al. 2016 China (175)</i>	Longitudinal (Ecological)	Tmax < 1 st percentile	OR= 1.09 (0.96 to 1.24) for myocardial infarction mortality; 1.25 (1.04 to 1.50) for congestive heart failure mortality; 1.10 (0.41 to 2.96) for cardiac arrest mortality; 1.14 (1.03 to 1.26) for stroke mortality; 1.17 (1.10 to 1.25) for CVD mortality; 1.37 (1.13 to 1.65) for hypertensive disease mortality.	Lag 0-6 days assessed. Older adults (age > 75), individuals who were economically inactive, individuals who are not married, and women experienced an increased susceptibility to extreme cold.
<i>Sartini et al. 2016 United Kingdom (176)</i>	Cross-Sectional (Case-Control)	Tmean < 10 th percentile for at least 3 consecutive days	RR= 1.76 (1.05 to 2.95) for coronary heart disease mortality (British Regional Heart Study, Jan 1998 to Dec 2012); 1.10 (0.67 to 1.82) for coronary heart disease mortality (PROspective Study of Pravastatin, Dec 1997 to June 2009); 1.24 (0.47 to 3.24) for stroke mortality (British Regional Heart Study, Jan 1998 to Dec 2012); 1.22 (0.53 to 2.78) for stroke mortality (PROspective Study of Pravastatin, Dec 1997 to June 2009).	Lag 0-6 days assessed. Smoking, alcohol consumption that was more than occasionally, and car ownership were associated with increased susceptibility to extreme cold.
<i>Xie et al. 2013 China (177)</i>	Longitudinal (Ecological)	Temperature < 5 th percentile for at least 5 consecutive days	RR for CVD mortality (0-27 days after exposure) = 1.59 (0.99 to 2.55) for Guangzhou; 0.72 (0.28 to 1.85) for Nanxiong; 1.73 (1.06 to 2.83) for Taishan.	Lag 0-27 days assessed. Results were significant for: Guangzhou = lag 0-6 and 0-13; Nanxiong = no Lags; Taishan = lag 0, 0-6, 0-13, 0-20. Age > 75 years was associated with increased susceptibility to extreme cold.
<i>Ma et al. 2013 China (178)</i>	Longitudinal (Ecological)	Temperature < 3 rd percentile for 7 consecutive days	Rate ratio= 1.21 (1.07 to 1.36) for coronary heart disease mortality; 1.18 (1.02 to 1.37) for stroke mortality; 1.21 (1.12 to 1.31) for CVD mortality.	Lags not assessed. Subgroup analysis not reported.

<i>Lin et al. 2013 Taiwan (179)</i>	Longitudinal (Ecological)	Temperature < 2.5 th percentile	RR (0-21 days after exposure) = 1.62 (1.30 to 2.01) for IHD mortality; 1.48 (1.04 to 2.12) for cerebrovascular disease mortality; 2.04 (1.61 to 2.59) for heart disease mortality.	Lag 0-20 days assessed. Subgroup analysis not reported.
Chiu et al. 2021 Canada (180)	Cross-sectional (Ecological)	Temperature quantiles around the median	Lower temperatures were associated with a higher number of CVD deaths.	Lag 0-14 days assessed. Subgroup analysis not reported.
Du et al. 2022 China(184)	Longitudinal (Case-Crossover)	Temperature < 1st percentile	OR for circulatory mortality = 1.13 (1.04 to 1.24).	Lag periods 0-8 days assessed. Significant effects on circulatory mortality were seen on lag5 and lag6. Cumulative lag effects were significant on lag 0-4, lag 0-5, lag 0-6, lag 0-7 and lag 0-8. Extreme cold had a stronger impact on women (OR for circulatory system death on lag6 = 1.21 (1.08 to 1.36)), but no impact on men. Age groups ≥75 years were significantly affected, but there were no significant effects in the age groups 65-74 years.
<i>Anderson et al. 2009. United States(172)</i>	Longitudinal (Ecological)	Temperature <1st percentile	Cardiovascular mortality adjusted for PM10 at lag1 = 4.5% (2.4% to 6.7%). Cardiovascular mortality adjusted for ozone at lag 0 = 4.3% (3.0% to 5.7%).	Lag 0-28 days was assessed. Association of cold with mortality began after a 2-3-day lag (varying by community) but persisted for more than 3 weeks. Long lag periods were required to fully capture the association of cold with mortality.

				Significantly elevated cardiovascular mortality in all ages, 65 – 74 years and >75 years. Results were not significant for individuals <65 years.
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B. Extreme Cold: Cardiovascular Morbidity

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Comments, Including Observed Heterogeneity (if reported)
<i>Tian et al. 2016 China</i> (60)	Longitudinal (Ecological)	Temperature <1 st vs optimal temperature (23 °C)	RR (0-21 days after exposure) = 2.08 (1.76 to 2.45) for IHD hospitalization; 2.38 (1.83 to 3.10) for acute myocardial infarction hospitalization; 2.61 (2.24 to 3.04) for heart failure hospitalization; 1.33 (1.15 to 1.53) for stroke hospitalization; 1.69 (1.56 to 1.82) for circulatory disease hospitalization.	Lag 0-21 days assessed. All outcomes were significant at all lags except 0-1 days assessed. Subgroup analysis not reported.
<i>Borghei et al. 2020 Iran</i> (61)	Longitudinal (Ecological)	Temperature 5 th vs 25 th percentile	RR for cardiac arrest= 1.31(1.01 to 1.52).	Lag 0-21 days assessed. Lag 0–4 days was associated with increased number of out-of-hospital cardiac arrests and increased number of unsuccessful resuscitation attempts. Age > 65 years was associated with increased susceptibility to extreme cold.

<i>Lu et al. 2020</i> <i>Australia</i> (66)	Longitudinal (Case- crossover)	Temperature 1 st vs 10 th percentile	RR for CVD hospitalization= 1.02 (1.01 to 1.03).	Lag 0-21 days assessed. Age < 70 years were associated with increased susceptibility to extreme cold.
<i>Guo et al. 2018</i> <i>China</i> (67)	Longitudinal (Ecological)	Temperature < 1 st percentile	RR for CVD emergency incidence=1.55 (0.98 to 2.46).	Lag 0-21 days assessed. Male sex and age > 65 years were associated with increased susceptibility to extreme cold.
<i>Giang et al. 2014</i> <i>Vietnam</i> (68)	Longitudinal (Ecological)	Temperature 1 st vs 10 th percentile	RR for CVD hospital admission= 1.12 (1.01 to 1.25) for 1°C decrease below the threshold.	Lag 0-30 days assessed. Subgroup analysis not reported.
<i>Lam et al. 2018</i> <i>China</i> (70)	Longitudinal (Ecological)	Temperature 1 st vs 25 th percentile	RR for acute myocardial infarction admission (0- 22 days after exposure) = 2.10 (1.62 to 2.72) among diabetic individuals; 1.43 (1.21 to 1.69) among non-diabetic individuals.	Lags not assessed. Age <75 years was associated with increased susceptibility to extreme cold.
<i>Ponjoan et al. 2017</i> <i>Spain</i> (73)	Cross- Sectional (Case- Control)	Temperature < 5 th percentile	IRR (0 day after exposure) = 1.27 (1.12 to 1.44) for heart failure hospitalization; 1.09 (0.94 to 1.27) for coronary heart disease hospitalization; 1.22 (1.02 to 1.44) for stroke hospitalization; 1.20 (1.10 to 1.30) for CVD hospitalization.	Lags not assessed. Subgroup analysis not reported.
<i>Mohammadi et al. 2018</i> <i>Iran</i> (74)	Longitudinal (Case- Crossover)	Temperature 5 th vs 25 th percentile	RR for acute myocardial infarction= 0.96 (0.91 to 1.00).	Lag 0-28 days assessed. Results were not significant at any lag assessed. Male sex and age > 65 years were associated with increased susceptibility to extreme cold.

<i>Kwon et al. 2015 South Korea (75)</i>	Longitudinal (Ecological)	Temperature daily Tmin < - 12°C	RR for acute myocardial infarction hospital admission= 1.03 (1.01 to 1.05).	Lags not assessed. Female sex, age > 75 years, residence in urban areas, and low socioeconomic level were associated with increased susceptibility to extreme cold.
<i>Xu et al. 2021 Australia (78)</i>	Cross- Sectional (Case Control)	Temperature 1 st percentile of 10 days' moving average temperature vs Tmean	OR for stroke hospitalization= 1.60 (1.03 to 2.47).	Lag 0-10 days assessed. Results were significant from lag 0 to lag 7 days assessed. Male sex was associated with increased susceptibility to extreme cold.
<i>Lavigne et al. 2014 Canada (79)</i>	Longitudinal (Ecological)	Temperature 1 st vs 25 th percentile	RR for CVD emergency room visits= 2.24 (1.12 to 6.10) for individuals with kidney diseases; 1.35 (1.02 to 2.04) for individuals with cardiac diseases.	Lag 0-13 days assessed. Results were significant at lag 0-13 days but not lag 0-1 days assessed. Subgroup analysis not reported.
<i>Zhao et al. 2018 China (81)</i>	Longitudinal (Ecological)	Temperature 1 st percentile vs Tmean	RR for CVD clinical visits= 1.55 (1.26 to 1.92).	Lag 0-28 days assessed. Results were significant from lag 6 to lag 22. Subgroup analysis not reported.
<i>Xiong et al. 2015 China (83)</i>	Longitudinal (Ecological)	Temperature < 1 st percentile	RR (0-16 days after exposure) = 1.05 (0.48 to 2.30) for cerebrovascular disease hospital admission; 0.98 (0.47 to 2.04) for CVD hospital admission.	Lag 0-30 days assessed. Subgroup analysis not reported.

<i>Ma et al. 2020 China (84)</i>	Longitudinal (Ecological)	Temperature < 10 th percentile	Hospital visits for cardiovascular diseases per 1°C increase in Tmin= 1.04 (1.02 to 1.06) for men; 1.32 (1.01 to 1.05) for women.	Lag 0- 7 days assessed. The lag day on which the strongest association was noted varied by subgroup and season. Age > 75 years was associated with increased susceptibility to extreme cold.
<i>Ma et al. 2011 China (85)</i>	Cross- Sectional (Ecological)	Temperature < 3 rd percentile for at least 7 consecutive days	RR for CVD hospital admission= 1.33 (1.28 to 1.37).	Lags not assessed. Subgroup analysis not reported.
<i>Lin et al. 2020 Taiwan (90)</i>	Longitudinal (Ecological)	Temperature 1 st percentile vs average temperature	RR= 1.01 (0.99 to 1.02) for IHD emergency room visit; 1.05 (1.01 to 1.09) for IHD outpatient visit; 1.10 (1.06 to 1.13) for cerebrovascular disease emergency room visit; 1.01 (0.97 to 1.04) for cerebrovascular disease outpatient visit; 1.41 (1.35 to 1.48) for circulatory disease emergency room visit; 1.06 (1.04 to 1.09) for circulatory disease outpatient visit; 1.01 (0.99 to 1.02) for heart disease emergency room visit; 1.02 (0.99 to 1.05) for heart disease outpatient visit.	Lag 0-25 days assessed. For outpatient visits, RR appeared greater than 1 after lag 5 days for all outcomes except circulator diseases, where it was positive at all lags except 0 and 25. Subgroup analysis not reported.
<i>Son et al. 2014 South Korea (91)</i>	Longitudinal (Ecological)	Temperature 1 st vs 10 th percentile	Proportional increase in CVD hospitalization (0-32 days after exposure) = 3.1% (-8.4% to 15.9%)	Lag 0-32 days assessed. Female sex and age 65-74 years were associated with increased susceptibility to extreme cold.
<i>Madrigano et al. 2013 United States (96)</i>	Longitudinal (Case- Crossover)	Temperature < 5 th percentile	RR for acute myocardial infarction on lag 0-1= 1.36 (1.07 to 1.74).	Lag 0-5 days assessed. Results were only significant for lag 0-1.

				Subgroup analysis not reported.
<i>Thu Dang et al. 2019 Vietnam</i> (97)	Longitudinal (Ecological)	Temperature < 5 th percentile	RR for acute myocardial infarction hospital admission= 1.25 (1.02 to 1.55).	Lag 0-20 days assessed. Age > 65 years and male sex were associated with increased susceptibility to extreme cold.
<i>Aklilu et al. 2020 China</i> (98)	Longitudinal (Case-Crossover)	Temperature < 1 st percentile	RR=0.43 (0.35 to 0.53) for coronary heart disease hospital admissions; 0.45 (0.37 to 0.55) for CVD admissions; 0.35 (0.24 to 0.51) for atrial fibrillation; 0.61 (0.49 to 0.77) for heart failure hospital admissions.	Lag 0-27 days assessed. Although there was no significant association between extremely low temperatures and CVD outcomes overall, CVD admissions were elevated at lag 0; coronary heart disease admissions were elevated at lag 15,27; atrial fibrillation and heart failure admissions were not elevated at any lag. Age > 65 years was associated with increased susceptibility to extreme cold.
<i>Mohammadi et al. 2021 Iran</i> (101)	Longitudinal (Ecological)	Temperature < 1 st percentile	RR for CVD hospital admission= 1.33 (1.11 to 1.61).	Lag 0-7 days assessed. Results were only significant at lag 0 to lag 3. Subgroup analysis not reported.
<i>Iniguez et al. 2021 Spain</i> (105)	Longitudinal (Ecological)	Temperature < 2.5 th percentile	RR= 1.27 (1.16 to 1.4) for CVD hospital admission.	Lag 0-21 days assessed.

				Subgroup analysis not reported.
<i>Guo et al. 2017 China</i> (109)	Longitudinal (Ecological)	Temperature < 2.5 th percentile	RR= 1.55 (1.01 to 2.40) for intracerebral hemorrhage; 1.45 (1.08 to 1.95) for cerebral infarction.	Lag 0-21 days assessed but did not report results by lag date. Age > 60 years and male sex were associated with increased susceptibility to extreme cold.
<i>Webb et al. 2014 Australia</i> (121)	Longitudinal (Ecological)	Temperature <5 th percentile	Change in Admission Rate for heart failure = 64% (-2% to 158%; p=0.045) in indigenous women age >65; 56% (4% to 123%; p=0.02) in non-indigenous women	Lags not assessed. Age > 75 years was associated with increased susceptibility to extreme cold.
<i>Dastoorpoor et al. 2021 Iran</i> (128)	Longitudinal (Ecological)	Physiologically Equivalent Temperature <1 st percentile	RR of hospitalization associated with extreme cold PET at lag 0 for all CVD= 0.929 (0.862 to 1.002); hypertensive heart disease= 0.956 (0.711 to 1.287); IHD= 0.861 (0.778 to 0.953); other heart disease= 0.842 (0.735 to 0.966); cerebrovascular disease= 1.266 (1.037 to 1.545)	Lag 0-30 days assessed. Results were significant for the following lags: CVD= lag 0, 0-2, 0-6; Hypertensive heart disease = no Lags ; IHD = lag 0, 0-2, 0-6, 0-13; other heart disease = lag 0; cerebrovascular disease = lag 0-2. There were no significant differences in hospitalizations between men and women. Patients age<65 were less likely to be hospitalized for CVD compared to older patients,

				but only for lag 02, 0-6, and 0-13.
<i>Costa et al. 2021 Brazil (129)</i>	Longitudinal (Ecological)	Cold Wave: Tmin ≤8.0 °C for at least three consecutive days	Cardiovascular hospitalization rates during normal days = 0.714 hospitalizations per day; cold waves = 0.751 hospitalizations per day.	Lag 0-30 days assessed. Subgroup analysis not reported.
<i>Park et al. 2021 South Korea (133)</i>	Longitudinal (Ecological)	Tmean<1 st percentile	RR of out-of-hospital cardiac arrests attributable to extreme cold compared to the minimum morbidity temperature= 1.62 (1.20 to 2.18)	Lag 0-14 days assessed. Out of hospital cardiac arrest attributed to cold occurred more commonly in the population with hypertension (31.0%) than the populations with diabetes (24.3%) and heart disease (17.4%). Based on central estimates, the cold impacts on OHCA were more evident in people aged 0– 64 y (19.7%) and females (20.2%) than in people aged 65 y+ (18.1%) and males (16.6%), although the difference was not statistically significant.
<i>Fonseca-Rodriguez et al. 2021 Sweden (138)</i>	Longitudinal (Ecological)	Days when morning and afternoon apparent temperature were <16 th percentile	Extreme cold was not associated with any change in CVD hospitalizations during the winter in the south but was associated with a slight decrease in CVD hospitalizations for lag 0-5 in the northern cities.	Lags not assessed. Age>65 was more likely to be hospitalized for CVD during extreme cold than those <65.

<i>Meng et al. 2023 China</i> (152)	Longitudinal (Ecological)	Maximum value of daily average temperature (-12 °C) compared to temperature at the 75th percentile (20 °C)	RR of IHD hospitalization = 1.559 (0.619 to 3.925) in men; 1.303 (0.379 to 4.483) in women; 1.049(0.404 to 2.725) for age <65; and 1.972 (0.739 to 5.265) for age >65. RR of coronary artery disease hospitalization = 2.638(0.656 to 10.599) in men; 3.156(0.595 to 16.735) in women; 2.227(0.526 to 9.439) for age <65; and 3.352 (0.817 to 13.746) for age >65. RR for acute coronary syndrome hospitalization= 1.141(0.457 to 2.845) in men; 0.358 (0.097 to 1.323) in women; 0.565 (0.184 to 1.737) for age <65; and 1.478 (0.503 to 4.346) for age >65.	Lag 0-30 days assessed. Reduced risk of IHD observed at lag 10-15. Increased risk of coronary artery disease was seen in females at lag7 and patients <65 years at lag10. Reduced risk of ACS in patients < 65 years observed at cumulative lag0-21 days assessed.
<i>Xu et al. 2023 China</i> .(162)	Longitudinal (Ecological)	Temperature 5th percentile (6.14°C)	There was no significant effect of extreme cold exposure at any gestational week on relative risk for congenital heart disease	Lags not assessed. There was no effect of sex or education level on risk of congenital heart disease.
<i>Sun et al. 2023 China</i> (167)	Longitudinal (Ecological)	Temperature ≤5th percentile	Adjusted OR of hypertensive disorder of pregnancy in the first trimester = 1.067 (0.985 to 1.156); second trimester = 1.298 (1.200 to 1.404); third trimester = 1.236 (1.134 to 1.347).	Lags not assessed. Significantly elevated risk of hypertensive disorders during pregnancy in women ≥35 years and <35 years.
<i>Flores et al. 2023 United States</i> (168)	Longitudinal (Case-crossover)	Temperature <5th percentile	There was a significant decrease in rate of hospitalization for acute myocardial infarction in insured individuals, but not in uninsured individuals.	There was a significantly increased rate of myocardial infarction hospitalization in uninsured vs insured individuals when exposed to extreme cold 0-6 hours prior to the event.

				Subgroup analysis not reported.
Chiu et al. 2021 Canada (180)	Cross-sectional (Ecological)	Temperature quantiles around the median	Lower temperatures were associated with a higher number of CVD hospitalizations and deaths	Lag 0-14 days assessed. Subgroup analysis not reported.
<i>Jimba et al. 2022</i> <i>Japan</i> (181)	Longitudinal (Ecological)	Lowest ambient daily temperature in °C	Proportional increase in admissions associated with a 1 °C decrease in daily lowest temperature for = HFpEF+HFmrEF (EF>40%) 3.3% (2.8% to 3.7%); HFrEF (EF<40%): 1.5% (1.0% to 2.0%) Proportional increase in admissions associated with a 1 °C decrease in daily lowest temperature amongst patients with HFrEF with ischemic cardiomyopathy: 2.4% (1.7% to 3.2%) and non-ischemic cardiomyopathy: 1.0 (0.5% to 1.8%); p=0.048.	Lags not assessed. In both the HFpEF+HFmrEF and HFrEF groups, there was no significant effect of age, gender, BMI, baseline comorbidities (Diabetes, COPD, hypertension), or prior HF hospitalization.
<i>Li et al. 2021</i> <i>Taiwan</i> (182)	Longitudinal (Ecological)	Daily difference in minimum and maximum air temperature	A drop of 1°C when the air temperature is below 15 °C was associated with a relative increase of 1.6% of Acute MI incidence.	Lags not assessed. Subgroup analysis not reported.
<i>Vieira et al. 2021</i> <i>Portugal</i> (183)	Longitudinal (Ecological)	Extreme cold: Tmin measured as a continuous variable	Proportional increase in RR of STEMI associated with 1 °C drop Tmin at lag 2 = 2.0%; lag 3 = 1.8%; lag 6 = 1.4% Estimated RR of STEMI associated with Tmin two days before event = 1.9% (0.5 to 3.3)	Lags not assessed. Subgroup analysis not reported.

<i>Yu et al. 2021</i> <i>China</i> (170)	Longitudinal (Ecological)	Daily Tmin<2.5 th percentile	RR for acute aortic dissection associated with extreme cold exposure = 1.733 (1.130 to 2.658)	Lag 0-25 days assessed. Results for acute aortic dissection were only significant on lag 0 and lag 1. There was no effect of age, sex, and underlying hypertension.
<i>McGuinn et al. 2013</i> <i>England</i> (171)	Longitudinal (Ecological)	Extreme cold <2°C	For each decrease of 1°C below 2°C, the risk of implantable cardiac defibrillator (ICD) activation increased by 11.2% (0.5% to 23.1%)	Lags not assessed. There was an increased risk of temperature-related activation in patients 65 years or over. Living in London was associated with significantly increased odds of ICD activation compared to living in the surrounding areas.
<i>Jiang et al. 2023</i> <i>China</i> (185)	Longitudinal (Case- crossover)	Temperature ≤ 2.5th percentile	Percent change in AMI incidence associated with cold spells of ≥2 days = 4.61% (1.89% to 7.40%); ≥3 days = 3.84% (1.09% to 6.67%); ≥4 days = 2.96% (0.12% to 5.89%).	Lag 0-6 days assessed. No significant effects on AMI risk after lag 5. Patients ≥65 years of age were at higher risk of AMI onset associated with cold spells.
<i>Peng et al. 2022</i> <i>China</i> (186)	Longitudinal (Ecological)	Daily Tmin (3.5 °C)	OR for AMI = 1.78 (1.16 to 2.72). The attributable fraction for AMI = 1.40 % (0.11 % to 1.79 %).	Lag 0-7 days assessed. Subgroup analysis not reported.

<i>Zhu et al. 2023 China</i> (187)	Longitudinal (Case- crossover)	Temperature 1st percentile (- 9.3°C)	Cumulative relative risk of atrial fibrillation episode over lag 0–7 d = 1.25 (1.08 to 1.45).	Lag 0-7 days assessed. Statistical significance occurred at lag 2, peaked at lag 3, and attenuated at lag 5. Higher risks were found amongst males and people aged <65 years.
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C. Extreme Cold: Other Cardiovascular Outcomes

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Comments, Including Observed Heterogeneity (if reported)
<i>Pourshaikhian et al. 2019 Iran</i> (76)	Longitudinal (Ecological)	Temperature 1 st vs 25 th percentile	RR for CVD ambulance attendance= 0.97 (0.85 to 1.1) 0 day after exposure; 1.03 (1.01 to 1.06) 0-7 days after exposure.	Lag 0-20 days assessed. The results only significant when assessing lag 0-7 days assessed. No significant difference was observed in regard to age or sex.

eTable 6. Ground-Level Ozone. Abbreviations: CVD=Cardiovascular Disease, IHD=Ischemic Heart Disease, OR=Odds Ratio, RR=Relative Risk.

A. Ground-level Ozone: Cardiovascular Mortality

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Qian et al. 2008</i> <i>China</i> (115)	Longitudinal (Ecological)	Temperature > 95 th percentile Ozone: daily mean level (µg/m3)	Heat + ozone: Proportional change in daily mortality associated with extreme heat and a 10 µg/m3 increase in ozone concentration for strokes: 1.09% (-0.77% to 2.98%); CVD: 1.39% (-0.25% to 3.06%).	Lags not assessed. Subgroup analysis not reported.
<i>Chen et al. 2018</i> <i>Finland, Sweden,</i> <i>Denmark, Germany,</i> <i>Italy, Spain</i> (118)	Longitudinal (Ecological)	Temperature> 75 th percentile Ozone: daily maximum 8- hour average concentration(µg/m3)	Proportional increase in CVD mortality associated with a 10µg/m3 increase in ozone during high temperature = 0.54% (0.06% to 1.02%). Proportional change in CVD mortality associated with a 10µg/m3 increase in ozone during cold temperatures= 0.44% (−0.05% to 0.93%).	Lag 1 day for ozone exposure included in the main analysis. No significant difference was observed in different age groups or sex.
<i>Tong et al. 2010</i> <i>Australia</i> (119)	Cross- Sectional (Ecological)	Extreme Heat:Days of the 2004 Brisbane, Australia heat wave (February 7-26, 2004) Ozone: daily average (ppb)	5 (-14 to 25) CVD deaths during the heat waves were attributed to ozone exposure	Lags not assessed. Subgroup analysis not reported.

<i>Chen et al. 2013</i> <i>China</i> (124)	Longitudinal (Ecological)	Temperature: >75 th percentile Air pollution: 1, 8, 24-hr average ozone level	Proportional increase in CVD mortality related to an interquartile range increase in ozone concentrations for: 1-hr ozone average= 6.14 (-17.35 to 36.31); 8-hr ozone average= 6.88 (-14.87 to 34.18); 24-hr ozone average= 6.55(-0.44 to 14.02).	Lags not assessed. Subgroup analysis not reported.
<i>Gryparis, et al. 2004</i> <i>Greece, Spain,</i> <i>Switzerland, United</i> <i>Kingdom, Hungary,</i> <i>Finland, Germany,</i> <i>Slovenia, France, Italy,</i> <i>Netherlands, Czech</i> <i>Republic, Sweden, Israel</i> (188)	Longitudinal (Ecological)	Ozone: 1- and 8-hour mean levels (µg/m ³)	Increase in cardiovascular deaths of 0.45% (0.22 to 0.69) and 0.46% (0.22 to 0.73) for a 10 µg/m ³ increase in ozone concentrations over 1 and 8 hours, respectively in the winter period. No statistically significant increase in the winter period.	Lag of 1 and 8 hours assessed. Subgroup analysis not reported.
<i>Ng et al. 2013</i> <i>Japan</i> (189)	Longitudinal (ecological)	Ozone: 8-hour moving average (ppb)	Daily CVD mortality increased by 0.58% (0.11 to 1.05) in individuals older than 65 years old for a 10 parts per billion increase in ozone concentration (lag 0-2 days). Numerically larger changes after adjusting for other pollutants.	Lag 0-2 days assessed. Subgroup analysis not reported.
<i>Shin et al. 2020</i> <i>Canada</i> (190)	Longitudinal (ecological)	Ozone: 8-hour average (ppb)	Circulatory mortality increased by 0.7% (0.2 to 1.1) for a 10ppb increase in ozone concentration.	Various single-day lags assessed. Strongest association for lag 1 day. Female sex was associated with a greater increase in circulatory mortality with ozone exposure.
<i>Qin et al. 2017</i> <i>China</i> (191)	Longitudinal (Ecological)	Ozone: 24-hour mean, 1- hour maximum, and 8-hour	CVD mortality increased by 1.28% (0.34 to 2.23) for a 10	Lag 0-5 days assessed. Similar findings across lag periods.

		maximum concentrations ($\mu\text{g}/\text{m}^3$)	$\mu\text{g}/\text{m}^3$ increase in daily ozone concentration.	Subgroup analysis not reported.
<i>Anderson et al. 1996</i> <i>United Kingdom</i> (193)	Longitudinal (Ecological)	Ozone: 1- and 8-hour average ($\mu\text{g}/\text{m}^3$)	Proportional increase in CVD mortality associated with an increase in ozone level from the 10 th to 90 th percentile = 1.44% (-0.45 to 3.36).	Lag 0-3 days assessed. Ozone concentrations recorded on the same day (lag 0) showed the most consistent association with daily mortality. CVD mortality associated with ozone exposure was significant in the warm season (4.37%, 1.96 to 6.85) but not in the cool season (1.69%, -3.89 to 0.68).
<i>Bell et al. 2004</i> <i>United States</i> (198)	Longitudinal (Ecological)	Ozone: 8- and 24-hour average; maximum hourly concentrations (ppb)	Proportional increase in CVD and respiratory mortality for a 10ppb increase in the preceding week's ozone levels= 0.64% (0.31 to 0.98).	Lag 0-3 days assessed. Significant for lag 0 and 3 days assessed. Significant association for constrained and unconstrained distributed lag models. No effect of age or underlying cardiopulmonary disease.
<i>Borja-Aburto et al. 1998</i> <i>Mexico</i> (200)	Longitudinal (Ecological)	Ozone: hourly concentrations (ppb)	Proportional increase in CVD mortality for 10 parts per billion increase in ozone concentrations (lag 0-1)= 1.76% (0.07 to 4.58).	Lag 0-5 days assessed. Lag 0-1 day findings were significant. Lag 0 was also significant. Subgroup analysis not reported.
<i>deAlmeida et al. 2011</i> <i>Portugal</i> (207)	Longitudinal (Ecological)	Ozone: daily 8-hour maximum moving average concentration ($\mu\text{g}/\text{m}^3$)	A 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentrations was associated with a 0.83% (0.12 to 1.74) increase in CVD mortality.	Lag 0-3 days assessed. Lag 0-1 days reported in the main analysis. Ozone was only associated with increased CVD mortality during the summer season. There was

				no effect modification when accounting for age.
<i>Diaz et al. 2018 Spain</i> (208)	Longitudinal (Ecological)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	RR of CVD mortality per $10\mu\text{g}/\text{m}^3$ increase in ozone concentration= 1.025 (1.018 to 1.033).	Lags not assessed. Subgroup analysis not reported.
<i>Garrett et al. 2011 Portugal</i> (210)	Longitudinal (Ecological)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	RR of CVD mortality per $10\mu\text{g}/\text{m}^3$ increase in daily mean ozone concentration= 1.0197 (1.00119 to 1.0276).	Lag 0-4 days assessed. Mortality increased when there is an accumulative effect of high O ₃ levels for two and three consecutive days assessed. Similar findings among adults age ≥ 65 years.
<i>Cakmak et al. 2016 Canada</i> (211)	Cross-sectional (Ecological)	Ozone: Annual average ozone exposure (ppb)	Using the most populated spatial synoptic zone (i.e., climate zone) as a reference, a 10 ppb increase in ozone exposure was associated with increases in CVD mortality (HRs ranged from 1.007 [0.99 to 1.015] to 1.030 [1.02, 1.041]), cerebrovascular disease mortality (HRs ranged from 1.013 [0.996 to 1.030] to 1.058 [1.034 to 1.082]), and IHD mortality (HRs ranged from 1.020 [1.006 to 1.034]. HRs remained significant after adjustment for PM _{2.5} .	Main analysis included a 1 year lag and moving 7-year-average level of pollutant exposure. Subgroup analysis not reported.
<i>Dastoorpoor, et al. 2018 Iran</i> (212)	Longitudinal (Ecological)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Risk Ratio of cardiovascular deaths with an interquartile range increase in ozone concentrations at lag 3 = 1.002 (0.988 to 1.015).	Lag 0-14 days assessed. Strongest association at lag 3 days assessed. Male sex was associated with an increased risk ratio at lag 3

				(1.006; 1.001 to 1.012), an effect that was not seen in women (0.992; 0.982 to 1.003).
<i>Farzad, et al. 2021 Iran (213)</i>	Longitudinal (Ecological)	Ozone: 1-, 8-, and 24-hour maximum concentration	RR of cardiovascular mortality per 10ppb increase in the 8-hour maximum ozone concentration at 3 days lag= 1.018 (0.997 to 1.039).	Lag 0-4 days were assessed. Significant findings only noted on lag day 3. No significant association at other lags. There was no effect of gender on cardiovascular mortality.
<i>Fischer, et al. 2003 The Netherlands (214)</i>	Longitudinal (Ecological)	Ozone: 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	RR of cardiovascular mortality associated with an increase in ozone from the 1 st to 99 th percentile for age class: <45= 1.022 (0.863 to 1.212); 45-64= 1.038 (0.977 to 1.103); 65-74= 1.005 (0.960 to 1.053); >75= 1.073 (1.044 to 1.102).	Lag 1 day assessed. Significant association of ozone exposure with cardiovascular mortality only in individuals age >75 years.
<i>Goldberg, et al. 2001 Canada (215)</i>	Longitudinal (Ecological)	Ozone: 8- and 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in daily mortality associated with an interquartile range increase in ozone concentration for: CVD= 3.00% (1.33 to 4.59) and coronary artery disease= 3.71% (1.69 to 5.77).	Lag 0-3 days assessed. Largest association seen with 3-day moving average exposure level. Significant associations only observed in adults ages 65 or older.
<i>Guo et al. 2014 Thailand (216)</i>	Longitudinal (Ecological)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Increase in cardiovascular mortality with 10 $\mu\text{g}/\text{m}^3$ increase in ground-level ozone= 1.92% (0.39% to 3.45%) in the summer, but no significant association in the rainy season or in the winter.	Lags 0-5 days assessed, significant association noted at lag 3 and lag 0-5. Subgroup analysis not reported.
<i>Hwang et al. 2020 South Korea (223)</i>	Longitudinal (Ecological)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	There was no increased risk of mortality from IHD or cerebrovascular disease with ozone exposure.	Lags not assessed. Subgroup analysis not reported.

<i>Jerrett et al. 2009 United States and Canada (224)</i>	Longitudinal (Ecological)	Ozone: 24-hour mean concentration (ppb)	RR of mortality per 10ppb increase in ozone concentration for: CVD= 1.011 (1.003 to 1.023); IHD=1.015 (1.003 to 1.026).	Lags not assessed. Subgroup analysis not reported.
<i>Kan et al. 2008 China (225)</i>	Longitudinal (Ecological)	Ozone: maximal 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration=0.38 (-0.03 to 0.80).	Lag 0-1 day reported in the main analysis. Total mortality associated with increased ozone was higher in the cold season than the warm season, higher for females than males, and higher for individuals age >65.
<i>Kazemiparkouhi et al. 2020 United States (226)</i>	Longitudinal (Ecological)	Ozone: maximal 8- and 24- hour mean concentration (ppb)	Proportional increase in mortality per 10 ppb increase in ozone concentration for: CVD= 1.027 (1.025 to 1.028); IHD= 1.043 (1.0141 to 1.045), cerebrovascular disease= 1.012 (1.008 to 1.016); congestive heart failure = 1.052 (1.045 to 1.060).	Lags not assessed. Increased ozone was no longer associated with increased cerebrovascular disease once accounting for PM _{2.5} .
<i>LaTertre et al. 2002 France (228)</i>	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	RR for cardiovascular mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration= 1.024 (0.997 to 1.0151).	Lag 0-5 days assessed. Lag 0-1 day reported into main (overall) analysis. Subgroup analysis not reported.
<i>Li et al. 2020 China (229)</i>	Longitudinal (Ecological)	Ozone: maximum 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular years of life lost per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration= 0.38% (0.30 to 0.46).	Lag 0-3 days assessed. Strongest association on lag days 0 and 1, lower RR but also significant on lag day 2, not significant on lag day 3. Similar findings by age, sex, education, or season on years of

				life lost due to cardiovascular causes.
<i>Lin et al. 2013 China (230)</i>	Longitudinal (Case-Crossover)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	An increase in ozone concentration by one interquartile range was not associated with increased odds of acute myocardial infarction mortality.	Lag 0-1 day assessed and reported in the main analysis. Subgroup analysis not reported.
<i>Lopez-Villarrubia et al. 2010 Spain (232)</i>	Longitudinal (Case-Crossover)	Ozone: 8-hour maximum moving average concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in heart disease mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration= 0.35% (-3.90 to 4.79) in Las Palmas de Gran Canaria and 0.03% (-6.02 to 6.45) in Santa Cruz de Tenerife.	Lag 0-5 days assessed. Significant association of ozone with heart disease mortality in Las Palmas de Gran Canaria (lag 2) with an increase of 2.5% (CI 95%: 0.03 to 5.1). Subgroup analysis not reported.
<i>Mazidi et al. 2018 United States (235)</i>	Cross-Sectional (Ecological)	Ozone: average daily estimate (ppm)	Significant positive association between ozone levels and CVD mortality ($P<0.001$) but not stroke mortality.	Lags not assessed. The significant association between ozone exposure and CVD mortality persisted after accounting for poverty, ethnicity, and education ($P<0.001$).
<i>Nuvolone et al. 2013 Italy (239)</i>	Longitudinal (Case-Crossover)	Ozone: daily 8-hour maximum moving average ($\mu\text{g}/\text{m}^3$)	Proportional increase in out of hospital coronary deaths per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration (lag 0-5days) = 6.3% (1.2% to 11.7%). No significant association with hospitalized acute myocardial infarctions at any lag.	Lag 0-5 days assessed. The maximum and statistically significant effect estimate of the association between O3 levels and out-of-hospital coronary deaths was observed for the cumulative lag 0–5. Higher risk of out of hospital coronary deaths associated with increased ozone exposure was

				seen in female sex, age >85, and prior hospitalizations for cerebrovascular disease or artery disease.
<i>Parodi et al. 2005 Italy (241)</i>	Longitudinal (Ecological)	Ozone: 8- and 24-hour mean concentrations and 1-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	Mean variation percent in daily CVD mortality for $50 \mu\text{g}/\text{m}^3$ increase in ozone concentration = 9.4% (3.1 to 16.0) using 24-hour mean; 6.9% (2.4 to 11.6) using 8-hour mean; 5.9% (2.1 to 9.9) using 1-hour maximum.	Lag 0-2 days assessed. Strongest association at lag 1 day. A statistically significant synergistic effect between ozone and temperature was observed for cardiovascular mortality, particularly in elderly. People, with an evident increase in mortality risk above 26C (mean variation 30.0% for the whole population and 40.0% for the elderly, respectively).
<i>Pascal et al. 2012 France (242)</i>	Longitudinal (Case-Crossover)	Ozone: 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in mortality per $10 \mu\text{g}/\text{m}^3$ increase in ozone concentration for: cardiac= 0.7% (0.2 to 1.1); cardiovascular= 0.4% (0.0 to 0.7); IHD = 0.5% (-0.2 to 1.1); and cerebrovascular mortality= 0.1 (-0.7 to 0.8)	Lags not assessed. Association of ozone and cardiac/cardiovascular mortality was higher for the warmest temperature strata. Cardiac and cardiovascular mortality were significantly increased in individuals age >74 but not individuals 0-74 years old.
<i>Ponka et al. 1998 Finland (245)</i>	Longitudinal (Ecological)	Ozone: 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	Proportional decrease in CVD mortality associated with a $20 \mu\text{g}/\text{m}^3$ increase in ozone concentrations five days after exposure in individuals age<65= 11.7% (-3.9% to -	Lag 0-7 days assessed. Only significant association was at lag 5 in adults < 65 years. High ozone levels increased the effect of other gaseous pollutants on cardiovascular mortality.

			18.9%). No association in adults ≥ 65 years.	
<i>Qian et al. 2007 China (247)</i>	Longitudinal (Ecological)	Ozone: 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in daily mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration for: CVD= 0.04 (-0.39 to 0.47); stroke= -0.13 (-0.65 to 0.39); cardiac= 0.25 (-0.49 to 0.99); and cardiopulmonary disease= 0.31 (-0.12 to 0.74).	Lags not assessed. There was no effect of age on daily mortality for non-accidental, CVD, stroke, cardiac, or cardiopulmonary disease.
<i>Raza et al. 2018 Sweden (250)</i>	Longitudinal (Ecological/ Case- Crossover)	Ozone: 8-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	Time series: Proportional increase in CVD mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration for: lag 0-1= 0.7% (0.1 to 1.3) and for lag 0-6 days= 0.8% (0.1 to 1.6). Case-Crossover Proportional increase in CVD mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration for: lag 0-1= 1.2% (0.6 to 1.8) and for lag 0-5 days= 1.1% (0.3 to 1.9).	Lag 0-1 day and 0-6 days assessed. Similar findings. Individuals with no prior hospitalizations or prior hospitalization for acute myocardial infarction had increased rates of CVD mortality with increased ozone exposure on lag 0-1.
<i>Ren et al. 2010 United States (251)</i>	Longitudinal (Case- Crossover)	Ozone: 8-hour maximum concentration (ppb)	Proportional increase in mortality per 10ppb increase in the four-day moving average ozone concentration for: CVD= 0.44% (-1.45 to 2.37); heart diseases= -0.83% (-2.94 to 1.32); acute myocardial infarction = -1.09% (-4.27 to 2.19); and stroke= 6.5% (1.74 to 11.49).	Lag 0-6 days assessed. Lag 0-3 reported in the main analysis. Mortality associated with increased ozone exposure was did not vary by baseline socioeconomic status.

<i>Ren et al. 2009 United States (252)</i>	Longitudinal (Ecological)	Ozone: 24-hour mean concentration (ppb)	Proportional increase in cardiovascular mortality per 10ppb increase in ozone concentration over previous 3 days = 0.41% (-0.19 to 0.93) for temperature<33 rd percentile, 0.27% (-0.44 to 0.87) for temperature>33 rd and <66 th percentile, and 1.68% (0.07 to 3.26) for temperature>67 th percentile.	Lag 0-2 days assessed. Strongest association noted at high temperatures (>67 th percentile). Subgroup analysis not reported.
<i>Ren et al. 2008 United States (253)</i>	Longitudinal (Ecological)	Ozone: 1-hour maximum concentration (ppb)	A 10°C increase in average Tmax on a current day was associated with a proportional increase in cardiovascular mortality for: the lowest quartile of ozone exposure= 1.17% (1.06 to 3.06); the second quartile of ozone exposure= 4.35% (2.12 to 6.41); the third quartile of ozone exposure= 4.31% (1.59 to 7.08); and the fourth quartile of ozone exposure= 8.31% (4.22 to 11.99).	Lag 0-1 day assessed for temperature but not for ozone. Subgroup analysis not reported.
<i>Revich et al. 2010 Russia (254)</i>	Longitudinal (Ecological)	Ozone: 24-hour maximum concentration (µg/m ³)	Proportional increase in mortality per 10 µg/m3 increase in ozone concentration for: IHD= 1.61% (1.01 to 2.21) and cerebrovascular disease= 1.28% (0.54 to 2.02).	Lag 0-1 days assessed. Regression coefficients were not sensitive to the variation in time lag. Findings similar in adults age 75 years or older. Proportional increase in mortality per 10 µg/m3 increase in ozone concentration for: IHD= 1.88% (1.08 to 2.68) and

				cerebrovascular disease= 1.25% (0.31 to 2.19)
<i>Saez et al. 2002 Spain</i> (258)	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration (lag 1 day)= 0.56% (0.07% to 1.13%).	Lag 0-5 days assessed. Significant association at lag 1 day. Subgroup analysis not reported.
<i>Samoli et al. 2009 Greece, Spain, Switzerland, United Kingdom, Hungary, Finland, Slovenia, France, Italy, Netherlands, Czech Republic, Sweden</i> (260)	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration during June-August= 0.43% (0.18 to 0.69).	Lags 0-20 days were assessed. Significant association for lag 0 and lag 0-1 days assessed. Subgroup analysis not reported.
<i>Sanyal et al. 2018 France</i> (261)	Longitudinal (Ecological)	Ozone: annual average ozone concentration ($\mu\text{g}/\text{m}^3$)	RR for CVD mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration= 0.999 (0.997 to 1.000).	Lags not assessed. Subgroup analysis not reported.
<i>Shi et al. 2020 China</i> (268)	Longitudinal (Ecological)	Ozone: 1-hour maximum and 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration: Temperature <25 th percentile = -0.08 (-0.22 to 0.15) Temperature 25 th -75 th percentile = 0.34 (0.21-0.46), and high temperature >75 th percentile= 0.42% (0.32 to 0.51).	Lag 0-1 day assessed and reported in the main analysis. When stratified by age or sex, ozone exposure only led to increased cardiovascular mortality for at temperatures >25 th percentile.
<i>Simpson et al. 1997 Australia</i> (269)	Longitudinal (Ecological)	Ozone: 1- hour maximum and 8-hour average concentration ($\mu\text{g}/\text{m}^3$)	RR for cardiovascular mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration using: 1-hour maximum ozone (lag 0)= 1.012 (0.994 to 1.031) and 8-hour	Lag 0-5 days assessed. The most significant effects existed for same-day averages.

			average ozone=1.020 (0.992 to 1.049).	No significant associations in subgroups by age.
<i>Spencer-Huang et al. 2011</i> <i>United States</i> (270)	Longitudinal (Ecological)	Ozone: monthly average concentration (ppb)	RR for coronary heart disease mortality among kidney transplant recipients per 10ppb increase in ozone concentration= 1.27 (1.02 to 1.60).	Lags not assessed. Subgroup analysis not reported.
<i>Stafoggia et al. 2020</i> <i>Sweden</i> (271)	Longitudinal (Case-Crossover)	Ozone: 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration during: October-March= 0.54% (-1.12 to 2.2) and April-September= 1.77% (-0.49 to 4.08).	Lag 0-5 days assessed. No association. Subgroup analysis not reported.
<i>Stafoggia et al. 2010</i> <i>Italy</i> (272)	Longitudinal (Case-Crossover)	Ozone: daily 8-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration for: cardiac= 2.3% (1.1 to 3.6) and cerebrovascular= 1.4% (0.1 to 2.6).	Lag 0-5 days assessed. The association lasted several days for cardiac mortality (lag 0–5), and was delayed for cerebrovascular deaths (lag 3–5). Subgroup analysis not reported.
<i>Sun et al. 2018</i> <i>China</i> (273)	Longitudinal (Ecological)	Ozone: 1- and 8-hour maximum, 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration using: 24-hour average= 0.66% (0.28 to 1.04); 1-hour maximum= 0.31% (0.11 to 0.51); 8-hour maximum= 0.39% (0.16 to 0.62).	Lag 0-2 days assessed and reported in the main analysis. Subgroup analysis not reported.
<i>Vanos et al. 2014</i> <i>Canada</i> (277)	Longitudinal (Ecological)	Ozone: daily mean concentrations (ppb)	RR for cardiovascular mortality associated with an increase in ozone exposure for: Winter = 1.048 (1.032 to 1.064); Spring=	Lag 0-5 days included in the main analysis. Subgroup analysis not reported.

			1.034 (1.018 to 1.050); Summer= 1.060 (1.040 to 1.080); Fall= 1.021 (1.011 to 1.031).	
<i>Vedal et al. 2003</i> <i>Canada</i> (278)	Longitudinal (Ecological)	Ozone: 1-hour mean concentrations (ppb)	There was no significant proportional increase in cardiovascular mortality per 10 ppb increase in ozone concentration in the summer or winter.	Lag 0-2 days assessed. No significant association at any lag. Subgroup analysis not reported.
<i>Wong et al. 2008</i> <i>China</i> (283)	Longitudinal (Ecological)	Ozone: 8-hour average concentrations ($\mu\text{g}/\text{m}^3$)	Proportional increase in CVD mortality in socially deprived urban areas per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration: 0.42% (-0.12 to 0.97).	Lag 0-4 days assessed. Strongest association at lag 1 day but not statistically significant. There was no effect of social deprivation index on CVD mortality associated with increased ozone concentration.
<i>Yap et al. 2019</i> <i>Singapore</i> (288)	Longitudinal (Ecological)	Ozone: 8-hour average concentrations ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration at lag 1= 0.292 (-0.166 to 0.854).	Lag 0-30 days assessed. No significant association with CVD mortality observed at any lag. Subgroup analysis not reported.
<i>Yin et al. 2017</i> <i>China</i> (289)	Longitudinal (Ecological)	Ozone: 24-hour average concentrations ($\mu\text{g}/\text{m}^3$)	Proportional increase in mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration for: CVD=0.27% (0.10 to 0.440; hypertension- 0.60% (0.08 to 1.11); coronary heart disease= 0.24 (0.02 to 0.46); and stroke=0.29 (0.07 to 0.50).	Lags not assessed. The effect of ozone exposure on total mortality increased with age and education level, but but the difference was not significant. No effect of gender was found.
<i>Zeghnoun et al. 2001</i> <i>France</i> (291)	Longitudinal (Ecological)	Ozone: 24-hour average concentrations ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular mortality per interquartile range increase in ozone concentration for:	Lag 0-3 days assessed. No significant association at any lag. Subgroup analysis not reported.

			Rouen= 5.3% (-1.0 to 12.0) and Le Havre= 6.7% (-0.9 to 14.9).	
<i>Zmirou et al. 1998</i> <i>United Kingdom, France, Spain, Italy, Poland, Slovakia (293)</i>	Longitudinal (Ecological)	Ozone: 1-hour maximum and 8-hour average concentrations ($\mu\text{g}/\text{m}^3$)	RR for cardiovascular mortality per 50 $\mu\text{g}/\text{m}^3$ increase in ozone concentration using the: 1-hour maximum= 1.02 (1.01 to 1.03) and 8-hour average= 1.02 (1.00 to 1.03).	Lag 0-3 days assessed for total mortality but lag 0 reported in the analysis for cardiovascular mortality. Subgroup analysis not reported.
<i>Adebayo-Ojo et al. 2022</i> <i>South Africa (294)</i>	Longitudinal (Ecological)	Ozone: 24-hour mean concentration($\mu\text{g}/\text{m}^3$)	RR of CVD mortality associated with an IQR increase in two-day moving average ozone concentration ($\mu\text{g}/\text{m}^3$)= 1.025 (1.002 to 1.048).	Lag up to 3 weeks assessed. Strongest association at lag 0-1 days assessed. No significant difference was observed when stratified by age using cutoff of 65 years old. RR of CVD mortality was higher in men than women.
<i>Chen et al. 2021</i> <i>China (297)</i>	Longitudinal (Ecological)	Ozone: 1-, 8-, and 24-hour average and maximum concentrations ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardio-cerebrovascular mortality associated with a 10 ($\mu\text{g}/\text{m}^3$) increase in ozone exposure= 1.002 (1.0007 to 1.033). An interaction observed with temperature, with larger increases in cardiovascular and cerebrovascular mortality at extreme temperatures (both extreme heat and extrem cold). Proportional increase in cardio-cerebrovascular mortality associated with a 10 ($\mu\text{g}/\text{m}^3$) increase in ozone exposure when Temperature>90 th	Lag 0-1 days assessed. Significant associations at lag 0 and lag 0-1 days assessed. Subgroup analysis not reported.

			percentile= 1.019 (1.0093 to 1.0144). Proportional increase in cardio-cerebrovascular mortality associated with a 10 (µg/m ³) increase in ozone exposure when Temperature<10 th percentile= 1.0062 (1.005 to 1.0164).	
<i>Chen et al. 2022 China (301)</i>	Longitudinal (Case-crossover)	Ozone: mean daily concentration(µg/m ³)	Proportional increase in chronic IHD mortality for every 10 µg/m ³ increase in ozone above 123 µg/m ³ = 1.70% (1.03 to 2.38%).	Lag 0-6 days assessed. Maximum effect seen at lag 3 days assessed. In stratified analyses, larger effect size in adults ≥80 years (compared with <80 years, interaction term not significant), men (compared with women, interaction term statistically significant). Effect only seen in the warm season (April to October).
<i>Godzinski et al. 2021 France (308)</i>	Cross-Sectional (Ecological)	Ozone: daily ozone concentration (µg/m ³)	One standard deviation increase in ozone was not associated with a statically significant increase in cardiovascular mortality.	Lag assessment unclear. Subgroup analysis not reported.
<i>Li et al. 2022 China (322)</i>	Longitudinal (Ecological)	Ozone: daily 8-hour maximum concentration(µg/m ³)	Ozone exposure was associated with a significantly increased RR of CVD mortality RR 1.19 (1.12-1.27), IHD mortality RR 1.20 (1.09-1.33), and cerebrovascular disease mortality 1.22 (1.12-1.33).	Lags not assessed. Significant associations noted among men and women, as well as among individuals <65 and ≥65 years of age.

<i>Liu et al. 2021 China (331)</i>	Case- crossover (Ecological)	Ozone: Average 8-h daily maximum concentration($\mu\text{g}/\text{m}^3$)	After adjusting for daily air temperature and dew point temperature, ozone exposure was not associated with significant increases in mortality from MI.	Lag 0-1 day included in the main analysis. No significant association was observed by age group, sex, or race.
<i>Shin et al. 2021 Canada (338)</i>	Longitudinal (Ecological)	Ozone: hourly concentration (ppb) 0.3% (-0.5 to 1.0)	Women: proportional yearly increase in CVD mortality associated with a 10-ppb increase in ozone concentrations= 0.7% (0.1% to 1.3%). Men: proportional yearly increase in CVD mortality with a 10-ppb increase in ozone= 0.3% (-0.2% to 0.7%).	Lags not assessed. For women, the increased CVD mortality associated with increased ozone was only significant during the warm season (April to September)
<i>Thongphunchung et al. 2022 Thailand (341)</i>	Longitudinal (Ecological)	Ozone: daily mean concentration (ppb)	Proportional increase in circulatory disease mortality associated with a 1 ppb increase in ozone concentration = 0.27% (0.00% to 0.55%).	Lags not assessed. Subgroup analysis not reported.
<i>Wu et al. 2022 China (346)</i>	Longitudinal (Ecological)	Ozone: 8h average ozone concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiovascular mortality associated with a 10 $\mu\text{g}/\text{m}^3$ increase in ozone = 1.26% (0.68% to 1.83%).	Lag 0-7 days assessed. In single- day lag models, significant association was observed on lag day 0 through lag day 3. In cumulative lag models, significant association persisted through lag day0-7 (largest magnitude of association for lag day 0-3). The magnitude of the association was larger among people aged <65 years compared with people

				aged ≥ 65 years, and among women compared with men.
<i>Xu et al. 2022 China</i> (348)	Longitudinal (case-crossover)	Ozone: maximum 8h average concentrations($\mu\text{g}/\text{m}^3$)	Proportional increase in total stroke mortality associated with a $10 \mu\text{g}/\text{m}^3$ increase in ozone (lag2) = 0.37% (0.18% to 0.57%). Proportional increase in ischemic stroke mortality associated with a $10 \mu\text{g}/\text{m}^3$ increase in ozone = 0.54% (0.27% to 0.82%).	Lag 0-6 days assessed. In single-day-lag models, significant association with total stroke noted on day0 though day 2; in cumulative lag models, association with total stroke persisted through 04 days assessed. Similar findings across sex and age group.
<i>Yan et al. 2021 China</i> (349)	Longitudinal (Ecological)	Ozone: average daily concentration($\mu\text{g}/\text{m}^3$)	After adjusting for temperature, relative humidity, weekend effect, and ambient air pollution there was no significant association between ozone and mortality due to cerebrovascular diseases.	Lag 0-5 days assessed. No significant association across any lag tested. Similar findings by sex and age group.
<i>Turner et al. 2016 United States.</i> (354)	Longitudinal (Ecological)	Ozone: daily maximum 8-hour average concentrations(ppb)	Hazard ratio for the association of a 10 ppb increase in ozone with: all circulatory mortality (including diabetes) = 1.03 (1.01 to 1.05); CVD mortality = 1.03 (1.01 to 1.05); IHD mortality = 0.98 (0.95 to 1.00); dysrhythmia, heart failure, and cardiac arrest mortality = 1.15 (1.10 to 1.20); cerebrovascular disease mortality = 1.03 (0.98 to 1.07).	Lags not assessed. Subgroup analysis not reported.
<i>Cheng et al. 2023 China</i> (357)	Longitudinal (case-crossover)	Ozone: daily concentrations ($\mu\text{g}/\text{m}^3$)	OR for acute myocardial infarction with an interquartile range increase in ozone concentration for = 1.07 (1.03	Lag 0-6 days assessed. The odds of acute myocardial infarction death was significantly increased a few days after exposure.

			to 1.12). Odds of acute myocardial infarction deaths increased by 7% for an IQR increase in ozone.	Increased odds of acute myocardial infarction deaths in females.
<i>Cortes et al. 2023 Brazil</i> (358)	Longitudinal (case-crossover)	Ozone: 8-h maximum concentration ($\mu\text{g}/\text{m}^3$)	OR for CVD mortality associated with 10 $\mu\text{g}/\text{m}^3$ increase in ozone = 1.01 (1.00 to 1.01).	Lag 1-3 days assessed. No difference by lag. No associations observed in different subgroups: age ≥ 65 years, age 0-64 years, females and males.
<i>Huang et al. 2023 China</i> (364)	Longitudinal (Ecological)	Ozone: 24-h average concentrations (ppb)	No significant associations noted.	Lag 0-3 days assessed. No significant association. Subgroup analysis not reported.
<i>Shin et al. 2023 Canada</i> (381)	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration (ppb)	No significant association between ozone and circulatory hospitalization during the warm season, but significant associations noted for both 5- and 6-day lagged ozone during the cold season (5-day lagged ozone having risk estimates of 0.8% with 95% posterior interval 0.3 to 1.3 for the 1-pollutant model). Year-round, circulatory hospitalization risk was also significantly associated with 6-day lagged ozone, 0.2% (0.0, 0.5). No significant associations between ozone and circulatory mortality in the warm or cold season for single-pollutant models.	Lag 0-6 days assessed. Subgroup analysis not reported.

B. Ground-level Ozone: Cardiovascular Morbidity

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Linares et al. 2008</i> <i>Spain</i> (122)	Longitudinal (Ecological)	Tmax>36°C Ozone: 3-hour average level (µg/m ³)	Ozone+Heat= Increase in absolute numbers of emergency hospital admissions for cardiovascular causes with exposure to elevated ozone per 1°C increase over 0-7 days= 0.84 (0.16 to 1.52).	Lags not assessed. Older age (>75 years) was not associated with significantly higher risk of cardiovascular admission
<i>Simoes et al. 2022</i> <i>France</i> (140)	Longitudinal (Ecological)	Ozone: daily maximum concentration (µg/m ³)	RR of CVD incidence associated with an increase in ozone concentration (µg/m ³) to heavily polluted levels defined at daily concentration >180 µg/m ³ (lag0 – lag2) = 1.06 (1.00 to 1.15).	Lag 0-14 days assessed. Subgroup analysis not reported.
<i>Wang et al. 2020</i> <i>China</i> (192)	Longitudinal (Ecological)	Ozone: 24-hour average (µg/m ³)	RR for arrhythmia outpatient visits per 10 µg/m ³ increase in ozone concentrations= 0.991 (0.971 to 1.012).	Lag 0-3 days assessed. Similar findings by lag. There was no significant variation in outpatient visits for arrhythmia in regard to age, gender, or season.
<i>Atkinson et al. 1999</i> <i>United Kingdom</i> (194)	Longitudinal (Ecological)	Ozone: 8-hour average (µg/m ³)	Proportional change in CVD hospital admissions associated with an increase in ozone level from the 10 th to 90 th percentile= 2.34% (0.19% to 4.55%) at lag 2.	Lag 0-3 days assessed. Strongest association noted at lag 2. Ozone exposure was associated with a proportional increase in CVD hospital admissions for

				age 65+ (3.38%, 1.12 to 5.69) but a proportional decrease for age 0-64 (-2.59%, -4.78 to -0.34).
<i>Atkinson et al. 2013 United Kingdom (195)</i>	Longitudinal (Ecological)	Ozone: annual mean concentration ($\mu\text{g}/\text{m}^3$)	Hazard ratio associated with an interquartile change in ozone concentrations for: myocardial infarction =0.96(0.93 to 1.00); stroke= 1.00(0.97 to 1.04); heart failure =0.94(0.90 to 0.98); arrhythmia=1.02 (0.98 to 1.05).	Lags not assessed. There was no observed effect of age, sex, smoking, BMI, or comorbidities (diabetes and hypertension).
<i>Ballester et al. 2006 Spain (196)</i>	Longitudinal (Ecological)	Ozone: daily 8-hour maximum moving average ($\mu\text{g}/\text{m}^3$)	Proportional increase in hospital admissions per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentrations for: CVD= 0.7% (0.3 to 1.0) and heart disease= 0.7% (0.1 to 1.2).	Lag 0-3 days assessed. Significant findings on lag 2-3 days assessed. Subgroup analysis not reported.
<i>Ballester et al. 2001 Spain (197)</i>	Longitudinal (Ecological)	Ozone: 8-hour average ($\mu\text{g}/\text{m}^3$)	RR of hospital admissions per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentrations for: CVD (Lag 2 days)= 0.9905 (0.9701 to 1.0104); heart disease= 0.9786 (0.9535 to 1.0044); and cerebrovascular disease (Lag 2 days) = 0.9760 (0.9464 to 1.0066).	Lag of 0-5 days assessed. No significant association. Subgroup analysis not reported.
<i>Bhaskaran et al. 2011 United Kingdom (199)</i>	Longitudinal (Case-Crossover)	Ozone: hourly concentrations ($\mu\text{g}/\text{m}^3$)	Proportional change in risk of MI per 10 $\mu\text{g}/\text{m}^3$ increase in hourly ozone exposure= -0.6% (-1.3 to 0.1).	Lag of 0-72h assessed. No significant association across any lag. The effect of ozone did not change when accounting for other pollutants or during different seasons.

<i>Butland et al. 2017 United Kingdom (201)</i>	Longitudinal (Case-Crossover)	Ozone: daily mean and daily maximum 9-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in risk per $10 \mu\text{g}/\text{m}^3$ increase in ambient ozone for: total strokes= -1.2% (-5.3 to 3.0); ischemic strokes= -0.7% (-5.4 to 4.2); and hemorrhagic strokes= 2.8% (-8.1 to 15.1).	Lag 0-1 day assessed. No significant association. When adjusting for season, there was a significantly proportional decrease in total and ischemic strokes during autumn. There was no significant effects on hemorrhagic strokes or on any stroke type during other seasons.
<i>Cackmak et al. 2006 Canada (202)</i>	Longitudinal (Ecological)	Ozone: 8- and 24- maximum concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in hospitalizations for cardiac disease per $10 \mu\text{g}/\text{m}^3$ increase in ozone concentration= 2.0% (0.1 to 3.9).	Lag 0-5 days assessed. Mean lag for strongest association across all cities was 2.9 days assessed. Gender: Women experienced a greater increase in cardiac hospitalizations than men (2.7% [0.2 to 5.2] in women compared with 1.4% [0.9 to 1.9] in men) Socioeconomic status: ozone was associated with increased risk of cardiac hospitalizations only in the third quartile of income, i.e., second highest quartile of educational attainment (6.0%; 0.2 to 11.8). Overall effect of all pollutants (ozone, nitrogen dioxide, and sulfur dioxide) statistically significant only in the lowest quartile of education.

				Family income: ozone was associated with increased risk of cardiac hospitalizations only in the third quartile of family income, i.e., second highest income quartile (3.0%; 0.6 to 5.4%). Overall effect of all pollutants (ozone, nitrogen dioxide, and sulfur dioxide) statistically significant only in the lower two quartiles of family income.
<i>Chang et al. 2005 Taiwan (203)</i>	Longitudinal (Case-Crossover)	Ozone: 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	OR for cardiovascular hospitalization with an interquartile range increase in ozone concentration for: temperature $>20^\circ\text{C}$ = 1.189 (1.154 to 1.225); temperature $<20^\circ\text{C}$ = 1.073 (1.022 to 1.127).	Lag 0-2 days assessed. After accounting for other sources of air pollution, ozone only had a statistically significant increase in the odds of cardiovascular hospitalization on days with temperature $>20^\circ\text{C}$
<i>Cheng et al. 2009 Taiwan (204)</i>	Longitudinal (Case-Crossover)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	OR for MI hospitalization with an interquartile range increase in ozone concentration for: temperature $>25^\circ\text{C}$ = 1.18 (1.10 to 1.26); temperature $<25^\circ\text{C}$ = 1.10 (0.99 to 1.23).	Lag 0-2 days assessed. Once accounting for other sources of air pollution, ozone only had a statistically significant increase in the odds of myocardial infarction hospitalization on days with temperature $>25^\circ\text{C}$
<i>Chiu et al. 2017 Taiwan (205)</i>	Longitudinal (Case-Crossover)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	OR for MI hospitalization with an interquartile range increase in ozone concentration for: temperature $>23^\circ\text{C}$ = 1.07 (1.02 to 1.12); temperature $<23^\circ\text{C}$ = 1.17 (1.11 to 1.25).	Lag 0-2 days assessed. Once accounting for other sources of air pollution, ozone only had a statistically significant increase in the odds

				of myocardial infarction hospitalization on days with temperature >23°C.
<i>Corea et al. 2012 Italy (206)</i>	Longitudinal (Case-Crossover)	Ozone: 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Men: OR for hospitalization for: any cerebrovascular event= 0.99 (0.98 to 1.01); ischemic stroke= 0.99 (0.98 to 1.00). Women: OR for hospitalization for: any cerebrovascular event= 1.01 (0.99 to 1.02); ischemic stroke= 1.00 (0.99 to 1.02).	Lags not assessed. No statistically significant association noted among men or women, or by stroke subtype.
<i>Ensor et al. 2013 United States (209)</i>	Longitudinal (Case-Crossover)	Ozone: daily maximum 8-hour running mean concentration (ppb)	A 20ppb ozone increase for the 8-hour average daily maximum was associated with an increased risk of OHCA= 1.039 (1.005 to 1.073). Each 20ppb increase in average ozone over the previous 1-3 hours was associated with an increased risk of OHCA= 1.044 (1.004 to 1.085).	Lag 0-8h and 0-5 days assessed. Strongest effect seen 1-3h after exposure. Subgroup analysis not reported.
<i>Henrotin, et al. 2007 France (217)</i>	Longitudinal (Case-Crossover)	Ozone: 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	OR associated with a 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentrations on the day after exposure for Ischemic stroke= 1.075 (1.022 to 1.131) but was not significant for hemorrhagic stroke.	Lag 0-3 days assessed. Significant association for ischemic stroke at lag 1 day but no significant association with hemorrhagic stroke across all lags tested. When stratified for sex, ozone exposure only led to increased odds of ischemic stroke in men. Individuals with cardiovascular risk factors (dyslipidemia,

				hypertension, and smoking) had a greater increase in odds with ozone exposure (OR = 1.212, 0.996 to 1.477).
<i>Henrotin, et al. 2010 France (218)</i>	Longitudinal (Case- Crossover)	Ozone: 1-hour maximum and 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	OR associated with a 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentrations on the third day after exposure for: all ischemic events (ischemic cerebrovascular event + myocardial infarction) = 0.998 (0.962 to 1.035) and recurrent ischemic events= 1.074 (1.016 to 1.135).	Lag 1-4 days assessed. Significant association between exposure to O ₃ and recurrent intra-cerebral vascular event with a 3-day lag (OR=1.115; 95% CI 1.027 to 1.209). The direction and magnitude of the association between exposure to O ₃ and recurrent MI were similar but not statistically significant. In Subgroup analysis, hypercholesterolemia was associated with increased risk of MI (incident and recurrent), while diabetes was associated with increased risk of ischemic cerebrovascular events (incident and recurrent). Greater numbers of vascular risk factors increased risk for MI and ischemic cerebrovascular events.
<i>Hosseinpoor, et al. 2005 Iran (219)</i>	Longitudinal (Ecological)	Ozone: 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	RR of angina pectoris admission per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration= 0.96396 (0.94256 to 0.98587).	Lag 0-3 days assessed. Significant association at lag 1 day. Subgroup analysis not reported.
<i>Hsieh, et al. 2010 Taiwan (220)</i>	Longitudinal (Case- Crossover)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	OR for myocardial infarction admission with an interquartile range increase in ozone	Lag 0-2 days assessed.

			concentration for: temperature $\geq 23^{\circ}\text{C}$ = 1.11 (1.07 to 1.16) and temperature $< 23^{\circ}\text{C}$ = 1.14 (1.08 to 1.20).	There was no difference in myocardial infarction admissions associated with ozone exposure on hot vs. cold days assessed.
<i>Huang et al. 2017 China</i> (221)	Longitudinal (Case-Crossover)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Proportional change in hospital admissions for stroke per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration = 0.23 (0.08 to 0.37).	Lag 0-2 days assessed. Significant association at lag 0, and lag 1 days when considering all days, and at lag 0, 1, 2, and 3-day average in warm and cold seasons. Ozone was associated with increased stroke admissions during the warm season and decreased admissions during the cold season.
<i>Huschmann et al. 2020 Germany</i> (222)	Longitudinal (Case-crossover)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	There was no increased risk of developing heart failure with short-term ozone exposure.	Lag 1-3 days assessed. No significant findings across any lag period. Subgroup analysis not reported.
<i>Kwon et al. 2019 South Korea</i> (227)	Longitudinal (Ecological)	Ozone: 1-hour mean concentration ($\mu\text{g}/\text{m}^3$)	No association between short-term ozone exposure and new-onset non-valvular atrial fibrillation. HR for new-onset non-valvular atrial fibrillation associated with an interquartile range increase in long-term ozone concentration: 1.05 (1.00 to 1.10).	Lag 0-5 days assessed in the short-term exposure analysis. No significant association. Once adjusting age and sex, the effect of ozone on new-onset non-valvular atrial fibrillation was no longer significant
<i>Lisabeth et al. 2008 United States</i> (231)	Longitudinal (Ecological)	Ozone: hourly average per 24-hr period (ppb)	Risk ratio of stroke/transient ischemic attack associated with an interquartile range increase	Lag 0-1 day assessed. Similar findings noted for Lag 0 and lag 1 models.

			in ozone level= 1.02 (0.97 to 1.08).	Subgroup analysis not reported.
<i>Maji et al. 2018 India (233)</i>	Longitudinal (Ecological)	Ozone: 24-hour mean concentration ($\mu\text{g}/\text{m}^3$)	RR for cardiovascular morbidity per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration= 1.04 (0.975 to 1.1).	Lags not assessed. Subgroup analysis not reported.
<i>Malik et al. 2019 United States (234)</i>	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration (ppm)	Ozone exposure was independently associated with poorer Seattle Angina Questionnaire summary scores at 1- year= -0.9 (-1.3 to -0.4). Higher ozone levels were associated with worse recovery at 1-year after a myocardial infarction.	Lags not assessed. Subgroup analysis not reported.
<i>Montresor-Lopez et al. 2016 United States (236)</i>	Longitudinal (Case-Crossover)	Ozone: daily maximum of 8-hour mean ozone concentrations (ppb)	Ozone: OR for hospitalization per 10ppb increase in ozone exposure for: all strokes= 0.98 (0.96 to 1.00); ischemic strokes= 0.98 (0.96 to 1.01); and hemorrhagic strokes= 0.95 (0.89 to 1.02).	Lag 0-2 days assessed. Similar findings across all lags evaluated. OR for hospitalization for all strokes or stroke subtypes associated with increased ozone exposure was not significant even when accounting for sex or ethnicity.
<i>Morris et al. 1995 United States (237)</i>	Longitudinal (Ecological)	Ozone: 1-hour maximum ozone concentrations (ppm)	Ozone: RR for Heart failure admission per 0.12 ppm increase in ozone concentration ranged from 0.89 (0.81 to 0.97) in New York to 1.06 (1.01 to 1.11) in Los Angeles.	Lag 0-7 days assessed. Once adjusting for other pollutants, higher levels of ozone were not associated with increased risk of heart failure admission.
<i>Nascimento et al. 2012 Brazil (238)</i>	Longitudinal (Ecological)	Ozone: estimated ozone levels ($\mu\text{g}/\text{m}^3$)	RR for stroke hospitalization associated with increased ozone exposure= 1.001 (0.998 to	Lag 0-2 days assessed. No significant association at any lag.

			1.008) but the association was not statistically significant (in single- or multiple-pollutant models).	Subgroup analysis not reported.
<i>Oudin et al. 2010 Sweden (240)</i>	Longitudinal (Ecological/Case-Crossover)	Ozone: 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	Time-series approach: RR of hospitalization with ambient ozone level $\geq 90 \mu\text{g}/\text{m}^3$ for: ischemic stroke = 0.97 (0.89 to 1.06) and hemorrhagic stroke = 0.96 (0.74 to 1.25). Case-Crossover approach: OR of hospitalization with ambient ozone level $> 90 \mu\text{g}/\text{m}^3$ for: ischemic stroke = 0.94 (0.94 to 1.04) and hemorrhagic stroke = 0.84 (0.63 to 1.11).	Lag 0-2 days assessed. No significant association by any lag day assessed. Subgroup analysis not reported.
<i>Peel et al. 2007 United States (243)</i>	Longitudinal (Case-Crossover)	Ozone: 8-hour maximum concentration (ppb)	OR for emergency department visits per 25ppb increase in ozone concentration for: all CVD = 1.00 (0.98 to 1.02); IHD = 1.025 (1.003 to 1.049); dysrhythmia = 1.012 (0.973 to 1.052); peripheral and cerebrovascular disease = 1.021 (0.979 to 1.064); heart failure = 0.952 (0.908 to 0.997).	Lag 0-2 days assessed and reported in main analysis. Diabetes had no effect on OR for emergency department visits, but comorbid chronic obstructive pulmonary disease was associated with statistically significant increase in emergency department visits for peripheral and cerebrovascular disease.
<i>Metzger et al. 2004 United States (244)</i>	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration (ppb)	Risk Ratio for emergency department visits per 25ppb increase in ozone concentration for: all CVD = 1.008 (0.987 to 1.030) IHD = 1.019 (0.981 to	Lag 0-2 days assessed and reported in the main analysis. Subgroup analysis not reported.

			1.059); dysrhythmia= 1.008 (0.967 to 1.051); peripheral and cerebrovascular disease= 1.028 (0.985 to 1.073); heart failure = 0.965 (0.918 to 1.014).	
<i>Ponk et al. 1996 Finland (246)</i>	Longitudinal (Ecological)	Ozone: 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	RR for hospitalization per one log (approximately 2.7-fold) increase in ozone concentration for: IHD= 0.87 (0.80 to 0.94) one day after exposure and 1.13 (1.03 to 1.24) two days after exposure). Overall admissions due to cerebrovascular diseases did not show a significant association with pollution.	Lag 0 to 7 days assessed. Findings other than those in the main analysis were not significant. Subgroup analysis not reported.
<i>Qian et al. 2007 China (247)</i>	Longitudinal (Ecological)	Ozone: 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in daily mortality per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration for: CVD= 0.04 (-0.39 to 0.47); stroke= -0.13 (-0.65 to 0.39); cardiac= 0.25 (-0.49 to 0.99); and cardiopulmonary disease= 0.31 (-0.12 to 0.74).	Lag 0-4 assessed but only lag 0 reported. There was no effect of age on daily mortality for non-accidental, CVD, stroke, cardiac, or cardiopulmonary disease.
<i>Qin et al. 2015 China (248)</i>	Cross-Sectional (Ecological)	Ozone: 8-hour mean concentration ($\mu\text{g}/\text{m}^3$)	OR of stroke associated with an interquartile range increase in ozone concentration for: body mass index <25= 0.98 (0.82 to 1.18); body mass index 25-30= 1.29 (1.05 to 1.59); body mass index >30= 1.47 (0.83 to 2.39). OR of CVD associated with an interquartile range increase in ozone concentration for: body mass index <25= 1.08 (0.87 to 1.35); body mass index 25-30=	Lags not assessed. Female sex with body mass index >25 was associated with increased stroke risk, while male sex was not associated with increased stroke incidence regardless of body mass index.

			1.09 (0.85 to 1.35); body mass index >30= 1.56 (1.02 to 2.39).	
<i>Qiu et al. 2020 United States (249)</i>	Longitudinal (Ecological)	Ozone: daily average concentration (ppb)	No clear pattern of distributed lag effects or cumulative effects of ozone on cardiovascular hospitalization rates were observed. Results were similar when considering all-season ozone level as well as ozone levels during warm seasons.	Lag 0-5 days assessed. No differences by lag. No differences observed by sex, race white vs Black individuals), and prior history of diabetes or chronic obstructive pulmonary disease. People with COPD and Black individuals had a significantly higher risk of admission for ischemic stroke for each 10 ppb increase in ozone level.
<i>Rich et al. 2004 Canada (255)</i>	Longitudinal (Case-Crossover)	Ozone: daily 1-hour maximum concentration (ppb)	OR for implantable cardioverter defibrillator discharge associated with an interquartile range increase in ozone concentration during the winter= 2.27 (0.67 to 7.66).	Lag 0-3 days assessed. No statistically significant effect for any lag, but numerically strongest association at lag 1 day. Subgroup analysis not reported.
<i>Rosenthal et al. 2013 Finland (256)</i>	Longitudinal (Ecological)	Ozone: 1-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	OR for out-of-hospital cardiac arrest associated with an interquartile range increase in ambient ozone concentration at lag 0-2 days for: all cardiac causes= 1.18 (1.03 to 1.35); myocardial infarction = 0.91 (0.80 to 1.17); other cardiac causes= 1.30 (1.11 to 1.53).	Lag 0-7 days assessed. Significant association with out-of-hospital cardiac arrest from all cardiac causes on lag day 2 and for cardiac causes other than an acute myocardial infarction on lag days 1, 2, and 0-3 days assessed. Subgroup analysis not reported.
<i>Ruidavets et al. 2005 France (257)</i>	Longitudinal (Case-Crossover)	Ozone: 8-hour moving average concentration ($\mu\text{g}/\text{m}^3$)	RR for acute myocardial infarction per 5 $\mu\text{g}/\text{m}^3$ increase in ozone concentration: 1.05 (1.01 to 1.08) on the day of	Lag 0-3 days assessed. RR significant for lag 0 and lag 1 day.

			exposure and 1.05 (1.01 to 1.09 on the next day.	Subjects age 55-64 with no personal history of IHD were the most susceptible to develop acute myocardial infarction.
<i>Salfipour et al. 2019 Iran (259)</i>	Longitudinal (Case-Crossover)	Ozone: 8-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	OR for hospitalization for atrial fibrillation with rapid ventricular response (defined as heart rate >90bpm) per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration= 1.082 (0.763 to 1.533).	Lag 0-1 day assessed. Subgroup analysis not reported.
<i>Sarnat et al. 2016 United States (262)</i>	Longitudinal (Ecological)	Ozone: 24-hour average concentration (ppb)	RR associated with a 10 ppb increase in ozone concentration for: supraventricular ectopy 1.78 (0.95 to 3.35) and ventricular ectopy= 1.43 (0.63 to 3.27).	Lag 0-5 days assessed. Cumulative air pollution effects (five day moving average concentrations before the health assessment) as numerically highest may suggest that a long-acting mechanism promoted the ectopic beats in our population. Subgroup analysis not reported.
<i>Schwartz, 1997 United States (263)</i>	Longitudinal (Ecological)	Ozone: 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in CVD admissions associated with an interquartile range increase in ozone concentration= 0.54% (-2.3 to 3.45).	Lags not assessed. Subgroup analysis not reported.
<i>Schwartz et al. 1995 United States (264)</i>	Longitudinal (Ecological)	Ozone: 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	RR of hospital admission associated with an interquartile range increase in ozone concentration for= IHD: 1.010 (0.99 to 1.032), heart failure: 1.022 (0.997 to 1.046).	Lag 0-2 days assessed. No significant association at any lag tested. Subgroup analysis not reported.
<i>Shahi et al. 2014 Iran (265)</i>	Cross-Sectional (Ecological)	Ozone: 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	RR for CVD admissions associated with an increase in ozone concentration= 1.02 (1.01 to 1.03).	Lag 0-7 days assessed. Significant association noted at lag 0, 1, and 2 days assessed.

				Subgroup analysis not reported.
<i>Shin et al. 2018 Canada (266)</i>	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in hospitalizations per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration for: IHD= 0.4% (-0.3 to 1.1); other heart disease= 0.4% (-0.2 to 1.0); cerebrovascular disease= 0.2% (-0.8 to 1.2).	Lag 0-2 days assessed. No significant association. Male sex was associated with increased risk of cerebrovascular disease admissions. There was no clear effect of age (cutoff 65 years old).
<i>Shin et al. 2019 Canada (267)</i>	Longitudinal (Ecological)	Ozone: Five-yearly average concentration ($\mu\text{g}/\text{m}^3$)	HR associated with an interquartile range increase in ozone concentration for: atrial fibrillation= 1.01 (1.00 to 1.02) and stroke= 1.05 (1.03 to 1.06).	Lags not assessed. Younger age and lack of hypertension at baseline were associated with increased HR for the development of atrial fibrillation.
<i>Sun et al. 2019 United States (274)</i>	Longitudinal (Case- Crossover)	Ozone: 24-hour average concentration (ppb)	OR for stroke incidence per 10 ppb increase in ozone concentration for: total strokes= 0.99 (0.92 to 1.07); ischemic strokes= 1.00 (0.92 to 1.09); hemorrhagic strokes= 0.96 (0.80 to 1.15); unspecified stroke type= 1.01 (0.68 to 1.51).	Lag 0-6 days assessed. No statistically significant association for any lag Subgroup analysis not reported.
<i>Tan et al. 2019 China (275)</i>	Longitudinal (Ecological/C ase- Crossover)	Ozone: 24-hour average concentration ($\mu\text{g}/\text{m}^3$)	No statistically significant association between ozone exposure and daily CVD outpatient visits.	Lag 0-7 days assessed. No significant differences by lag. Subgroup analysis not reported.
<i>Turner et al. 2007 Australia (276)</i>	Longitudinal (Ecological)	Ozone: daily mean, maximum, and minimum concentrations (pphm)	Rate ratio for emergency department visits for cardiovascular or chest pain syndromes that were considered immediately or imminently life threatening per 10 pphm	Lag 0-7 days assessed. Strongest association for lag 1 day. Subgroup analysis not reported.

			increase in ozone concentration (lag 1 day)= 1.13 (1.01 to 1.26).	
<i>Von Klot et al. 2005</i> <i>Germany, Spain, Finland, Italy, Sweden</i> (279)	Longitudinal (Ecological/C ase- Crossover)	Ozone: daily maximum 8- hour mean concentrations ($\mu\text{g}/\text{m}^3$)	RR for hospital readmission after MI (from day 29 after index event onward) per 15 $\mu\text{g}/\text{m}^3$ increase in ozone concentration for: MI= 1.000 (0.954 to 1.048); angina pectoris= 1.044 (1.012 to 1.077); other cardiac causes=1.026 (1.001 to 1.051).	Lag 0-3 days assessed. Strongest association at lag 0. Subgroup analysis not reported.
<i>Wang et al. 2015</i> <i>Canada</i> (280)	Longitudinal (Case- Crossover)	Ozone: 6-, 12-, and 24-hour average; daily 1-hour maximum and daily 1-hour minimum concentrations ($\mu\text{g}/\text{m}^3$)	No significant association of ozone with hospitalizations for myocardial infarction.	Lag 0-5 days assessed. Subgroup analysis not reported.
<i>Wellenius et al. 2005</i> <i>United States</i> (281)	Longitudinal (Case- Crossover)	Ozone: 24-hour mean concentrations (ppb)	Proportional increase in hospital admission for congestive heart failure in patients age>65 years associated with an interquartile range increase in ozone concentration (17ppb) = -1.60 (- 3.77 to 0.61).	Lag not assessed. Subgroup analysis not reported.
<i>Wing et a, 2015</i> <i>United States</i> (282)	Longitudinal (Case- Crossover)	Ozone: 24-hour maximum concentrations (ppb)	OR for ischemic stroke per 10ppb increase in ozone concentration at lag 2 for: non- Hispanic white Americans= 1.12 (1.01 to 1.25) and Mexican Americans= 0.99 (0.90 to 1.09).	Lag 0-3 days assessed. Non-Hispanic white individuals had stronger associations between ozone concentrations and incident ischemic stroke with strongest association at lag 2.
<i>Xue et al. 2019</i> <i>China</i> (284)	Longitudinal (Case- Crossover)	Ozone: 8-hour maximum concentrations ($\mu\text{g}/\text{m}^3$)	OR for incidence of stroke per 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration= 1.026 (0.899 to 1.17).	Lag 0-5 days assessed. No association with stroke risk.

				Similar findings in subgroups by sex, age, rurality.
<i>Xu et al. 2013 United States (285)</i>	Longitudinal (Case-Crossover)	Ozone: 24-hour maximum concentrations (ppm)	OR for hospitalization associated with an interquartile range increase in ozone concentration for: all strokes= 1.019 (1.000 to 1.038); ischemic strokes=1.019 (0.999 to 1.040).	Lag 0-3 days assessed. Strongest association at lag 0. Male sex and age 65-79 (compared to age 80+) were associated with increased risk for acute stroke hospitalization with ozone exposure.
<i>Yang et al. 2008 Taiwan (286)</i>	Longitudinal (Case-Crossover)	Ozone: 24-hour average concentrations ($\mu\text{g}/\text{m}^3$)	OR for congestive heart failure admission associated with an interquartile range increase in ozone concentration for: temperature>20°C= 1.21 (1.15 to 1.27) and temperature<20°C= 0.75 (0.68 to 0.83).	Lag 0-2 days assessed. Subgroup analysis not reported.
<i>Yang et al. 2004 Taiwan (287)</i>	Longitudinal (Case-Crossover)	Ozone: 24-hour average concentrations ($\mu\text{g}/\text{m}^3$)	OR for CVD admission associated with an interquartile range increase in ozone concentration for: temperature>25°C= 1.351 (1.279 to 1.427) and temperature<25°C= 1.057 (0.962 to 1.162).	Lag 0-2 days assessed. Subgroup analysis not reported.
<i>Zanobetti et al. 2006 United States (290)</i>	Longitudinal (Case-Crossover)	Ozone: 24-hour average concentrations (ppb)	Proportional increase in MI admissions per increase in ozone concentration from the 10 th to 90 th percentile: 0.90% (-8.36 to 6.55).	Lag 0-1 day assessed. Subgroup analysis not reported.
<i>Zheng et al. 2020 China (292)</i>	Longitudinal (Ecological)	Ozone: 8-hour average concentrations ($\mu\text{g}/\text{m}^3$)	An interquartile range increase in ozone concentration was not associated with increased risk of hospitalization for acute myocardial infarction.	Lag 0-3 days assessed. No significant association. There was no difference in risk of acute myocardial infarction

				hospitalization when evaluating by sex or age (65 years old cut off).
<i>Biondi-Zoccai et al. 2020 Italy</i> (295)	Cross-sectional (Ecological)	Ozone: 24-hour mean, minimum, and maximum concentrations	Increased mean and maximum ozone concentrations ($\mu\text{g}/\text{m}^3$) were associated with a decreased risk of STEMI on the day of event Association with mean ozone = 0.998 (0.996-1.000) and up to three days preceding the event.	Lag 0-3 days assessed. Increasing mean levels of ozone associated with a small but significant reduction in events. Subgroup analysis not reported.
<i>Chang et al. 2022 Taiwan</i> (296)	Cross-sectional (Ecological)	Ozone: 24-hour mean concentration($\mu\text{g}/\text{m}^3$)	After adjusting for temperature and humidity, ozone exposure was not associated with significant increases in stroke hospitalizations.	Lag 0-4 days assessed. No statistically significant association noted at any lag. Subgroup analysis not reported.
<i>Cheng et al. 2021 Australia</i> (298)	Cross-Sectional (Ecological)	Ozone: mean hourly concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in emergency department visits for acute myocardial infarction associated with a $10\mu\text{g}/\text{m}^3$ increase in ozone concentration for = 1 hour: 0.54%(-4.54% to 5.88%); 2-6 hours: 3.89% (-2.31% to 10.47%); 7-12 hours: 4.87% (-1.45% to 11.59%); 13-24 hours: -3.92% (-10.58% to 3.24%).	Lag 1-24 hours included in the main analysis. They did not find modification effect by age, gender, season, or time of day.
<i>Chen et al. 2021 China</i> (299)	Cross-Sectional (Ecological)	Ozone: average 8 hour maximum concentrations($\mu\text{g}/\text{m}^3$)	Proportional increase in hospitalizations for ischemic stroke associated with a $10\mu/\text{m}^3$ increase in ozone for lag6 = 0.7% (0.0% to 1.5%).	Lag 0-7 days assessed. Significant association only on lag day 6. Similar findings in ischemic stroke hospitalizations when stratified by sex, age (cutoff 75 years old), or season.

<i>Chen et al. 2022 China (302)</i>	Longitudinal (Case- crossover)	Ozone: national average hourly concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in acute coronary syndrome (ACS) onset associated with an IQR increase in ozone concentration for = all ACS: -0.31 (-1.68 to 1.08), STEMI = 1.38 (-0.92 to 3.74), NSTEMI = -0.63 (-3.71 to 2.54), unstable angina = -1.73 (-3.77 to 0.35). During non- peak time ozone, estimated percent change of ACS = 0.71 (-0.88 to 2.33), STEMI = -1.22 (-3.71 to 1.33), NSTEMI = 1.68 (-1.78 to 5.25), unstable angina = 2.46 (-3.82 to 9.15) for each interquartile range increase in ozone concentration.	Lag 0-72 hours reported. No association between hourly ozone and ACS presentations. Subgroup analysis not reported.
<i>Dahlquist et al. 2022 Sweden (303)</i>	Longitudinal (Case- crossover)	Ozone: 24-hour mean concentration($\mu\text{g}/\text{m}^3$)	In patients with intracardiac devices, OR of atrial fibrillation during the warm season associated with an IQR increase in ozone concentrations for= lag 1-24hrs: 1.12 (0.84 to 1.48); 24-48 hours= 1.13 (0.99 to 1.29).	Lag 0-6 days assessed. A stronger association was observed for 1–24 hours (OR 1.12 [0.84 to 1.48] per IQR) and 24–48 hour (OR 1.13 CI [0.99 to 1.29] per IQR) compared with the longer lags. Subgroup analysis not reported.
<i>Danesh Yazdi et al. 2021 United States (304)</i>	Longitudinal (Ecological)	Ozone: total exposure (ppb)	Median risk difference (%) per 1 ppb increase in yearly ozone concentration for hospitalizations for MI = -0.00024 (-0.00052 to 0.00002); Stroke = -0.00278 ; (-0.00300 to -0.00246); Atrial fibrillation and flutter =	Lags not assessed. Individuals who were Medicaid-eligible, male, and younger had a higher probability of hospital admission with an

			-0.00072 (-0.00091 to -0.00047).	MI as compared with those who were not Medicaid eligible, female, and older, respectively. For stroke and atrial fibrillation, stratified analysis also had negative coefficients as with the main analysis.
<i>Danesh Yazdi et al. 2022 United States (305)</i>	Longitudinal (Ecological)	Ozone: average warm season levels (ppb)	Rate difference (per 100,000 person-years) in hospital admissions associated with a 1 ppb increase in annual ozone exposure for= CVD: 9.08 (4.78 to 13.19); MI: = 2.23 (1.12 to 3.37); Stroke = 1.18 (0.24 to 2.13).	Lags not assessed. Subgroup analysis not reported.
<i>Danesh Yazdi et al. 2019 United States (306)</i>	Longitudinal (Ecological)	Ozone: average annual levels (ppb)	Hazard Ratio for hospital admissions associated with a 1 ppb increase in annual ozone exposure in patients age>65 for= heart failure: 1.023 (1.022 to 1.024); MI: 1.011 (1.010 to 1.012); stroke: 1.012 (1.012 to 1.013).	Lags not assessed. Subgroup analysis not reported. Association with CVD outcomes persisted at levels below the current standard.
<i>Gentile et al. 2021 Italy (307)</i>	Longitudinal (Ecological)	Ozone: mean daily concentration of ozone (µg/m3)	OR for higher out-of-hospital cardiac arrest (>0.3 cases per 100,000) associated with increased ozone exposure = 2.4 (1.6 to 3.6). Days with above average incidence of out-of-hospital cardiac arrests were associated with decreased OR of ambient ozone concentrations when compared to days with below average incidence= 29.9 (10.9	Lags not assessed. Subgroup analysis not reported.

			to 61.7) vs 56.1 (25.5 to 74.1), p<0.001.	
<i>Godzinski et al. 2021 France</i> (308)	Cross-Sectional (Ecological)	Ozone: daily ozone concentration (µg/m3)	One standard deviation increase in ozone was not associated with a statically significant increase in cardiovascular emergency admissions.	Lags not assessed. Subgroup analysis not reported.
<i>Guo et al. 2021 China</i> (309)	Longitudinal (Ecological)	Ozone: daily maximum 8-h concentration of ozone(µg/m3)	An IQR increase in ozone concentration was associated with a 2.3% (0.8% to 3.9%) increase in risk of outpatient visits for cardiovascular and cerebrovascular disease.	Lag 0-7 days assessed. Largest effect on lag 4-6 days assessed. There was no statistically significant difference in the association between one IQR increase in ozone concentration and outpatient visits for cardiovascular and cerebrovascular disease by sex or age group.
<i>Gwon et al. 2022 South Korea</i> (310)	Longitudinal (Ecological)	Ozone: long-term average concentration of ozone(ppb)	HR for increased venous thromboembolism associated with ozone = 1.039 (1.026 to 1.053).	Lags not assessed. Subgroup analysis not reported.
<i>He et al. 2021 China</i> (311)	Longitudinal (Ecological)	Ozone: average concentration of ozone (µg/m3)	Excess RR for CVD hospitalizations associated with increased ozone concentration ozone (µg/m3) at = lag 0: -1.12 (-1.69 to -0.55); lag 3: 0.76 (0.18 to 1.35).	Lag 0-3 days assessed. Significant negative association at lag 0 days and significant positive association at lag 3 days assessed. There was a statistically significant excess RR found for age ≥65 years at lag 3 for CVD hospitalizations (excess RR 1.11 [0.19 to 2.03])
<i>Ho et al. 2022 Singapore</i> (312)	Longitudinal (Case-crossover)	Ozone: median (1 st -3 rd quintile) daily ozone levels(µg/m3)	Incidence rate ratio of hemorrhagic stroke associated with ozone exposure in the third	Lag 0-5 days assessed. Lag 1 day and 5 days significant for tertile 3 of ozone exposure

			tertile compared to the first tertile on= day 1: 1.07 (1.02 to 1.12) and day 5: 1.07 (1.02 to 1.13).	compared with tertile 1 (reference). Subgroup analysis not reported.
<i>Ho et al. 2021 Singapore</i> (313)	Longitudinal (Case-crossover)	Ozone: daily mean ambient concentration($\mu\text{g}/\text{m}^3$)	Ozone exposure in the fourth quartile was associated with acute ischemic stroke incidence, IRR compared with the first quartile = 1.05 (1.01 to 1.08).	Lag 0-5 days assessed. The increased incidence of ischemic stroke persisted up to 5 days after exposure to ozone. There was no significant effect modification by age ≥ 65 or smoking status. Stronger association noted in individuals with atrial fibrillation, IRR for fourth quartile compared with first quartile 1.15 (1.09 to 1.21).
<i>Huang et al. 2021 China</i> (314)	Longitudinal (Ecological)	Ozone: daily mean concentration($\mu\text{g}/\text{m}^3$)	In a linear regression model, the incidence of coronary heart disease hospitalization was not associated with ozone levels.	Lags not assessed. Similar findings in younger and older individuals (<65, ≥ 65 years).
<i>Huang et al. 2021 China</i> (315)	Longitudinal (Ecological)	Ozone: daily mean concentration($\mu\text{g}/\text{m}^3$)	OR of birth defects associated with ozone exposure prior to pregnancy= one month prior: 0.94 (0.89 to 1.03); two months prior: 1.02 (0.93 to 1.12); three months prior: 0.96 (0.88 to 1.06). OR of birth defects associated with ozone exposure during pregnancy= first month: 0.83 (0.99 to 1.00); second month: 1.00 (0.99 to 1.05); third month: 1.00 (0.99 to 1.06).	Lags not assessed. Subgroup analysis not reported.

<i>Johnson et al. United States</i> (316)	Cross-Sectional (Ecological)	Ozone: mean and maximum 8-hour ozone exposure within 7 days leading up to VTE diagnosis (ppb)	OR for venous thromboembolism associated with exposure to increased ozone four days prior to event for= 8-hour mean: 0.989 (0.981 to 0.997); 8-hour maximum: 0.992 (0.985 to 0.999).	Lag 0-7 days assessed. Negative association at lag 4 days as reported in the main results. Among individuals with an admission within 30 days, ozone exposure was associated with statistically significant increased risk of venous thromboembolism at lag Days 6 and 7. Gender, age ≥ 65 , and having a surgical procedure within the preceding 30 days did not modify the association between Ozone exposure and venous thromboembolic events.
<i>Kim et al. 2021 South Korea</i> (317)	Cross-Sectional (Ecological)	Ozone: mean daily concentration(ppb) across 365 days	Exposure to ozone (0.01 ppm) for 1 year was associated with an adjusted OR1.53 (1.27 to 1.84) for IHD and exposure for 2 years was associated with an adjusted OR1.70 (1.40 to 2.07) for IHD.	Lags not assessed. Significant association across all age groups, men (but not women), low-income (but not high-income), and urban (but not rural) subgroups.
<i>Klomp maker et al. 2021 United States</i> (318)	Longitudinal (Ecological)	Ozone : annual average zip code concentration	HR for one IQR increase in ozone exposure (4.4 ppb) for hospitalizations for CVD: 0.992 (0.990 to 0.994); coronary heart disease: 0.997 (0.994 to 1.001); cerebrovascular disease: 0.990 (0.988 to 0.993). In the low-exposure group (<40ppb), HR for hospitalization for CVD 1.375 (1.359 to 1.391), coronary heart disease 1.460 (1.437 to 1.482) and	Lags not assessed. Subgroup analysis not reported.

			cerebrovascular disease 1.407 (1.389 to 1.426).	
<i>Le et al. 2022 Vietnam</i> (319)	Longitudinal (Ecological)	Ozone: maximum 8-hour moving average(ppb)	No statistically significant association between concentration of ozone level and CVD hospitalizations.	Lag 0-7 days assessed. No significant association observed. Subgroup analysis not reported.
<i>Lee et al. 2020 South Korea</i> (320)	Longitudinal (Ecological)	Ozone: hourly average concentration levels	Proportional increases in heart failure hospitalizations for each 10-ppb increase in ozone concentration: Lag 0-3: 1.89% (0.11% to 3.70%) Lag 0-4: 2.06% (0.10% to 4.07%) Lag 0-5: 2.03% (0.05% to 4.05%) Lag 0-7: 2.06% (0.02% to 4.13%)	Lag 0-7 days assessed. Largest effect size on lag 0-4 days assessed. Subgroup analysis not reported.
<i>Li et al. 2022 China</i> (321)	Longitudinal (Ecological)	Ozone: daily maximum 8 hour mean ozone concentration(ppb)	Proportional increase in hypertension hospitalizations for every 10 µg/m ³ increase in O ₃ = 2.93% (1.42% to 4.46%) at lag 61 days assessed.	Lags of 56-64 days reported. Significant association at 61 and 62 days assessed. Subgroup analysis not reported.
<i>Liu et al. 2021 China</i> (323)	Longitudinal (Ecological)	Ozone: daily mean concentrations(µg/m ³)	RR of hospitalizations for CVD associated with extremely high ozone concentrations (>99 th percentile) at lag 3 days for= females: 1.13 (1.06 to 1.20); age <60: 1.11 (1.04 to 1.18); age>65: 1.04 (0.99 to 1.10). Low ozone levels were associated with increased risk at day 0, with a maximum RR of 1.07 (1.02 to 1.13) in males and 1.07 (1.01 to 1.13) among	Lag 0-7 days assessed. Low levels of ozone increased CVD risk starting on the day of the exposure (days 0-2) whereas high levels of ozone had the greatest effect on CVD risk on day 3 (days 2-4). Greater effects of high concentration of O ₃ were more pronounced in the young (< 65 years) and female at lag 3 days;

			individuals younger than 65 years.	The effect of low concentration of O ₃ was greater in male and the young (< 65 years) at lag 0 day.
<i>Olaniyan et al. 2021</i> <i>Canada</i> (324)	Longitudinal (Ecological)	Ozone: long-term annual estimate of ambient O ₃ (ppb)	HR for acute MI for each IQR increase in O ₃ exposure = 1.062 (1.041 to 1.084). HR for acute stroke for each IQR increase in O ₃ exposure = 1.055 (1.028 to 1.082).	One-year lag included in the main analysis. HRs for acute MI for each IQR increase in O ₃ exposure were higher for females, age >65, and people from the 4 th income quartile.
<i>Zhang et al. 2020</i> <i>China</i> (325)	Longitudinal (Ecological)	Ozone: maximum daily 8-h average concentrations(μg/m ³)	Significant association between ozone level and risk of transient ischemic attack starting on 1 day after exposure. The association was not significant on day 0 (overall) but was significant on warm days: proportional increase in same day admission for transient ischemic attack associated with a 10 (μg/m ³) increase in ozone on warm days= 0.23% (0.07% to 0.4%).	Lag 0-2 days assessed. Significant associations at lag 1 and 2 days assessed. Null association on day 0 even when stratified by age and sex.
<i>Zhang et al. 2022</i> <i>China</i> (326)	Longitudinal (Ecological)	Ozone: 8-hour maximum average concentrations (μg/m ³)	RR of congenital heart disease associated with an IQR increase in ozone concentrations at 15 weeks of gestation= 1.62 (1.001 to 2.649) at lag 15 weeks.	Lag 0-40 weeks assessed to examine entire pregnancy; results reported in the main analysis. Exposure to Ozone at lag 9–15 weeks was significantly associated with an increased risk of congenital heart disease. Subgroup analysis not reported.

<i>Zhao et al. 2021 China (327)</i>	Cross- Sectional (Ecological)	Ozone: average daily concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in hospitalizations for ischemic stroke associated with an IQR increase in ozone concentrations: single pollutant model without adjustment for meteorological factors = 2.23% (1.56% to 2.90%) on the day of the exposure (lag 0); no significant association in multi-pollutant model after adjustment for meteorological factors.	Lag 0-5 days assessed. Significant association on day 0 and 1, but in cumulative lag models, the effect persists for 5 days assessed. Multivariable model showed similar null association by age group, sex, and insurance status.
<i>Fang et al. 2021 China (328)</i>	Longitudinal (Ecological)	Ozone: average daily concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in atrial fibrillation hospitalization associated with a $10\mu\text{g}/\text{m}^3$ increase in ozone exposure = 1.82% (0.60% to 3.06%). Significant association seen in warm seasons but not cold seasons.	Lag 0-7 days assessed. Significant association noted on single-day lag day 3 and day 4, and cumulative lag 03 to 07 days assessed. In subgroup analyses, significant associations in females, age <70 years.
<i>Fasola et al. 2021 Italy (329)</i>	case-crossover (Ecological)	Ozone: daily mean concentration ($\mu\text{g}/\text{m}^3$)	After adjusting for temperature, ozone exposure was not associated with significant increase in CVD hospitalizations.	Lag 0-6 days assessed. No significant association at any lag. No significant difference was observed in different age groups, genders, smokers, patients with occupational exposures and pre-existent cardiovascular/respiratory disease.
<i>Liu et al. 2021 China (330)</i>	Case- crossover (Ecological)	Ozone: Daily average	Extreme-low ozone was associated with a decreased risk of ischemic stroke among	Lag 0-13 days assessed. Significant associations noted beyond cumulative lags 0-9

		extreme-low(<5 th percentile) and extreme-high(>99 th percentile) concentrations (µg/m ³)	patients with type 2 diabetes: RR = 0.88 (0.78 to 0.98) at lag 0-13 days assessed. Extreme-high ozone was associated with an increased risk of ischemic stroke among patients with type 2 diabetes: RR = 1.33 (1.12 to 1.57) at lag 0-13 days assessed.	days for extreme-low ozone and lags 0-5 days for extreme-high ozone. Extreme-high ozone had similar associations with ischemic stroke mortality by gender but a stronger association in younger adults compared with adults age ≥65 years.
<i>Lozano-Sabido et al. 2021 Mexico</i> (332)	Longitudinal (Ecological)	Ozone: 24h average concentration (µg/m ³)	After adjusting for temperature and atmospheric pressure, ozone exposure was not associated with a significant increase in ST-elevation myocardial infarction.	Lag 0-3 days assessed. No significant association at any lag. Subgroup analysis not reported.
<i>Lu et al. 2022 China</i> (333)	Longitudinal (Ecological)	Ozone: Daily average concentration (µg/m ³)	In winter and spring, the number of CVD hospital visits was inversely correlated to external ozone concentration.	Lags not assessed. Subgroup analysis not reported.
<i>Lu et al. 2021 China</i> (334)	Longitudinal (Ecological)	Ozone: Daily average concentration (µg/m ³)	OR for atrial fibrillation incidence (8 after exposure) = 1.031 (1.014 to 1.049).	Lag 0-13 days assessed. Strongest association at lag 8 days assessed. Subgroup analysis not reported.
<i>Zha et al. 2022 China</i> (335)	Longitudinal (Ecological)	Ozone: 8-h concentration(µg/m ³)	Increased ozone concentrations were associated with lower daily CVD hospital admissions, as well as lower costs and lower lengths of stay for these CVD admissions.	Lag 0-31 days assessed and reported in the main analysis. Subgroup analysis not reported.
<i>Posadas-Sánchez et al. 2022 Mexico</i> (336)	Longitudinal (Ecological)	Ozone: 5-year median concentration (ppb)	OR for premature coronary artery disease associated with a 1 ppb increase in ozone at 1 year = 1.10 (1.03 to 1.18); 2 years = 1.17 (1.05 to 1.30); 3	Lag of 1-5 years assessed and reported in the main analysis. Subgroup analysis not reported.

			years = 1.18 (1.05 to 1.33); 5 years = 1.13 (1.04 to 1.23).	
<i>Sepandi et al. 2021 Iran</i> (337)	Longitudinal (Ecological)	Ozone: Daily mean concentration ($\mu\text{g}/\text{m}^3$)	Ozone had no significant effect on hospital admissions.	Lag 0-14 days assessed. No significant association at any lag. Subgroup analysis not reported.
<i>Shin et al. 2021 Canada</i> (338)	Longitudinal (Ecological)	Ozone: hourly concentration (ppb)	Overall, there was no significant increase in CVD hospitalizations associated with 10-ppb increase in ozone concentrations during the warm or cold seasons. There was a significant increase in non-IHD hospitalizations associated with 10-ppb increase in ozone concentrations during the warm season for males: 1.4% (0.3% to 2.5%), but not for females: 0.0% (-0.8% to 0.7%). There was a significant increase in cerebrovascular disease hospitalizations associated with a 10-ppb increase in ozone concentration during the cold season for females: 2.3% (0.3% to 4.4%), but not for males: -0.2% (-1.6% to 1.3%).	Lag 0-2 days assessed. In subgroup analyses, significant association in the warm season among men for other forms of heart disease (other than IHD) at lag 2 days and cold season among women for cerebrovascular disease at lag 2 days assessed.
<i>Zhang et al. 2021 China</i> (339)	Longitudinal (Ecological)	Ozone: daily mean concentration ($\mu\text{g}/\text{m}^3$)	No significant association between ozone levels and the hazard of heart failure readmission, cardiovascular	Lags not assessed. Hazard ratio for heart failure incidence associated with each 10 $\mu\text{g}/\text{m}^3$ increase in annual

			death, or a composite of both in the overall population.	concentration of O ₃ varied by age: among individuals older than 65 years = 1.060 (1.004 to 1.119; among individuals younger than 65 years = 0.889 (0.824 to 0.960). There were no significant associations between ozone concentration and clinical outcomes among females.
<i>Tang et al. 2020</i> <i>China</i> (340)	Longitudinal (Ecological)	Ozone: daily average concentration (µg/m ³)	Proportional increase in incidence of emergency strokes associated with a 10 µg/m ³ increase in ozone concentration (lag0) = 2.482% (1.044% to 3.919%).	Lag of 0-6 days assessed. In single-day lag models, significant positive association was noted on lag 0, 4, and 5 days, but in cumulative lag models, a significant association was noted for up to 6 days after exposure. There was a 0.77% percent increase in emergency strokes in males compared to females with every 10 µg/m ³ increase of ozone. Patients younger than 60 years had a 1.14% increase in risk. Patients with pre-existing hypertension had a 0.26% higher risk than the group with no pre-existing hypertension.
<i>Ugalde-Resano et al. 2022</i> <i>Mexico</i> (342)	Longitudinal (Ecological)	Ozone: 24-h daily average concentration (µg/m ³)	Proportional increase in cardiovascular emergency department visits associated with a 10 µg/m ³ increase in ozone concentration (Lag0-5) = 1.1% (0.2% to 2.0%).	Lag 0 to 7 days assessed. Significant association at lag 0 days as well as cumulative lag 0-3, 0-4, and 0-5 days assessed.

			Proportional increase in cerebrovascular accidents associated with a 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration = 1.8% (0.3% to 3.4%).	Increase of cardiovascular emergency department visits was greater in the female group with a difference of 0.4% at lag 0, but this was not statistically significant. No significant difference by age-group.
<i>Versaci et al. 2022 Italy (343)</i>	Longitudinal (Ecological)	Ozone: daily average concentration ($\mu\text{g}/\text{m}^3$)	Mean ozone concentrations was significantly associated with overall cerebrovascular events, any stroke, ischemic stroke, and ruptured intracranial aneurysm, but not cerebrovascular dissection or transient ischemic attack	Lags 0-30 days assessed. Strongest associations at lag day 0. Subgroup analysis not reported.
<i>Weng et al. 2021 China (344)</i>	Longitudinal (Ecological)	Ozone : maximum 8-h average concentrations ($\mu\text{g}/\text{m}^3$)	Proportional increase in stroke admissions associated with a 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration = 0.4% (−0.2% to 1.01%).	Lag 0-2 days assessed. No significant association with stroke at any lag. No significant difference was observed in different age groups and gender.
<i>Wolf et al. 2021 Sweden, Denmark, the Netherlands, Germany (345)</i>	Longitudinal (Ecological)	Ozone: mean concentration of warm-season ozone ($\mu\text{g}/\text{m}^3$)	Ozone was not associated with an increase in the incidence of stroke or coronary heart disease.	Lags not assessed. Subgroup analysis not reported.
<i>Xu et al. 2022 China (347)</i>	Longitudinal (case-crossover)	Ozone: 24h average concentrations ($\mu\text{g}/\text{m}^3$)	After adjusting for temperature there was no association found between ozone concentration and recurrent ischemic cerebrovascular events.	Lag 01 day incorporated in the main analysis. Lag 0-3 days assessed. No significant association at any lag. Subgroup analysis not reported.
<i>Zhang et al. 2022 China (350)</i>	Longitudinal (Ecological)	Ozone: 24-h average concentration ($\mu\text{g}/\text{m}^3$)	A small but significant negative association was found between ozone concentration and cardiovascular hospital	Lag 0-5 days assessed. Negative associations noted across all lags tested.

			admissions in both rural and urban areas.	No significant difference was observed in different genders.
<i>Zhang et al. 2021 China</i> (351)	Longitudinal (Ecological)	Ozone: 8-h maximum concentration($\mu\text{g}/\text{m}^3$)	In STEMI survivors, HR for recurrent cardiovascular events associated with short-term fourth quartile exposure of ozone = 5.35 (3.12 to 9.20). HR for long-term exposure of recurrent cardiovascular events associated with ozone = 1.07 (0.80 to 1.42). After multivariable adjustment, exposure to ozone was not associated with an increased risk of recurrent cardiovascular events in STEMI survivors.	Lags not assessed. Subgroup analysis not reported.
<i>Zhao et al. 2022 China</i> (352)	Longitudinal (Ecological)	Ozone: Average hourly concentration ($\mu\text{g}/\text{m}^3$)	In patients with hypertension, proportional increase in stroke hospital admissions associated with a 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration for: lag 0: 0.23% (0.12% to 0.35%); lag 0-1: 0.20% (0.05% to 0.34%).	Lag 0-5 days assessed. Significant association in patients with hypertension on lag 0 days (same day as exposure) and lag 01 day (average on day of exposure and day prior). No significant difference was found in different genders and age groups.
<i>Meng et al. 2022 China</i> (353)	Longitudinal (Ecological)	Ozone: 24-h average concentration ($\mu\text{g}/\text{m}^3$)	RR of hospital admissions associated with a 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentrations for= hypertension: 1.028 (0.982 to 1.077); coronary heart disease:1.051 (0.993 to 1.112),	Lag 0-7 days assessed. No significant association across any lag tested. No statistical differences between gender, age (cutoff

			heart disease: 1.040 (0.994 to 1.089).	65), and blue-collar versus white-collar workers.
<i>Bai et al. 2019 Canada</i> (355)	Longitudinal (Ecological)	Ozone: average of daily 8-hour maximum concentrations (ppb) during the warm season (May through October)	Hazard ratio associated with an interquartile range increase in ozone concentration for incidence of congestive heart failure= 1.03 (1.02 to 1.03) and acute myocardial infarction= 1.04 (1.03 to 1.05).	Lags not assessed. There was no significant difference in results when accounting for age, sex, pre-existing comorbidities, health care acces, or neighborhood demographics.
<i>Cao et al. 2023 China</i> (356)	Longitudinal (Ecological)	Ozone: 8-hour average concentration (µg/ m3)	Proportional increase in hospitalization associated with 10 µg/m3 increase in ozone for CVD = 0.718% (0.156% to 1.284%); hypertension = 0.956% (0. 346% to 1.570%), coronary heart disease = 0.499% (0.057% to 0.943%); cerebrovascular disease = (0.025% to 0.748%); heart failure = 0.907% (0.118% to 1.702%).	Lag 0-14 days assessed. Hospitalizations for CVD were significantly elevated on lag days 5, 7, 9, and 10. No significant differences were found between males and females for the association with high blood pressure, cerebrovascular disease, or heart failure.
<i>Cui et al. 2022 China</i> (359)	Longitudinal (Ecological)	Ozone: 8-h average concentration (µg/ m3)	RR for hospitalization due to ischemic stroke associated with a 10 µg/m3 increase in ozone concentration = 1.006 (0.999 to 1.013).	Lag periods 0-7 days assessed. No significant association at any lag. Effects of ozone on hospitalization was not related to age and gender.
<i>Czernych et al. 2023 Poland</i> (360)	Cross-Sectional (Ecological)	Ozone: daily average concentration (µg/ m3)	RR of stroke for IQR changes in ozone level = 1.00 (0.97 to 1.03); myocardial infarction (MI) = 0.96 (0.92 to 0.99).	Lag periods 0-3 days assessed. No significant association with stroke incidence on any lag day. Ozone has a significant negative association with the incidence of MI on the day of exposure (lag 0 days).

				Significant negative association among women and individuals younger than 65 years.
<i>Dzhambov et al. 2023 Bulgaria</i> (361)	Longitudinal (Case-crossover)	Ozone: hourly concentrations ($\mu\text{g}/\text{m}^3$)	Incidence risk ratio for IHD associated with a $10 \mu\text{g}/\text{m}^3$ increase in ozone = 0.991 (0.982 to 1.001); cerebral infarction = 0.995 (0.985 to 1.004).	Lag periods 0-7 days assessed. Significant association with IHD at lag 7 days assessed. Age ≥ 65 years was associated with increased risk of IHD. Significant association with IHD at lag 7 days in men 65 years of age or older.
<i>Feng et al. 2022 China</i> (362)	Longitudinal (Ecological)	Ozone: 8-h average concentration ($\mu\text{g}/\text{m}^3$)	Proportional increase in coronary heart disease (CHD) associated with $10 \mu\text{g}/\text{m}^3$ increase in ozone = 0.993 (0.988 to 0.999).	Lag periods 0-13 days assessed. Risk of CHD significantly increased on lag 0 and lag 1. Cumulative risk of CHD is significantly increased on lag 0-7. Ozone negatively correlated with the rate of CHD hospitalization in females and people ≥ 65 years of age. The rate of CHD hospitalization among males and people < 65 years were not statistically significant.
<i>Hasnain et al. 2023 Australia</i> (363)	Longitudinal (Ecological)	Ozone: 8-h average concentration (pphm)	Incidence rate ratio of cardiovascular and cerebrovascular hospitalizations associated with a unit increase in ozone = 0.94 (0.89 to 0.98). Incidence rate ratio of CVD hospitalizations associated with	Lag periods 0-5 days were evaluated. The largest effect was observed at lag 0. Subgroup analysis not reported.

			a unit increase in ozone = 0.95 (0.87 to 1.04). Incidence rate ratio of ischemic stroke hospitalizations associated with a unit increase in ozone = 0.99 (0.88 to 1.01).	
<i>Huang et al. 2023 China</i> (365)	Cross-Sectional (Case-Control)	Ozone: hourly concentrations ($\mu\text{g}/\text{m}^3$)	Adjusted OR for congenital heart disease associated with 10 $\mu\text{g}/\text{m}^3$ increase in ozone exposure in the first month of pregnancy = 0.997 (0.981 to 1.014); second month = 1.024 (1.005 to 1.043); third month = 1.012 (0.998 to 1.027).	Lags not assessed. Subgroup analysis not reported.
<i>Jiang et al. 2023 China</i> (366)	Longitudinal (Case-crossover)	Ozone: daily average concentrations ($\mu\text{g}/\text{m}^3$)	No significant association was found between ozone levels and first-ever stroke.	Lag periods 0-7 days assessed. No significant association was seen on any lag day. Significant association between ozone exposure with first-ever stroke was noted in the subpopulation with physical inactivity.
<i>Jiang et al. 2023 China</i> (367)	Longitudinal (Ecological)	Ozone: 8-h maximum 2-day moving average concentration ($\mu\text{g}/\text{m}^3$)	Percent change in hospitalization due to coronary heart disease associated with a 10 $\mu\text{g}/\text{m}^3$ increase in ozone concentration = 0.46% (0.28% to 0.64%); angina pectoris = 0.45% (0.13% to 0.77%); acute myocardial infarction = 0.75% (0.38% to 1.13%); acute coronary syndrome = 0.70% (0.41% to 1.00%); heart failure = 0.50% (0.24% to 0.77%);	Lag periods 0-1 days and lag 01 days (2-day moving average). Main results report lag01 days assessed. Consistent positive associations at all lags noted for coronary heart disease, acute myocardial infarction. Acute coronary syndrome, heart failure, stroke, and ischemic stroke.

			stroke = 0.40% (0.23% to 0.58%); ischemic stroke = 0.41% (0.22% to 0.60%); hemorrhagic stroke = -0.37% (-0.64% to -0.09%).	Similar findings by sex and age group.
<i>Jin et al. 2022 United States</i> (368)	Cross-sectional (Ecological)	Ozone: annual average concentration (ppb)	Hazard ratio for association of 1ppb increase in ozone concentration with: atrial fibrillation hospitalization = 0.9998 (0.9994 to 1.0003); congestive heart failure = 1.0035 (1.0028 to 1.0043); stroke = 1.0026 (1.0019 to 1.0032).	Lags not assessed. Effect modification by race/ethnicity varied based on condition studied.
<i>Keller et al. 2023 Germany</i> (369)	Cross-sectional (Ecological)	Ozone: 5 year average concentration (ppb)	Residence in federal districts with high long-term ozone-concentrations was associated with increased in-hospital case fatality rate for ischemic stroke (OR = 1.123 (1.070 to 1.178)).	Lags not assessed. The association was significant in individuals <70 years as well as ≥70 years, but the magnitude was larger in patients <70 years.
<i>Liang et al. 2023 China</i> (370)	Longitudinal (Ecological)	Ozone: 8-hour average concentration (ppb)	Hazard Ratio for the association of a 10 ppb increase in ozone with incident heart disease = 1.31 (1.22 to 1.42); total CVD = 1.07 (1.02 to 1.13); hypertension = 1.10 (1.03 to 1.18). Population-attributable fraction of heart disease = 13.79% (10.12% to 17.32%); hypertension = 5.11% (1.73% to 8.38%).	Lags not assessed. The magnitude of the association of ozone with incident heart disease was largely similar in males than females.
<i>Li et al. 2023 China</i> (371)	Longitudinal	Ozone: 8-hour maximum concentration (µg/ m3)	OR for association with each IQR (38.6 µg/m3) increase in 2-	Lag 0-7 days assessed. OR for ischemic stroke declined with

	(Case-crossover)		day average of ozone: stroke = 1.006 (0.987 to 1.026); ischemic stroke = 1.017 (95% CI: 1.002 to 1.033); hemorrhagic stroke = 0.970 (95% CI: 0.938 to 1.003).	increasing lag days assessed. Increased OR for hemorrhagic stroke seen with longer periods of exposure. Similar findings when stratified by sex or age group (<65 years vs. ≥65 years)
<i>Liu et al. 2023 China</i> (372)	Longitudinal (Case-crossover)	Ozone: 8-hour maximum concentration (µg/ m3)	Excess risk of ischemic stroke hospital admission associated with 10 µg/ m3 increase in ozone = 0.29% (0.18% to 0.40%).	Lag 0 – lag 03 days (moving average of current and previous 3 days) assessed. Similar findings across all lags assessed. Similar findings by age group and sex.
<i>Li et al. 2023 China</i> (373)	Longitudinal (Case-crossover)	Ozone: mean daily concentration (µg/m3)	Significant increase in total CVD and IHD at lag 6 and 7 days assessed.	Lag 0-7 days and lag 1-7 days assessed. The use of moving averages produced significant negative associations of ozone with CVD across all lags. Subgroup analysis not reported.
<i>Lv et al. 2023 China</i> (374)	Longitudinal (Case-crossover)	Ozone: hourly concentrations (µg/m3)	Percentage excess risk of hospital admission for total stroke associated with an IQR increase in ozone = -1.00 (-2.80 to 0.84); ischemic stroke = -0.77 (-2.66 to 1.17); hemorrhagic stroke = -1.19 (-9.58 to 7.99); undetermined stroke type = -4.38 (-12.27 to 4.22).	Lag periods of 0-2, 3-12, 13-24 and 0-12 hours, and lag 0-2 days assessed. Lag 0-2 hours was used to report main results. No association of ozone levels with stroke risk at any lag. No significant association noted when stratified by sex or age group.
<i>Ma et al. 2022 United States</i> (375)	Cross-Sectional (Ecological)	Ozone: annual average concentration (ppb)	Hazard Ratio for stroke hospitalization associated with	Lag 0-2 years assessed. All lag years showed a positive association with ozone.

			an IQR (6.5ppb) increase in ozone = 1.021 (1.017 to 1.024).	Similar findings when stratified by sex, educational attainment, Medicaid eligibility, and household income. Association larger in age <70 years compared with in age 70 years. and in White individuals compared with Black individuals.
<i>Ma et al. 2023 China</i> (376)	Cross-Sectional (Case-Control)	Ozone: 8-h maximum concentration (µg/ m3)	OR of congenital heart disease varied by lag between 1.163 (1.008 to 1.342) and 1.485 (1.070 to 2.062) for an increase of 10 µg/m3 in gestational exposure to ozone.	Lag 0-56 days (with lag 0 being the date of last menstruation) assessed. Statistically significant associations between congenital heart disease and ozone exposure before lag 10 and after lag 40 days assessed. No association was found between ozone and congenital heart disease in boys.
<i>Mohammadian-Khoshnoud et al. 2023 Iran</i> (377)	Longitudinal (Ecological)	Ozone: 24-hour average concentration (ppb)	A 10 µg/m3 increase in ozone exposure 2 days prior was associated with a 0.09% increase in the risk of myocardial infarction in men, while a 10 µg/m3 increase in ozone exposure 3 days prior was associated with a 0.013% increase in the risk of myocardial infarction in women.	Lag 0-7 days assessed. No significant associations using cumulative lags. Ozone had a significant positive effect on acute myocardial infarction among men and women.
<i>Schwartz et al. 2023 United States</i> (380)	Cross-Sectional (Ecological)	Ozone: annual concentration (ppb)	The study yielded inconsistent findings based on the causal approach used. No significant association between ozone	Lags not assessed. Subgroup analysis not reported.

			concentrations and rates of myocardial infarction in linear regression models (0.06 cases ppb per 10,000 per year [-0.18 to 0.304] or when analyzed using propensity scores 0.01 [-0.2 to 0.2]. However a significant association was noted using negative controls (0.048 [0.017 to 0.079]) and difference-in-differences (0.22 [0.11 to 0.34]).	
<i>Shin et al. 2023 Canada</i> (381)	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration (ppb)	Percent change in risk of circulatory hospitalization per 10ppb increase in ozone = -0.7% (-0.9% to -0.4%).	Lag 0-6 days assessed. Significant associations for both lag 5 and 6 during the cold season.
<i>Salvaraji et al. 2023 Malaysia</i> (379)	Longitudinal (Ecological)	Ozone: mean daily concentration (ppb)	Ozone level was an important predictor of CVD hospitalizations in two of the four districts evaluated.	Lags not assessed. No subgroups evaluated.
<i>Su et al. 2023 China</i> (382)	Longitudinal (Ecological)	Ozone: daily mean concentration (µg/ m3)	Long-term ozone exposure showed a non-linear dose-response relationship with CVD. OR for hypertension & diabetes (5 th quartile of ozone exposure vs 1 st quartile): 1.183(1.057,1.324). Hypertension & Cardio-cerebrovascular diseases = 1.212(1.138,1.29)	Lags not assessed. Magnitude of association is numerically stronger in women compared with men.

			Diabetes & Cardio-cerebrovascular diseases = 1.103(0.908,1.34) Hypertension & Diabetes & Cardio-cerebrovascular diseases 1.32(1.167,1.493).	
<i>Sun et al. 2023 China</i> (383)	Cross-Sectional (Ecological)	Ozone: average 4-month, 8-month, and 1-year concentration (µg/ m3)	In the adjusted model, OR of atrial fibrillation associated with 10 µg/ m3 increase in ozone at lag 4 months = 0.989 (0.968 to 1.010); lag 8 months = 1.006 (0.984 to 1.029); lag 1 year = 0.988 (0.954 to 1.023).	Lag 4 months, 8 months, and 1 year assessed. No significant association of atrial fibrillation with ozone levels at any lag in the adjusted model.
<i>Tan et al. 2022 Singapore</i> (384)	Longitudinal (Ecological)	Ozone: 24-hour daily mean concentration (µg/ m3)	OR for acute ischemic stroke in atrial fibrillation patients associated with 1µg/ m3 increase in ozone = 1.006 (1.003 to 1.008).	Lags not assessed. Higher odds of acute ischemic stroke among atrial fibrillation patients in those aged ≥65 years and non-smokers.
<i>Wei et al. 2023 China</i> (385)	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration (µg/ m3)	RR of acute myocardial infarction hospitalizations associated with 10µg/ m3 increase in ozone at lag 0 = 1.076 (1.043 to 1.111); lag 1 = 1.037 (1.022 to 1.053).	Lag 0-7 days assessed. Statistically significant increase in acute myocardial infarction hospitalization risk seen at lag 0 and lag 1. Association persisted through lag 07 days assessed. Males and younger people (15–64 years) were more susceptible to ozone. The largest effect of ozone on acute myocardial infarction hospitalizations were estimated at lag 03 for males and lag 02 for females.

<i>Wen et al. 2023 China</i> (386)	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	Hazard ratio of CVD per IQR increase in ozone = 4.52 (2.61 to 7.83).	Lag 1, 2 and 3 years assessed. The highest effects of ozone were seen at lag2. Stratified analyses by age group, sex, urbanicity, smoking status, and history of prior CVD demonstrated a significant association between ozone level and CVD in all subgroups, except for the rural subgroup. The estimated HRs of ozone exposure in the subgroup of smokers (HR = 7.39 [2.99 to 6.41]) and individuals aged <65 years (HR = 6.35 [3.35 to 12.03]) were higher than the HR among the overall population.
<i>Zhang et al. 2023 China</i> (387)	Cross- Sectional (Ecological)	Ozone: 3-hour mean, maximum, minimum, and change concentrations ($\mu\text{g}/\text{m}^3$)	Mean ozone concentration had a significant negative association with the risk of acute aortic dissection at lag 0 days: OR 0.9939 (0.9893- 0.9986).	Lag 0-7 days assessed. Significant negative association at lag 0 to lag 7 days assessed. Subgroup analysis not reported.
<i>Yang et al. 2023 China</i> (388)	Longitudinal (Ecological)	Ozone: 8-hour average concentration ($\mu\text{g}/\text{m}^3$)	RR for ischemic stroke hospitalizations associated with 10 ($\mu\text{g}/\text{m}^3$) increase in ozone peaked at lag 4 = 1.046 (1.013 to 1.081); cumulative lag 07 days = 1.110 (1.043 to 1.181).	Lag 0-7 days assessed. Statistically significant associations seen at lag 4 and cumulative lags 0-4, 0-5, 0-6 and 0-7. Older subgroups were more susceptible to the impact of ozone (55-74 or ≥ 75 years) than younger subgroups (<55 years).

<i>Yang et al. 2023</i> <i>China</i> (389)	Cross- Sectional (Ecological)	Ozone: 5-year average ozone ($\mu\text{g}/\text{m}^3$)	OR for CVD associated with 10 ($\mu\text{g}/\text{m}^3$) increase in ozone = 1.15 (1.07 to 1.23); coronary heart disease = 0.93 (0.80 to 1.09); stroke = 1.19 (1.10 to 1.29); myocardial infarction = 0.77 (0.58 to 1.01); hypertension = 1.07 (1.05 to 1.09); dyslipidemia = 1.15 (1.08 to 1.22); hypertriglyceridemia = 1.09 (1.06 to 1.13).	Lags not assessed. People with lower education levels, those over 50 years old, and those with overweight or obesity were more susceptible.
<i>Xu et al. 2022</i> <i>China</i> (390)	Longitudinal (Case- crossover)	Ozone: 8-hour maximum concentration ($\mu\text{g}/\text{m}^3$)	Percent change in odds of readmissions for heart failure associated with IQR increase in ozone = -0.27 (-9.10 to 9.41).	Lag 0-6 days assessed. No significant association at any lag. Subgroup analysis not reported.
<i>Xue et al. 2023</i> <i>China</i> (391)	Longitudinal (Case- crossover)	Ozone: hourly concentrations ($\mu\text{g}/\text{m}^3$)	OR for symptomatic atrial fibrillation associated with 10 $\mu\text{g}/\text{m}^3$ increase in ozone = 0.1 (-0.4 to 0.5); atrial flutter = 0.3 (-1.5 to 2.2); premature beats = 0.1 (-0.6 to 0.7); supraventricular tachycardia = 0.8 (0.2 to 1.4). Percent change in atrial fibrillation onset per IQR increase in concentration of ozone = 0.2 (-1.5 to 1.9); atrial flutter = 1.3 (-6.1 to 9.2); premature beats = 0.2 (-2.4 to 2.8); supraventricular tachycardia = 3.4 (0.7 to 6.1).	Lag 0-3 days assessed. Only significant association was with supraventricular tachycardia at lag 0 days assessed. Stronger association with supraventricular tachycardia in individuals < 65 years of age compared with individuals 65 years or older.

C. Ground-level Ozone: Other Cardiovascular Outcomes.

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Chen et al. 2021 China</i> (300)	Cross- Sectional (Ecological)	Ozone: mean daily concentration (µg/m3)	No significant association between ozone levels and emergency ambulance calls for CVD, with significant heterogeneity among included cities.	Lag 0-5 days assessed. No significant association at any lag
<i>Phosri et al. 2023 Japan</i> (378)	Longitudinal (Ecological)	Ozone: 8-hour maximum concentration (ppb)	RR of emergency ambulance dispatch for cardiovascular illness associated with a 10 ppb increase in ozone concentration on high temperature days (>75th percentile) = 0.19% (- 0.85% to 1.25%); moderate temperature days (25th -75th percentile) = -0.15% (-0.82% to 0.52%); low temperature days (<25th temperature) = -0.20 % (-1.53% to 1.16%).	Lag 0-7 days assessed. Effects of ozone were largest at lag 0 and reported in main results. No significant difference across any lag. Subgroup analysis not reported.

eTable 7. Wildfires. Abbreviations: CVD=Cardiovascular Disease, IHD = Ischemic Heart Disease, OR = Odds Ratio, RR=Relative Risk.

A. Wildfires: Cardiovascular Mortality

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Shaposhnikov et al. 2014 Russia</i> (120)	Cross- Sectional (Ecological)	Heat: Temperature > 98 th percentile Wildfire: 24-hour average ambient PM10 level (µg/m ³)	Extreme Heat + wildfire: RR= 2.29 (2.18 to 2.40) for IHD mortality; 2.37 (2.24 to 2.52) for cerebrovascular disease mortality. Interactions between high temperatures and air pollution from wildfires in excess of an additive effect contributed to more than 2000 deaths.	Lag 0-6 days assessed. Effects were seen among the working age population as well as the older population. Age > 65 years was associated with increased susceptibility to heatwaves.
<i>Vedal et al. 2006 United States</i> (455)	Longitudinal (Ecological)	24-hour average ambient PM level (µg/m ³)	No significant increase in CVD mortality (7.6 CVD deaths /million population vs 7.7 CVD deaths/million population in the reference period).	Lags not assessed. Subgroup analysis not reported.
<i>Johnston et al. 2011 Australia</i> (457)	Longitudinal (Case- Crossover)	24-hour average ambient PM10 level (µg/m ³) from fixed monitoring sites	OR for CVD mortality= 1.06 (0.97 to 1.17) on the day of exposure and 1.07(0.98 to 1.18) on the day after exposure.	Lag 0-3 days assessed. Similar findings on each lag day. Subgroup analysis not reported.
<i>Xi et al. 2020 United States</i> (459)	Longitudinal (Ecological)	Hourly average ambient PM2.5 level (µg/m ³) from the Community Multiscale Air Quality model	Among patients receiving hemodialysis, RR (on the day of exposure) = 1.02 (0.98 to 1.07) for cardiac mortality; 0.96 (0.80 to 1.15) for vascular mortality.	Cumulative lag of 0-30 days assessed. Similar findings in each lag category. Subgroup analysis not reported.

<i>Faustini et al. 2015</i> <i>Spain, France, Italy,</i> <i>Greece (462)</i>	Longitudinal (Case- Crossover)	Satellite measurement of aerosol optical depth for smoke exposure	Proportional increase in CVD mortality (0-5 days after exposure) = 6.29% (1.00% to 11.85%).	Cumulative lag 0-5 days assessed and reported as main results. Subgroup analysis not reported.
<i>Analitis et al. 2012</i> <i>Greece (465)</i>	Longitudinal (Ecological)	Ambient black smoke level ($\mu\text{g}/\text{m}^3$) from fixed monitoring sites	Proportional increase in CVD mortality= -1.9% (-4.7% to 1.0%) for small fire; 6.0% (-0.3% to 12.6% for medium fire; 60.6% (43.1% to 80.3%) for large fire.	Lag of 0-2 days assessed. Association with CVD mortality was higher during the fire that on lag days assessed. Cardiovascular effects of medium-sized fires were larger in those age <75 years.
<i>Kollanuswt al, 2016</i> <i>Finland (473)</i>	Longitudinal (Case- Crossover)	24-hour mean PM _{2.5} level ($\mu\text{g}/\text{m}^3$), long-range	On smoke-affected days, 10 $\mu\text{g}/\text{m}^3$ increase in PM _{2.5} was associated with an 8.0% increase in cardiovascular mortality among total population following same-day exposure (-4.7% to 22.4%) and 12.4% at a lag of three days (-0.2% to 26.5%). Smoke day PM _{2.5} was not associated with hospital admissions due to cardiovascular causes.	Lag of 0-3 days assessed. Association largest on lag day 3 but remains non-significant. On smoke-affected days, 10 $\mu\text{g}/\text{m}^3$ increase in PM _{2.5} was associated with a 13.8% increase in cardiovascular mortality among adults age ≥ 65 years following same-day exposure (-0.6% to 30.4%) and a 11.8% increase at a lag of three days (-2.2% to 27.7%).

<i>Morgan et al. 2010 Australia (480)</i>	Longitudinal (Ecological)	24-hour mean PM10 level attributable to bushfires ($\mu\text{g}/\text{m}^3$)	No consistent association with CVD mortality.	Lag 0-3 days assessed. Similar results across all lag days assessed. No substantial differences by age.
<i>Sastry et al. 2002 Malaysia (485)</i>	Longitudinal (Ecological)	PM10 levels ($\mu\text{g}/\text{m}^3$), visibility (km) associated with Indonesian fires	PM10 levels $>210 \mu\text{g}/\text{m}^3$ was not associated with increased CVD mortality in Kuching (RR=1.548; standard error =0.396) or Kuala Lumpur: (RR= 1.235; standard error= 0.170).	Lags up to “several weeks” tested but lag 1-day results are presented in the main analysis. The results suggest that except in the 65-74year-old age group, the effects of a high air-pollution day are short-lived. In particular, higher mortality one day after a smoke-haze episode is offset by lower mortality on the following day, two days after the initial episode of high air pollution. In Kuala Lumpur, increased PM10 levels were associated with increased CVD mortality for age 65-74. In Kuching, increased PM10 levels were associated with increased CVD mortality for age 75+.
<i>Chen et al. 2021 Canada, China, Colombia, Costa Rica, Czech Republic, Ecuador, Finland, Greece, Iran, Ireland, Japan, Kuwait, Mexico, Norway, Panama, Paraguay, Philippines, Portugal,</i>	Longitudinal (Ecological)	GEOS-Chem (version 12.0.0) model was used to estimate global fire-induced perturbations in PM2.5.	The pooled RRs of mortality associated with each $10 \mu\text{g}/\text{m}^3$ increase in the 3-day moving average (lag 0–2 days) of wildfire-related PM2.5 exposure was 1.017 (1.012 to 1.021) for cardiovascular	Lag 0-7 days assessed. Largest RR on lag day 0 (day of exposure) but significant association persisted through lag day 2. In single-day lag analyses, the association was significant on lag days 3-7.

South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, United Kingdom, United States, Vietnam (497)			mortality. Overall, 0.55% (0.43 to 0.67) of cardiovascular deaths, were annually attributable to the acute impacts of wildfire-related PM25 exposure during the study period.	Subgroup analysis not reported.
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B. Wildfires: Cardiovascular Morbidity

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Mott et al. 2005 Malaysia</i> (454)	Cross-Sectional (Ecological)	Hospital admission in Kuching, Malaysia during August 1 to October 31, 1997, which was defined as the forest fire period	No statistically significant increase in CVD hospitalizations was observed compared to similar time periods in non-forest fire years.	Lags not assessed. Similar findings in stratified analyses by age group (0-18, 19-39, 40-64, 65+).
<i>Hanigan et al. 2008 Australia</i> (456)	Longitudinal (Ecological)	24-hour average ambient PM10 level ($\mu\text{g}/\text{m}^3$) from fixed monitoring sites	No statistically significant change in CVD hospital admissions or IHD admissions.	Lag 0-3 days assessed. similar findings noted. Proportional change in CVD hospital admissions (0-3 days after exposure) = -3.43% (-9.00% to 2.49%) for non-indigenous people; -3.78% (-13.4% to 6.91%) for indigenous people.
<i>Delfino et al. 2009 United States</i> (458)	Longitudinal (Ecological)	24-hour average ambient PM2.5 level ($\mu\text{g}/\text{m}^3$)	Rate ratio for hospitalization (during the wildfire period) = 0.958 (0.920 to 0.997) for all	Lag 0-7 days assessed. Similar findings for CVD across all Lag periods.

			CVD; 0.913 (0.852 to 0.978) for IHD; 0.891 (0.817 to 0.972) for congestive heart failure; 0.968 (0.874 to 1.072) for cardiac dysrhythmia; and 1.066 (0.981 to 1.159). After the wildfire, rate ratio for all CVD hospitalizations = 1.061 (1.006 to 1.119). Effects attenuated by adjustment for PM2.5 levels.	There was a small relative increase in admission rates for total cardiovascular outcomes in people ages 45–99 years in relation to PM2.5 during the fires.
<i>Martin et al. 2013 Australia</i> (460)	Longitudinal (Case-Crossover)	24-hour average ambient PM10 level	OR (day of exposure to severe fire-related air pollution) = 1.01 (0.93 to 1.11) for congestive heart failure hospital admissions in Sydney 0.99 (0.94 to 1.05) for IHD hospital admissions in Sydney 0.99 (0.92 to 1.07) for cerebrovascular disease hospital admissions in Sydney. Similarly, no significant associations were noted between exposure to wildfire smoke and cardiovascular outcomes in Wollongong or Newcastle.	Lag 0-3 days assessed. Similar findings by lag period. Subgroup analysis not reported.
<i>Wettstein et al. 2018 United States</i> (463)	Cross-Sectional (Ecological)	Satellite images used to estimate smoke concentration. Dense smoke days defined as estimated	RR on dense smoke days for individuals age 19 years = 1.08 (1.03 to 1.12) for all-cause cardiovascular emergency department	Lag 0-4 days assessed. Statistically significant increase in CVD emergency room visits were noted with lags 0-3 days assessed.

		smoke density of >22 $\mu\text{g}/\text{m}^3$ of PM _{2.5}	visits, 1.01 (0.86 to 1.19) for IHD emergency department visits, 1.05 (0.83 to 1.32) for myocardial infarction emergency department visits, 1.12 (0.95 to 1.32) for cerebrovascular disease emergency department visits, 1.16 (1.08 to 1.25) for dysrhythmia emergency department visits, 1.09 (1.00 to 1.19) for congestive heart failure emergency department visits.	Numerically larger associations between wildfire smoke exposure and outcomes were noted among adults age ≥ 65 years. For instance, dense smoke was associated with a RR of 1.15 (1.09 to 1.22) for all-cause cardiovascular emergency department visits in adults age ≥ 65 years, compared with 1.03 (0.96 – 1.10) in adults age 45-64 years.
<i>Casey et al. 2021 United States</i> (464)	Longitudinal (Ecological)	Daily average ambient PM _{2.5} level ($\mu\text{g}/\text{m}^3$) from USEPA	Proportional change in CVD emergency department visits = -18.2% (-39.4% to 2.9%).	Lags not assessed. Subgroup analysis not reported.
<i>Lee et al. 2009 United States</i> (466)	Longitudinal (Ecological)	Hourly average of ambient PM ₁₀ level ($\mu\text{g}/\text{m}^3$) from fixed monitoring sites	Association between CVD clinic visits and natural log of adjusted PM ₁₀ levels, OR = 1.13 (0.94 to 1.37) for Hoopa Valley residents. Association between coronary artery disease clinic visits and natural log of adjusted PM ₁₀ levels, OR = 1.48 (1.11 to 1.97) for Hoopa Valley residents.	Lags not assessed. Larger association in adults age 50 years and over but no differences by sex.
<i>Johnston et al. 2007 Australia</i> (467)	Longitudinal (Case-Crossover)	24-hour average ambient PM ₁₀ level ($\mu\text{g}/\text{m}^3$) from fixed monitoring sites	No association between cardiovascular admissions in total and same day PM ₁₀ .	Lag 0-3 days assessed. Similar overall findings by lag day. OR for IHD hospital admissions = 0.75 (0.61 to 0.93) for non-

				indigenous people (day of exposure); 1.71 (1.14 to 2.55) for indigenous people (lag of 3 days after exposure). Association with IHD among indigenous populations on day 3 after exposure may be a spurious finding given overall negative results.
<i>Evans et al. 2017 United States (468)</i>	Longitudinal (Case-Crossover)	Hourly average ambient aerosol optical properties, black carbon, and PM2.5 level ($\mu\text{g}/\text{m}^3$)	Increases in markers of wood smoke and black carbon concentrations were not associated with increases in the relative odds of STEMI over any of the time lags examined. OR for ST-segment elevation myocardial infarction incidence per interquartile range of PM2.5 exposure = 1.17 (0.99 to 1.39).	Lag 1-72 hours assessed. Similar findings across all lag intervals. No significant differences by season, age, sex, race, smoking status, prior CVD, diabetes, hypertension, diabetes, or dyslipidemia were noted.
<i>Crabbe et al. 2012 Australia (469)</i>	Longitudinal (Ecological)	24-hour average ambient PM10 level ($\mu\text{g}/\text{m}^3$)	RR for CVD hospitalization = 1.020 (0.997 to 1.043).	Lag of 0-3 days assessed. No significant differences by lag. Subgroup analysis not reported.
<i>Rappold et al. 2011 United States (470)</i>	Cross-Sectional (Ecological)	Satellite measurement of aerosol optical depth as smoke exposure	RR= 1.13 (0.95 to 1.37) for all CVD related emergency department visits; 1.37 (1.01 to 1.85) for heart failure emergency department visits; 1.39 (0.75 to 2.57) for myocardial infarction emergency department visits; 0.79 (0.57 to 1.1) for	Lag 0-5 days assessed. In the exposed counties, RR for heart failure-related emergency department visits during the 3 high-exposure days and 5 subsequent lag days was increased compared with other days assessed. No differences by age or sex.

			cardiac dysrhythmia emergency department visit.	
<i>Resnick et al. 2015 United States (471)</i>	Cross- Sectional (Ecological)	24-hour average PM2.5 level ($\mu\text{g}/\text{m}^3$)	During the Wallow fire, there was a numerical increase in emergency department visits in Albuquerque, but this did not reach statistical significance. RR= 1.17 (0.89 to 1.55) for IHD; 1.08 (1.00 to 1.16) for CVD; and 1.13 (0.79 to 1.61) for cerebrovascular disease.	Lags not assessed. Examined acute exposure (known dates of the wildfire) and postacute exposure period. Similar findings across both periods. Similar findings across age groups.
<i>Alman et al. 2016 United States (472)</i>	Longitudinal (Case- Crossover)	24-hour mean PM2.5 level ($\mu\text{g}/\text{m}^3$)	OR = 1.00 (0.96 to 1.05) for emergency department visits for acute myocardial infarction; 1.01 (0.98 to 1.05) for IHD; 0.97 (0.93 to 1.02) for dysrhythmia; 0.93 (0.86 to 1.00) for heart failure; 0.99 (0.95 to 1.04) for ischemic stroke; and 0.98 (0.96 to 1.01) for CVD.	Lag of 0-2 days assessed. Similar findings across lag periods. Subgroup analysis not reported.
<i>Kollanuswt al, 2016 Finland (473)</i>	Longitudinal (Case- Crossover)	24-hour mean PM2.5 level ($\mu\text{g}/\text{m}^3$), long-range	On smoke-affected days, 10 $\mu\text{g}/\text{m}^3$ increase in PM _{2.5} was associated with an 8.0% increase in cardiovascular mortality among total population following same-day exposure (-4.7% to 22.4%) and 12.4% at a lag of three days (-0.2% to 26.5%). Smoke day PM _{2.5} was not	Lag of 0-3 days assessed. Association largest on lag day 3 but remains non-significant. On smoke-affected days, 10 $\mu\text{g}/\text{m}^3$ increase in PM _{2.5} was associated with a 13.8% increase in cardiovascular mortality among adults age ≥ 65 years following same-day exposure (-0.6% to

			associated with hospital admissions due to cardiovascular causes.	30.4%) and a 11.8% increase at a lag of three days (−2.2% to 27.7%).
<i>Liu et al. 2017 United States (474)</i>	Longitudinal (Ecological)	Wildfire-specific PM2.5 level ($\mu\text{g}/\text{m}^3$)	Wildfire-specific increases in PM2.5 levels were not associated with a statistically significant increase in CVD hospitalizations.	Lags not assessed. Subgroup analysis not reported.
<i>Tinling et al. 2016 United States (475)</i>	Cross-Sectional (Ecological)	Peat wildfire-specific PM2.5 level ($\mu\text{g}/\text{m}^3$)	RR = 1.05 (1.00 to 1.09) for emergency department visits for hypertension; 1.07 (0.99 to 1.15) for cardiac dysrhythmia; and 1.06 (1.00 to 1.13) for all-CVD emergency department visits.	Lag 0-2 days assessed. Consistent associations across all age-groups studied (albeit numerically larger among older adults). Counties with lower levels of poverty had more smoke days assessed.
<i>Le et al. 2014 United States (476)</i>	Longitudinal (Ecological)	24-hour mean PM2.5 level ($\mu\text{g}/\text{m}^3$), long-range	Compared with the non-haze period, this Medicare population had a 64.93% (44.30% to 88.51%) increased rate of CVD hospitalizations during the haze period compared to the non-haze period.	Lag of 0-2 days assessed. Statistically significant association noted for each lag day (day 0, 1, and 2), but numerically largest association noted with lag 0. Subgroup analysis not reported.

<i>Parthum et al. 2017 United States</i> (477)	Longitudinal (Ecological)	Aerosol optical depth (from satellite imagery)	RR = 1.37 (1.01 to 1.85) for emergency department visits for heart failure.	Lag 0-5 days assessed. Subgroup analysis not reported.
<i>Henderson et al. 2011 Canada</i> (478)	Longitudinal (Ecological)	Total and wildfire-specific 24-hour mean PM10 level($\mu\text{g}/\text{m}^3$), smoke exposure metric for plumes visible in satellite data	No statistically significant association between any measures of fire exposure and cardiovascular physician visits or hospital admissions.	Lag 0-7 days tested, but only lag 0 results reported. Some differences in risk by age groups, but association largely null. No clear differences by sex or socioeconomic level.
<i>Moore et al. 2006 Canada</i> (479)	Longitudinal (Ecological)	24-hour mean PM2.5 and PM10 levels ($\mu\text{g}/\text{m}^3$)	No statistically significant change in physician visits for CVD in two communities.	Lags not assessed. Subgroup analysis not reported.
<i>Morgan et al. 2010 Australia</i> (480)	Longitudinal (Ecological)	24-hour mean PM10 level attributable to bushfires ($\mu\text{g}/\text{m}^3$)	No consistent associations with admissions for all CVD or IHD.	Lag 0-3 days assessed. Similar results across all lag days assessed. No substantial differences by age.
<i>Yao et al. 2016 Canada</i> (481)	Longitudinal (Ecological)	Modeled daily PM2.5 levels attributable to forest fire smoke	No consistent associations except on extreme fire days: When local sum of fire-radiative power was in the 90 th percentile, a 10 $\mu\text{g}/\text{m}^3$ increase in modeled PM _{2.5} was associated with a 3% increase in nitroglycerin dispensations and a 1% increase in all cardiovascular physician visits.	Lag of 0-1 day assessed. Subgroup analysis not reported.

Dennekamp et al. 2015 Australia (482)	Longitudinal (Case- Crossover)	24-hour mean PM2.5 and PM10 levels ($\mu\text{g}/\text{m}^3$).	During the fire season, no significant association was noted between out-of- hospital cardiac arrests and lag 0 PM2.5 (1.3% increase per interquartile range increase in PM2.5; -1.0 to 3.8%; interquartile range = 6.1 $\mu\text{g}/\text{m}^3$) or lag 0 PM ₁₀ (0.2% decrease per interquartile range increase in PM10; -4.1 to 3.8%; interquartile range = 13.7 $\mu\text{g}/\text{m}^3$).	Lag 0-48 hours assessed. During the fire season, an association was noted between out-of-hospital cardiac arrests and 48-hr lagged PM2.5 (4.4% increase per interquartile range increase in PM2.5; 0.2 to 8.7%) but not 48-hr lagged PM ₁₀ (4.0% increase per interquartile range increase in PM10; -2.4 to 10.8%). In men, out-of-hospital cardiac arrest was associated with increases in 48-hr lagged PM2.5 (8.05% increase per interquartile range increase in PM2.5; 2.30 to 14.13%) or 48-hr lagged PM ₁₀ (11.1% increase per interquartile range increase in PM10; 1.55 to 21.48%). There was no significant association between the rate of out-of-hospital cardiac arrest and air pollutants among women.
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<i>Haikerwal et al. 2015 Australia (483)</i>	Longitudinal (Case- Crossover)	24-hour mean PM2.5 level ($\mu\text{g}/\text{m}^3$)	An increase in interquartile range of $9.04 \mu\text{g}/\text{m}^3$ in PM2.5 over 2 days (i.e., lag 0-1 days) moving average was associated with a 6.98% (1.03% to 13.29%) increase in risk of out-of-hospital cardiac arrests, 2.07% increased risk of IHD-related emergency department attendance (0.09% to 4.09%), and 1.86% increase in IHD-related hospital admissions at lag 2 days (0.35% to 3.4%).	Lag of 0-2 days assessed. Increase in risk was (2.07%, 95% CI 0.09% to 4.09%) for IHD-related emergency department attendance and (1.86%, 95% CI: 0.35% to 3.4%) for IHD-related hospital admissions at lag 2 days assessed. Strong association between increased PM2.5 over 2 days moving average with out-of-hospital cardiac arrests in men (9.05% increase, 1.63% to 17.02%) and adults age ≥ 65 years (7.25% increase, 0.24% to 14.75%). Increase in IHD-related emergency department attendance and IHD-related hospital admissions at lag 2 days greater in women and adults age ≥ 65 years
<i>Reid et al. 2016 United States (484)</i>	Cross- Sectional (Ecological)	2-day rolling average of PM2.5 level ($\mu\text{g}/\text{m}^3$) before, during, and after the wildfire	No statistically significant association between increase in PM2.5 during the fire and emergency department visits for cardiovascular conditions (all CVD, heart failure, IHD, hypertension, dysrhythmias, cerebrovascular disease).	Lag of 0-28 days were tested, but only results of lag 1-2 are reported. In subgroup analyses, decreased emergency department visits for heart failure noted in individuals age 65 year or older and increased emergency department visits for hypertension noted in women.

<i>Stowell et al. 2019 United States (486)</i>	Longitudinal (Case-Crossover)	2-day average of fire smoke PM2.5 levels	No statistically significant association between fire smoke PM2.5 levels and hospitalization or emergency room visits for cardiovascular outcomes (all cardiovascular causes, acute myocardial infarction, IHD, heart failure, dysrhythmia, peripheral vascular disease/cerebrovascular disease).	Lag 0-7 days assessed; 2-day lag included in the main analysis. Similar results to the main analysis. No statistically significant association between fire smoke PM2.5 levels and hospitalization or emergency room visits for cardiovascular outcomes when stratified by age or sex
<i>Mueller et al. 2020 Thailand (487)</i>	Longitudinal (Ecological)	Ambient air pollutant data (PM10, PM2.5, carbon monoxide, ozone, nitrogen dioxide)	Elevated PM10 was associated with increased outpatient visits on the same day as exposure for cerebrovascular disease (incident rate ratio = 1.020, 1.004 to 1.035) but not IHD (Incident rate ratio = 0.994; 0.974 to 1.014). Adjusting for carbon monoxide tended to increase effect estimates. However, no evidence of an exposure response relationship with levels of PM ₁₀ on days of biomass burning.	Lag of 0-5 days assessed. No differences by lag day for IHD, but the magnitude of the association between outpatient visits for cerebrovascular disease and PM10 was greatest on day 0 (same day as exposure). When stratified by sex, association between PM10 levels and cerebrovascular disease was statistically significant in men but not in women.

<i>DeFlorio-Barker et al. 2019</i> <i>United States (488)</i>	Longitudinal (Ecological)	Modeled wildfire specific PM2.5 levels in counties within 200km of large wildfires	Among older adults, exposure to PM2.5 was associated with a proportional increase of 0.61% (0.09 to 1.14) on smoke days and 0.69% (0.19 to 1.2) on non-smoke days for cardiovascular hospitalization on the day after the exposure.	Lag 0-6 days assessed. A consistent percentage increase in cardiovascular hospitalizations was present through lag of 6 days on both smoke and non-smoke days assessed. Subgroup analysis not reported.
<i>Hutchinson et al. 2018</i> <i>United States (489)</i>	Longitudinal (Case-Crossover)	Dates of wildfires in San Diego in October 2007	RRs for cardiovascular conditions among Medi-Cal beneficiaries tended towards null, although an increase was observed in outpatient visits on days 6-10 of the fire. Nominal increase in emergency department presentations and inpatient hospitalizations included dysrhythmia and stroke.	Lagged effects (post-exposure) estimated for 3 weeks after fire. Similar (null) findings in the post-exposure periods. Similar findings by age group.

<i>Jones et al. 2020 United States (490)</i>	Longitudinal (Case- Crossover)	Wildfire smoke density (light, medium, heavy smoke) from the National Oceanic Atmospheric Association's Hazard Mapping System	Out-of-hospital cardiac arrest risk increased with heavy smoke: lag 0 OR = 1.56 (1.05 to 2.33).	Lag 0-3 days assessed. Out-of-hospital cardiac arrest risk increased with heavy smoke on lag day 2 (OR, 1.70; 1.18 to 2.13) and lag day 3 (OR, 1.48; 1.02 to 2.13). Both sexes and age groups 35 years and older were impacted on days with heavy smoke. Risk in individuals with lower socioeconomic level was elevated on medium and heavy days, although not statistically significant. Higher socioeconomic level was associated with elevated odds ratios with heavy smoke but null results with light and medium smoke
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<i>Miller et al. 2017</i> <i>United States (491)</i>	Longitudinal (Ecological)	Satellite maps of smoke plumes from the National Oceanic and Atmospheric Administration's Hazard Mapping System	Among fee-for-service Medicare beneficiaries, exposure to wildfire smoke resulted in increased emergency room visits for circulatory conditions (1.131 additional visits per million, standard error 0.263), IHD (0.189 additional visits per million, standard error 0.085), heart failure (0.184 additional visits per million, standard error 0.110), and cerebrovascular events (0.357 additional visits per million, standard error 0.109) but not emergency room visits for heart rhythm disturbance or peripheral vascular disease. Among fee-for-service Medicare beneficiaries, exposure to wildfire smoke resulted in increased hospitalizations for circulatory conditions (1.805 additional hospitalizations per million, standard error 0.290), IHD (0.185 additional hospitalizations per million, standard error 0.093), heart failure (0.296 additional hospitalizations per million,	Lags of days -0-6 assessed. Magnitude of association is greatest on the day of smoke exposure (lag 0) and in the 2 days that follow. Smoke exposure was associated with larger increases in emergency room use in poorer areas.
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			standard error 0.123), and cerebrovascular events (0.528 additional hospitalizations per million, standard error 0.116) but not hospitalizations for heart rhythm disturbance or peripheral vascular disease.	
<i>Johnston et al. 2014. Australia (492)</i>	Longitudinal (Case-Crossover)	Average daily PM10 or PM2.5 levels, with a smoke day defined as levels exceeding the 99 th percentile	On the day of the exposure (i.e., lag 0), there was no statistically significant association between smoke events and emergency department visits for CVD (OR 1.00; 0.96 to 1.04). Smoke exposure was associated with a 2-day lagged increase in emergency department attendances for IHD (OR = 1.07; 1.00 to 1.15). A protective effect was noted for arrhythmias on the day after the exposure (OR = 0.91; 0.83 to 0.99), which was interpreted as a chance finding or possibly due to increased pre-hospital events. Smoke exposure was associated with increased heart failure visits in the 15-64 year-olds (OR=1.37; 1.05 to 1.78) on lag day 2.	Lag 0-3 days assessed. IHD emergency department attendances were increased at a lag of two days (OR, 1.07; 1.01 to 1.15) while arrhythmias had an inverse association at a lag of two days (OR, 0.91; 0.83 ro 0.99). Findings were inconsistent among various cardiovascular endpoints and lag periods. Some differences in cardiovascular outcomes by age, but findings were not consistent across endpoints.

<i>Nguyen et al. 2021 Australia (493)</i>	Cross-sectional (Ecological)	Ground concentration of smoke (µg/m ³) from monitoring stations	Excess CVD hospitalizations associated with wildfire exposure= 437 (81 to 984).	Lags not assessed. Subgroup analysis not reported.
<i>Ye et al. 2021 Brazil (494)</i>	Longitudinal (Ecological)	Wildfire-related PM _{2.5} (µg/m ³)	Proportional increase in CVD hospitalizations associated with a 10 µg/m ³ increase in wildfire related PM _{2.5} 0-1 days after exposure=1.10% (0.78% to 1.42%). Annual attributable rate of 3 (2 to 3) CVD hospitalizations per 100,000.	Lag 0-5 days assessed. Significant increase in CVD hospitalizations on lag days 0-1 and 0-2, but not 0-3. Similar findings in men and women. Magnitude of the association is greater in adults ages 60 years or older compared with those 59 years and younger.
<i>Wen et al. 2021 Australia (495)</i>	Longitudinal (Ecological)	Emergency department visits in areas of New South Wales exposed to bushfires	Proportional increase in CVD emergency department visits associated with bushfire exposure in 2019-2020= 10.0% (5.0% to 15.2%).	Lags not assessed. Similar findings in low and high socioeconomic level strata.
<i>Ong et al. 2023 Australia (496)</i>	Longitudinal (Ecological)	Residing within 200 km of a known active bushfire	Presence of bushfires was associated with a trend (P = .091) toward an increase in daily frequency of acute coronary syndrome admissions. The combination of greater than mean temperature, PM _{2.5} concentration, and presence of a bushfire within 200 km doubles the risk of acute coronary syndromes, but the risk of Takotsubo syndrome is unchanged.	Lags not assessed. Subgroup analysis not reported.

C. Wildfires: Other Cardiovascular Outcomes

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
Salimi et al. 2017 Australia (461)	Longitudinal (Ecological)	Hourly average ambient PM2.5 level (µg/m ³) from fixed monitoring sites	RR for ambulance dispatches (0-1 day after exposure) = 1.05 (1.01 to 1.09) for other heart problem; 1.03 (1.00 to 1.06) for cardiac arrest.	Lag of 0-2 days assessed. An association between lag2 of PM2.5 and ambulance dispatches for other heart problems was also observed (RR = 1.02, 95% CI 1.00 to 1.03). Subgroup analysis not reported.

eTable 8. Extreme Weather: Hurricanes/Tropical Storms. Abbreviations: CVD=Cardiovascular Disease, IHD = Ischemic Heart Disease, RR=Relative Risk.

A. Hurricanes/Tropical Storms: Cardiovascular Mortality

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Kim et al. 2017 United States</i> (401)	Longitudinal (Ecological)	Dates of landfall of Hurricane Sandy	Adjusted RR of CVD mortality= 1.06 (1.00 to 1.13) for the month following Hurricane Sandy and 1.06 (1.02 to 1.10) during the three months after the event.	Lag not assessed but follow-up included three months after landfall. Age > 76 years was associated with greater risk.
<i>McKinney et al. 2011 United States</i> (402)	Cross-Sectional (Ecological)	2004 Atlantic Hurricane Season	34% of deaths attributable to the hurricane were due to CVD.	Lag not assessed but follow-up typically included several months after landfall. Subgroup analysis not reported.
<i>Cruz-Cano et al. 2019 Puerto Rico, United States</i> (405)	Cross-Sectional (Ecological)	Dates of landfall of Hurricane Maria	CVD was the leading cause of excess mortality and accounted for 21% of the excess deaths (253 out of 1205).	Lags not assessed. Excess deaths were slightly higher among men than women (632 and 579 deaths, respectively) and found only among people aged 60 years or older (1038 deaths).
<i>Edmondson et al. 2013 United States</i> (412)	Cross-Sectional (Ecological)	Dates of landfall of Hurricane Katrina	Hazard ratio for CVD hospitalization or mortality among end stage renal disease patients with and without post-traumatic stress disorder=1.14 (0.83 to 1.57)	Lag not assessed but follow-up of 3.5 years. Subgroup analysis not reported.

			Hazard ratio for CVD hospitalization or mortality among end stage renal disease patients with and without depression = 1.33 (1.01 to 1.76).	
<i>Parks et al. 2022 United States (443)</i>	Longitudinal (Ecological)	Tropical cyclone days per county-month, defined as number of days in a month with a sustained maximal wind speed 34 knots or greater	Each additional cyclone day increased 30-day CVD by 1.2% (0.6% to 1.7%), which translated to 1.5 (0.8 to 2.2) increase in age standardized median death rate for the month following the event.	Lag of 0-6 months assessed. Statistically significant increase in CVD death for lags 0 and 1 month after a hurricane and lags 0-3 months after a tropical cyclone. When stratified by age group, effect on CVD death significant for lags 0-3 months in adults 65 years older but not in younger adults. Similar findings among men and women with some differences over the lag period.
<i>Lukowsky et al. 2022 United States (446)</i>	Longitudinal (Ecological)	Patients who were recorded as having at least one hemodialysis encounter in Puerto Rico or the U.S. Virgin islands in the year before and year after the 2017 Hurricane season (September 2016-September 2018)	OR for heart failure mortality among individuals with end stage renal disease on hemodialysis during Hurricanes Maria and Irma compared with non-hurricane periods = 2.07 (1.26 to 3.40).	Lags not assessed. Subgroup analysis not reported.
<i>McCann et al. 2023 United States(452)</i>	Longitudinal (Ecological)	All counties that received a major disaster declaration due to Hurricane Matthew were included; counties that received public and	Mean levels of CVD mortality increased in both low-damage counties (adjusted mean = 2.50,	Lags not assessed. Among the different social capital dimensions, the overall effects of social capital and its

		individual assistance were classified as “high-damage,” counties receiving public assistance only were classified as “low-damage”, and counties that did not receive any disaster relief as “no damage”	[2.40 to 2.72]) and high-damage counties (adjusted mean = 2.51, [2.49 to 2.84]).	sub-indices were largely nonsignificant.
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B. Hurricanes/Tropical Storms: Cardiovascular Morbidity

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Becquart et al. 2019 United States</i> (400)	Longitudinal (Ecological)	Hurricane: Individuals admitted to hospitals in the study area during the study period	In Orleans parish, CVD hospitalizations increased from 7.25 (SD 2.44) per 10,000 older adults in the baseline period to 18.46 (SD 17.3) in the week after landfall and remained elevated for 5 weeks after landfall.	Lag not directly assessed, but follow-up included approximately 3.5 months after landfall. Black older adults were more susceptible to the increased risk of CVD hospitalization than white older adults. In Orleans parish, CVD hospitalization rates per 10,000 older adults increased from 7.37 (SD 2.70) in the baseline period to 26.29 (SD 23.7) in the week after landfall in Black adults, and from 7.09 (SD 2.83) to 16.56 (SD 11.7) in white adults over the same period. Statistically significant increases persisted up to 5

				weeks after landfall in both groups.
<i>Swerdel et al. 2020</i> <i>United States</i> (403)	Cross-Sectional (Ecological)	Hurricane: individuals admitted to hospitals in the study area during the event	In high-impact areas of New Jersey, attributable rate ratio= 1.22 (1.16 to 1.28) for myocardial infarction hospital admission; 1.31 (1.22 to 1.41) for 30-day myocardial infarction mortality; 1.07 (1.03 to 1.11) for stroke hospital admission; 1.10 (0.99 to 1.21) for 30-day stroke mortality; 0.92 (0.90 to 0.95) for CVD hospital admission; 1.22 (1.15 to 1.30) for 30-day CVD mortality. No changes observed in low-impact areas of New Jersey.	Lag not assessed but follow-up included 2 weeks after landfall. Subgroup analysis not reported.
<i>Lenane et al. 2019</i> <i>United States</i> (404)	Longitudinal (Ecological)	Hurricane: individuals in the study area during and 24 months after the event	Hazard ratio for CVD event in individuals with post-traumatic stress disorder symptoms = 1.7 (1.1 to 2.6).	Lag not assessed, but 3.8 year of follow-up after landfall. Compared with those without PTSD symptoms, the HR for incident CVD outcome associated with PTSD symptoms was 4.8 (2.2 to 10.7) among Black individuals and 2.3 (1.0 to 5.3) among white individuals.
<i>Lawrence et al. 2019</i> <i>United States</i> (406)	Longitudinal (Ecological)	Hurricane: individuals in the study area during and after 12 months of the event	Risk ratio for CVD morbidity= 2.65 (2.64 to 2.66) during Hurricane Sandy; 2.62 (2.62 to 2.63) 4-month after	Lag not assessed, but follow-up included 12 months after landfall.

			Hurricane Sandy; 2.64 (2.64 to 2.65) 12-month after Hurricane Sandy.	Larger increase in women than in men, and decreases in Black and other racial groups compared with white populations.
<i>Jiao et al. 2012</i> <i>United States</i> (407)	Longitudinal (Ecological)	Hurricane: individuals admitted with acute myocardial infarction to Tulane University Hospital in the 2 years before Katrina and the 3 years after the hospital reopened	The mean age of onset of acute myocardial infarction decreased from 62 years before Katrina to 59 years after Katrina ($p<0.05$).	Lag not assessed, but follow-up included 3.5 years after landfall. Subgroup analysis not reported.
<i>Peters et al. 2014</i> <i>United States</i> (408)	Longitudinal (Ecological)	Hurricane: individuals admitted to Tulane University Health Sciences Center before and after Hurricane Katrina (August 29, 1999, to August 28, 2005; February 14, 2006, to February 13, 2012)	Acute myocardial infarction admission increased from 0.7% of total admissions to 2.4% of total admissions ($p<0.001$).	Lag not assessed, but follow-up included 6 years after landfall. Subgroup analysis not reported.
<i>Lee et al. 2016</i> <i>United States</i> (409)	Cross-Sectional (Ecological)	Hurricane: individuals lived in the most geographically vulnerable areas during and 1 week after the event	The number of myocardial infarction emergency department visits in patients with diabetes increased from 4 to 12 cases in level 1 evacuation zone.	Lag not assessed. Subgroup analysis not reported.
<i>Hua et al. 2021</i> <i>United States</i> (410)	Cross-Sectional (Ecological)	Hurricane: residency during the event	Unlike in the year prior to the event, hypertensive heart disease with heart failure was a top 10 indication for emergency department visits in the year of Hurricane Irma.	Lags not assessed. Subgroup analysis not reported.
<i>Yan et al. 2021</i> <i>United States</i> (411)	Cross-Sectional (Ecological)	Tropical cyclone: residency in a county during a storm with peak sustained	Over the entire duration of the storm, RR= 1.05 (1.00 to 1.10) for acute myocardial	Lag -2 to 7 days assessed.

		winds >21m/s at the county center	infarction hospitalization; 1.03 (1.00 to 1.06) for IHD hospitalization; 1.08 (1.04 to 1.11) for heart failure hospitalization; 1.00 (0.96 to 1.03) for cerebrovascular hospitalization; 1.03 (1.02 to 1.05) for CVD hospitalization.	Cardiovascular hospitalizations were 6% lower (RR, 0.94; 0.89 to 0.98) on the day of a storm's closest approach compared to matched unexposed days among Medicare beneficiaries in the study counties. Following the storm, cardiovascular hospitalization risks were elevated compared to matched unexposed days, with highest risks 2–3 days post-storm (RR at lag 2, 1.12; 1.07 to 1.16 and RR at lag 3, 1.08; 1.04 to 1.13). Subgroup analysis not reported.
<i>Edmondson et al. 2013 United States (412)</i>	Cross-Sectional (Ecological)	Hurricane: Individuals who received hemodialysis for end-stage renal disease at these facilities during the week before the landfall caused by Hurricane Katrina who were alive at the start of the study and completed baseline survey	Hazard ratio for CVD hospitalization or mortality among end stage renal disease patients with and without post-traumatic stress disorder=1.14 (0.83 to 1.57). Hazard ratio for CVD hospitalization or mortality among end stage renal disease patients with and without depression = 1.33 (1.01 to 1.76).	Lag not assessed but follow-up of 3.5 years. Subgroup analysis not reported.
<i>Gautam et al. 2009 United States (413)</i>	Longitudinal (Ecological)	Hurricane: individuals admitted with acute myocardial infarction to Tulane Health Sciences	The exposed group had a higher percent of acute myocardial infarction admissions than the	Lag not assessed, but follow-up included approximately 2.5 years after landfall.

		Center hospital 2 years before and after Hurricane Katrina	unexposed group (2.18% vs 0.71%; $p < 0.0001$).	Subgroup analysis not reported.
<i>Komatsu et al. 2022 Japan</i> (441)	Cross-sectional (Ecological)	Typhoon: patients living in the flooded district before versus after Typhoon Hagibis	The number of patients with unstable angina pectoris was significantly higher in 2019 ($n = 4$) than in 2017 and 2018 ($n = 0$) ($p = 0.001$), but no significant differences were noted to for other CVD outcomes (including cardiac death, total CVD, heart failure, acute myocardial infarction, atrial fibrillation, and total cerebrovascular disease).	Lags not assessed. Subgroup analysis not reported.
<i>Sunohara et al. 2021 Japan</i> (445)	Longitudinal (Ecological)	Flood disaster following Typhoon Reiwa (Nagano City, Japan)	Cardiovascular or cerebrovascular diseases admissions increased significantly during the 2 weeks immediately after the flood disaster. Unstable angina admissions significantly increased 1.5 to 2 months after the flood disaster. Cerebral hemorrhage admissions increased significantly during the 2 weeks after the flood disaster and decreased 2 to 2.5 months after the flood.	Lag not assessed but follow-up included 3 months after the flood. Subgroup analysis not reported.

			Patients with HF had significantly higher systolic and diastolic blood pressure measurements at the time of hospitalization compared to the average of the previous 2 years.	
<i>Weinberger et al. 2021 United States (447)</i>	Longitudinal (Ecological)	Dates of landfall of Hurricane Sandy (New York City, United States)	For adults age 65 years or older, RR of emergency department visits for CVD associated with hurricane exposure = 1.10 (1.02 to 1.19) during the first week after the hurricane (lag 1-7). Similar increase seen in adults age 18-64 years, but not statistically significant.	Lag 0-28 days assessed. Statistically significant decline in CVD visits at lag 0 (suggesting decreased utilization on the day of exposure to the storm's closest approach), followed by an increase the first week. Visits return to baseline rate starting week 3. Subgroup analysis not reported.
<i>Xiao et al. 2021 United States (448)</i>	Cross-sectional (Ecological)	Days with above average number of individuals experiencing power outage living in New York City during Hurricane Sandy were defined as power outage days (New York City, United States)	Emergency Department visits for cardiovascular complications of pregnancy did not increase during periods of power outage.	Lag 0-7 days assessed. Consistent findings across lag periods. Subgroup analysis not reported.
<i>Burrows et al. 2023 United States (449)</i>	Longitudinal (Ecological)	A county was considered to be exposed if it experienced local storm-associated winds of ≥ 21 m/s	CVD hospitalizations were significantly decreased on the first day of the storm (lag 0) and the subsequent day (lag 1) but were significantly elevated on lags 2-6. No statistically significant	Lag -2 to 7 days assessed. CVD hospitalizations were significantly decreased on the first day of the storm (lag 0) and the subsequent day (lag 1)

			change in the risk of CVD hospitalizations over the 10-day tropical cyclone period (2 days before the day of the storm, and 7 days following the storm): RR= 1.04 (0.87 to 1.24).	but were significantly elevated on lags 2-6. When stratifying by poverty level, the risk of CVD hospitalization on lag 0 was significantly lower in lower-poverty zip codes and on lag 3 was significantly higher in higher-poverty zip codes.
<i>Rawal et al. 2023 United States</i> (450)	Longitudinal (Ecological)	Pre-/post- analysis at a single center based on known date of Hurricane Katrina landfall.	The post-Katrina cohort saw 3.0% incidence of acute myocardial infarction ($p < 0.001$). The post- Katrina group was also noted to have significantly higher comorbidities including diabetes, hypertension, polysubstance abuse, and coronary artery disease.	The main analysis assessed differences between the pre- (2 years prior) and post- (14 years after) periods. Lags not assessed. Subgroup analysis not reported.
<i>Kim et al. 2022 United States</i> (451)	Longitudinal (Ecological)	Tropical cyclones that had data for Florida in the reports from the National Hurricane Center and Central Pacific Hurricane were included, whether or not the cyclones made landfall.	No significant correlation was found between congestive heart failure discharges and frequency of cyclones or the maximum wind speed.	Lags not assessed. Subgroup analysis not reported.

eTable 9. Extreme Weather: Floods. Abbreviations: CVD=Cardiovascular Disease, OR = Odds Ratio, RR=Relative Risk.

A. Floods: Cardiovascular Mortality

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Yan et al. 2020</i> <i>China</i> (396)	Longitudinal (Ecological)	Flood: individuals admitted to hospitals in the study area during the event	RR for CVD mortality= 1.37 (1.01 to 1.85).	Lags 0-4 days assessed. Relative risk not statistically significant the day after peak flood day. Subgroup analysis not reported.
<i>Obrová et al. 2014</i> <i>Czech Republic</i> (398)	Cross-Sectional (Case-Control)	Flood: deaths occurred 2 months prior to and 1 month after the flood in the study area	No significant change was observed for cardiac mortality in the month after the flood compared to the two months before the flood (p=0.088).	Lags not assessed. Subgroup analysis not reported.

B. Floods: Cardiovascular Morbidity

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Vanasse et al. 2016</i> <i>Canada</i> (397)	Longitudinal (Ecological)	Flood: individuals in the study area during the event	OR for acute CVD= 1.25 (0.81 to 1.92) compared with the previous spring; 1.27 (0.82 to 1.92) compared with the subsequent spring.	Lags not assessed. Subgroup analysis not reported.
<i>Nagayoshi et al. 2015</i> <i>Japan</i> (399)	Longitudinal (Ecological)	Flooding and mudslides: individuals admitted to the local hospital in the impacted area	The number of CVD events increased from 5.1 to 16.8 per month (p<0.01).	Lag not directly assessed but follow-up period included approximately 1.5 months after exposure.

				Subgroup analysis not reported.
<i>Deng et al. 2022 United States(444)</i>	Longitudinal (Ecological)	Residence in the impact area of flooding (hurricanes included in flood definition)	Rate ratio of CVD admission at lag 0 = 1.03 (1.01 to 1.06) for floods, 1.03 (1.01 to 1.04 for power outages) and 1.00 (0.89 to 1.13 for both).	Lag 0-6 days assessed. Rate ratio of CVD admission associated with flood exposure = 1.04 (1.02 to 1.06) a lag 6. Rate ratio of CVD admission associated with flood exposure and power outages became significant on lag 3 = 1.13 (1.03 to 1.24). No differences by lag day for the association between power outages and CVD admissions (all statistically significant). In subgroup analyses, significant association with flood and power outages and CVD admission was observed in women, white individuals, adults older than 65 years, individuals without insurance, and individuals on company insurance.

eTable 10. Extreme Weather: Mudslides. Abbreviation: CVD=Cardiovascular Disease.

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Nagayoshi et al. 2015 Japan (399)</i>	Longitudinal (Ecological)	Mudslides and flooding: individuals admitted to the local hospital in the impacted area	The number of CVD events increased from 5.1 to 16.8 per month ($p<0.01$).	Lag not directly assessed but follow-up period included approximately 1.5 months after exposure. Subgroup analysis not reported.

eTable 11. Extreme Weather: Dust Storms. Abbreviations: CVD=Cardiovascular Disease, IHD = Ischemic Heart Disease, OR = Odds Ratio, RR=Relative Risk.

A. Dust Storms: Cardiovascular Mortality

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Wang et al. 2015 Taiwan</i> (415)	Longitudinal (Ecological)	The arrival of a dust storm is identified as the ground level PM ₁₀ concentration exceeding 100 µg/m ³	RR of CVD mortality= 0 days after exposure: 1.04 (0.99 to 1.09).	Lag 0-2 days assessed. RR of CVD mortality 1 day after exposure: 1.00 (0.93 to 1.07); and 2 days after exposure: 1.05 (0.98 to 1.13). No increase in CVD mortality for age>65.
<i>Kashima et al. 2012 Japan</i> (416)	Longitudinal (Ecological)	24-hour average ambient PM8 level (µg/m ³)	RR (day of exposure) = 1.001 (0.998 to 1.003) for circulatory disease mortality; 1.003 (0.999 to 1.005) for heart disease mortality; 1.005 (1.001 to 1.010) IHD mortality; 1.008 (0.996 to 1.018) for arrhythmia mortality; and 1.000 (0.996 to 1.003) for cerebrovascular disease.	Lag 0-6 days assessed. Significant association for heart disease mortality and arrhythmia mortality at lag 2 and for IHD mortality at lag 0 and lag 1. Heterogeneity by region. Significant association for circulatory disease mortality in the northern area studied, at lag 1 and lag 0-6 days assessed.
<i>Kashima et al. 2016 Japan and South Korea</i> (419)	Longitudinal (Ecological)	24-hour average ambient PM10 level (µg/m ³)	No statistically significant association between Asian dust exposure and CVD	Lag 0-5 days assessed. RR for cerebrovascular disease mortality (0-3 day after

			mortality among people aged ≥ 65 years. However, RR for cerebrovascular disease mortality (1 day after exposure) = 1.006 (1.000 to 1.011).	exposure) in cities closer to Asian dust sources = 1.011 (1.001 to 1.021) among adults ages ≥ 65 years. Subgroup analysis not reported.
<i>Neophytou et al. 2013</i> <i>Cyprus</i> (421)	Longitudinal (Ecological)	24-hour average ambient PM10 level ($\mu\text{g}/\text{m}^3$)	Proportional increase in CVD mortality = 2.43% (0.53% to 4.37%) per 10 $\mu\text{g}/\text{m}^3$ increase in PM10.	Lag 0-2 days assessed. Significant effect only seen at lag 0. Subgroup analysis not reported.
<i>Renzi et al. 2018</i> <i>Italy</i> (422)	Longitudinal (Ecological)	24-hour average ambient PM10 level ($\mu\text{g}/\text{m}^3$)	Proportional increase in CVD mortality (0-1 days after exposure) = 2.83% (2.34% to 3.32%) per 10 $\mu\text{g}/\text{m}^3$ increase in PM10.	Lag 0-1 days in the base case and lag 0-5 days in sensitivity analyses. Proportional increase in CVD mortality (0-5 days after exposure) = 4.54% (3.82% to 5.26%) per 10 $\mu\text{g}/\text{m}^3$ increase in PM10. Subgroup analysis not reported.
<i>Chen et al. 2004</i> <i>Taiwan</i> (425)	Longitudinal (Ecological)	24-hour average level ($\mu\text{g}/\text{m}^3$)	Proportional change in CVD mortality for dust storm days = -0.14% (not statistically significant).	Lag 0-3 days assessed. Largest change on day 2 (2.59%) but not statistically significant. Subgroup analysis not reported.
<i>Díaz et al. 2012</i> <i>Spain</i> (427)	Longitudinal (Case-Crossover)	24-hour average level ($\mu\text{g}/\text{m}^3$)	Proportional increase in CVD mortality per 10 $\mu\text{g}/\text{m}^3$ increase in PM10 = 4.19% (1.34% to 7.13%) in warm period; -0.16% (-2.41% to 2.14%) in cold period.	Lag 0-4 days assessed. Significant increase in CVD mortality on lags 1 and 2 days after dust storm exposure.

			No statistically significant change in cerebrovascular disease mortality.	Subgroup analysis not reported.
<i>Vodanos et al. 2015 Israel (428)</i>	Longitudinal (Case-Crossover)	Dust storm days defined as days with average PM10 concentration two standard deviations above the background value ($\mu\text{g}/\text{m}^3$)	OR for hospital admission for acute coronary syndrome on the day of a dust storm= 1.001 (0.995 to 1.007) and on the day after a dust storm= 1.007 (1.002 to 1.012).	Lags not assessed. Female sex, age>65, and Bedoin populations were more likely to be hospitalized for acute coronary syndrome during dust storms.
<i>Chan et al. 2011 Taiwan (430)</i>	Longitudinal (Case-Crossover)	Hourly average of ambient PM2.5/10 level ($\mu\text{g}/\text{m}^3$)	OR for CVD mortality= 1.030 (1.000 to 1.060) 0 day after exposure; 1.023 (0.993 to 1.053) 0-1 day after exposure.	Lag 0-1 days assessed. Statistically significant increase only noted on the day of exposure. Older adults (age > 65 years) were more susceptible to dust storms.
<i>Liu et al. 2014 China (432)</i>	Longitudinal (Ecological)	Daily visibility is less than 10-km and relative humidity is lower than 90%	Cumulative excess risk for cerebrovascular mortality when visibility is 8-10km= 2.5 (-3.1 to 8.4); 5-8km= 5.1(-6.1. to 17.5), and < 5km= 7.7 (-9.0 to 27.4) Cumulative excess risk for CVD mortality when visibility is 8-10km= 4.1(0.3 to 8); 5-8km= 8.5(0.5 to 16.6), and < 5km=13.0 (0.8 to 26.0). The health effect of dust-haze was greater during cold season.	Lag 0-13 days assessed. Generally, the mortality risk peaked within one day after exposure to dust-haze weather, approached 1 after 6 days and then remained near to 1 during the next week without statistical significance. Main results reported effects at lag 06 days. Subgroup analysis not reported.

<i>Mallone et al. 2011</i> <i>Italy</i> (434)	Longitudinal (Ecological)	24-hour average ambient PM10 and PM2.5 level ($\mu\text{g}/\text{m}^3$)	Proportional increase in cardiac mortality with interquartile range increase in PM 2.5= 1.37 (-5.92 to 9.21) and PM 10= 9.55 (3.81 to 15.61). Proportional increase in cerebrovascular mortality with interquartile range increase in PM 2.5= -3.22% (-11.72% to 6.10%) and PM 10= 1.71% (-5.05% to 8.95%). Percent increase in circulatory mortality with interquartile range increase in PM 2.5= -0.91% (-7.04% to 5.62%) and PM 10= 5.91% (1.02% to 11.03%).	Lag 0-2 days assessed for CVD mortality and lag 0 for cerebrovascular mortality. Subgroup analysis not reported.
<i>Perez et al. 2012</i> <i>Spain</i> (435)	Longitudinal (Case-Crossover)	24-hour average ambient PM1/PM2.5/PM10 level ($\mu\text{g}/\text{m}^3$)	OR for cerebrovascular disease mortality= 1.002 (0.871 to 1.153) for PM2.5+PM1; 1.081 (0.959 to 1.219) for PM10+PM2.5. OR for CVD mortality= 1.093 (1.018 to 1.173) for PM2.5+PM1; 1.097 (1.029 to 1.169) for PM10+PM2.5.	Lag 0-2 assessed. Similar findings across examined lags. Subgroup analysis not reported.
<i>Sajani et al. 2011</i> <i>Italy</i> (436)	Longitudinal (Case-Crossover)	Days affected by Saharan dust	OR for CVD mortality= 1.092 (0.900 to 1.325).	Lag 0-4 days assessed. Strongest effect at lag 1, declining effect by lag 4 days assessed.

				Older adults (age > 75 years) were more susceptible to Saharan dust.
<i>Jiménez et al. 2010 Spain</i> (437)	Longitudinal (Ecological)	24-hour average ambient PM10 level ($\mu\text{g}/\text{m}^3$)	RR for CVD mortality (3 days after exposure) = 1.040 (1.017 to 1.063).	Lags 0-5 assessed. Significant association only at lag 3. Subgroup analysis not reported.
<i>Crooks et al. 2016 United States</i> (438)	Longitudinal (Case-crossover)	Dust storm incidence from the U.S. National Weather Service storm database	9.5% increase in cardiovascular mortality at lag 2 for the U.S. (0.31% to 19.5%).	Lags 0-5 days assessed. Significant findings at lag 2 (US) and lag 3 (Arizona). In Arizona (which accounted for 46% of the dust storms in the study sample), there was a 13.0% increase in cardiovascular mortality at lag 3 (0.40 to 27.1). In California, there was no increase in cardiovascular mortality (though increases were noted in all-cause mortality).
<i>Li et al. 2020 China</i> (439)	Longitudinal (Ecological)	Time, duration, and invasive range of sandstorms and death occurred in the region	RR for IHD mortality (26-30 days after exposure) = 1.183 (1.017 to 1.348).	Lags not assessed. Older adults (age $\geq$ 60 years), men, and rural populations were more susceptible.
<i>Jung et al. 2021 South Korea</i> (440)	Longitudinal (Ecological)	Dust storms: presence of an Asian Dust Storm (severe dust storms, over $400 \mu\text{g}/\text{m}^3$; and more severe dust storms, over $800 \mu\text{g}/\text{m}^3$; for 2-hours continually per day)	Cumulative Asian Dust Storm exposure over a 6-day lag period was significantly associated with an increased Years of Lost Life due to cardiovascular causes (34.4 years [4.0 to 64.7 years])	Lag 0-5 days assessed. Although analyses by sex, age group, education level, occupation, and marital status were performed for Years of Lost Life from all causes,

			and increased CVD deaths (8.9% [0.8% to 17.6%]).	cause-specific mortality was not examined by subgroup.
<i>Johnston et al. 2011 Australia</i> (457)	Longitudinal (Case-Crossover)	24-hour average ambient PM10 level ($\mu\text{g}/\text{m}^3$) from fixed monitoring sites	OR for CVD mortality= 1.12 (0.97 to 1.30) on the day of exposure and 1.01(0.90 to 1.13) on the day after exposure.	Lag period 0-3 days assessed. Similar findings on each lag day. Subgroup analysis not reported.
<i>Oktay et al. 2023 Türkiye</i> (453)	Longitudinal (Ecological)	Aerosol Optical Depth value >0.5 as an indicator of a desert dust storm day	Desert dust not associated with stroke mortality.	Lags not assessed. No significant association in subgroups by sex or age group.

B. Dust Storms: Cardiovascular Morbidity

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Lin et al. 2016 Taiwan</i> (414)	Longitudinal (Ecological)	24-hour average ambient PM2.5/PM10/NO ₂ /ozone level ($\mu\text{g}/\text{m}^3$)	RR for CVD emergency room visits (0-3 days after exposure) = 1.26 (0.99 to 1.60).	Lag 0-2 days assessed. Similar findings by lag day. No significant difference between spring and winter Asian dust storms.
<i>Kashima et al. 2017 Japan</i> (417)	Longitudinal (Case-Crossover)	Hourly average of ambient PM7 level ($\mu\text{g}/\text{m}^3$)	OR (day of exposure) = 1.04 (1.02 to 1.06) for cerebrovascular disease emergency room visits; 1.02 (1.00 to 1.04) for CVD emergency room visits.	Lag 0-4 days assessed. Findings only significant for lag 0. Subgroup analysis not reported.
<i>Lee et al. 2021 South Korea</i> (420)	Longitudinal (Ecological)	24-hour average ambient PM2.5/PM10 level ($\mu\text{g}/\text{m}^3$)	No significant association between Asian dust and non-ST-elevation myocardial infarction; RR for ST-segment elevation	Lag 0-7 days assessed. Differences by lag observed for ST elevation myocardial infarction, with largest RR at lag 5.

			myocardial infarction incidence = 1.083 (1.007 to 1.166) for PM2.5 (5 days after exposure); 1.075 (1.010 to 1.144) for PM10 (4 days after exposure).	RRs were significantly higher in < 65-year-olds than in ≥65-year-olds. Additionally, RRs between the BMI < 25 and BMI ≥ 25 groups were not different.
<i>Matsukawa et al. 2014 Japan (423)</i>	Longitudinal (Case-Crossover)	8-hour average ambient PM7/PM10 level (µg/m ³)	OR for acute myocardial infarction hospital admission= 1.33 (1.05 to 1.69) on the fourth day after exposure and 1.20 (1.02 to 1.04) in the period from exposure to the fifth day after exposure.	Lag 0-5 days observed. Significant findings only noted at lag 4 days assessed. Similar OR for age < 65 years and ≥ 65 years. Significant in men but not women, but interaction term was not statistically significant.
<i>Ishii et al. 2020 Japan (424)</i>	Longitudinal (Case-Crossover)	24-hour average ambient PM2.5 level (µg/m ³)	OR for hospital admission from myocardial infarction with no obstructive coronary artery disease= 1.65 (1.18 to 2.29) and for myocardial infarction = 0.97 (0.86 to 1.10).	Lag 0-2 days assessed. Significant association with myocardial infarction with no obstructive coronary artery disease observed on lag 2 days assessed. Increased risk of myocardial infarction with no obstructive coronary artery disease in age<65 years, body mass index <25 kg/m ² , non-smokers, patients without diabetes, and patients with lower baseline functional status.
<i>Chen and Yang et al. 2005 Taiwan (426)</i>	Longitudinal (Ecological)	24-hour average level (µg/m ³)	Proportional increase in CVD admission on dust storm days = 2.98% (not statistically significant).	Lag 0-3 days assessed. Largest percentage increase on lag 1 day (3.65%) but did not meet statistical significance. Subgroup analysis not reported.

<i>Vodonos et al. 2015</i> <i>Israel</i> (428)	Longitudinal (Case-Crossover)	24-hour average ambient PM10 level ($\mu\text{g}/\text{m}^3$)	OR for ACS hospital admission per 10 $\mu\text{g}/\text{m}^3$ increase in PM10 on dust storm days = 1.007 (1.002 to 1.012) on lag day 1.	Lags 0-2 days assessed. Significant OR on lag day 1 and for the cumulative 0-2 day assessment. Significant OR at lag 0 in women above the age of 65 years and Bedouin individuals over the age of 65 years.
<i>W.S. Tam et al. 2012</i> <i>China</i> (429)	Longitudinal (Case-Crossover)	24-hour average ambient PM10/PM2.5/SO ₂ /NO ₂ level ($\mu\text{g}/\text{m}^3$)	RR (day of exposure) = 1.04 (1.00 to 1.08) for IHD hospital admission; 1.03 (0.99 to 1.08) for cerebrovascular disease hospital admission; 0.99 (0.92 to 1.06) for heart failure hospital admission; 1.01 (0.98 to 1.04) for CVD hospital admission.	Lag 0-2 days assessed. Significant RR at lag 1 for any CVD hospitalizations and day 0 for IHD. Subgroup analysis not reported.
<i>Kang et al. 2012</i> <i>Taiwan</i> (431)	Longitudinal (Ecological)	24-hour average ambient PM level ($\mu\text{g}/\text{m}^3$)	Significant increase in stroke hospitalizations 1 and 2 days after the dust storm compared with non-dust storm day.	Lag -3 to 7 days assessed. Significant increases on day 1 and 2 after the dust storm but not on the day of the storm. Significant increases in stroke hospitalization the day after the dust storm noted in both men and women.
<i>Rodriguez et al. 2021</i> <i>Spain</i> (433)	Longitudinal (Case-Crossover)	Days affected by Saharan dust	IRR for ACS per 10 $\mu\text{g}/\text{m}^3$ increase in PM10 (0 day after exposure) = 1.01 (0.80 to 1.28).	Lag 0-5 days assessed. No statistically significant finding on any lag day. Subgroup analysis not reported.
<i>Nkosi et al. 2022</i> <i>South Africa</i> (442)	Cross-sectional (Ecological)	Occurrence of dust storms using satellite data	Additional hospital admissions from cardiac diseases on the day of dust storm = 44 (dust storm 1), 63 (dust storm 2).	Lags not assessed. Subgroup analysis not reported.

<i>Oktay et al. 2023 Türkiye</i> (453)	Longitudinal (Ecological)	Aerosol Optical Depth value >0.5 as an indicator of a desert dust storm day	Exposure to desert dust was associated with an increase in emergency department visits for stroke: OR = 1.219 (1.199 to 1.240).	Lags not assessed. Exposure to desert dust was associated with an increase in emergency department visits for stroke in women: OR = 1.158 (1.131 to 1.186), and in men OR = 1.296 (1.264 to 1.328). Significant association in individuals < 65 years (OR = 1.162 [1.134 to 1.191]) and in individuals 65 years or older (OR 1.278 [1.248 to 1.309]).
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C. Dust-Storms: Other Cardiovascular Outcomes

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Kashima et al. 2014</i> <i>Japan</i> (418)	Longitudinal (Ecological)	24-hour average ambient PM7 level ($\mu\text{g}/\text{m}^3$)	At lag 0, RR = 1.016 (1.001 to 1.032) for CVD emergency ambulance call; RR= 1.028 (1.007 to 1.049) for cerebrovascular disease emergency ambulance call.	Lag 0-4 days assessed. Findings only significant at lag 0. Subgroup analysis not reported.

eTable 12. Extreme Weather Events: Drought. Abbreviations: CVD=Cardiovascular Disease, RR=Relative Risk.

A. Drought: Cardiovascular Mortality

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Salvador et al. 2021 Portugal</i> (393)	Longitudinal (Ecological)	Drought: Weeks with a Standardized Evapotranspiration- Precipitation Index or Standardized Precipitation Index value less than 0 were defined as drought conditions	RR for circulatory mortality= 1.011 (1.004 to 1.019).	Lags not assessed. Statistically significant increase in circulatory mortality in both men and women.
<i>Salvador et al. 2020 Spain</i> (394)	Longitudinal (Ecological)	Drought: Weeks with a Standardized Evapotranspiration- Precipitation Index or Standardized Precipitation Index value less than 0 were defined as drought conditions	RR for CVD mortality= 1.0 to 1.054 depending on the district, but largely null findings.	Lags not assessed. Subgroup analysis not reported.
<i>Salvador et al. 2019 Spain</i> (395)	Longitudinal (Ecological)	Drought: Weeks with a Standardized Evapotranspiration- Precipitation Index or Standardized Precipitation Index value less than 0 were defined as drought conditions	RR= 1.068 (1.035 to 1.104) for CVD mortality in Ourense; 1.062 (1.021 to 1.104) for CVD mortality in Lugo.	Lags not assessed. Subgroup analysis not reported.

B. Drought: Cardiovascular Morbidity

Study Details (Title, author, year, location)	Study Design	Exposure Assessment	Association with Cardiovascular Outcomes	Observed Heterogeneity (if reported)
<i>Berman et al. 2017 United States</i> (392)	Longitudinal (Ecological)	Drought: defined as a consecutive string of at least 150 days of ‘moderate,’ ‘severe,’ ‘extreme,’ or ‘exceptional’ U.S. Drought Monitor category days	Proportional increase in CVD admission during low-severity drought = 1.41% (-1.49% to 4.40%) and during high-severity drought (2.54%, –1.04 to 6.26) compared with non-drought periods.	Lags not assessed. Subgroup analysis not reported.

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