UK Health Security Agency

Climate change and mental health: thematic assessment report

Appendix 1. Additional methodology

Contents

Definitions used in this report

We consider climate change and the extreme and adverse weather conditions (floods, droughts, heat and so on) that are impacted by climate change. Climate change reflects the long-term shift in the planet's weather patterns that occur over years and decades. People's mental health is frequently not exposed to climate change directly, but rather through the impacts on our weather and environment.

Mental health is termed throughout the report as encompassing both clinical mental health diagnoses and broader wellbeing. As evidence was assessed at the review level, it was not always possible to clarify whether conditions were clinically diagnosed, and it was also not always possible to confirm a consistent operational definition for specific conditions referred to in the literature (such as 'anxiety').

The term intervention is used throughout the report in a broad sense and refers to any organised programme or activity designed to promote mental health or broader wellbeing, or to prevent or reduce negative mental health outcomes in the context of climate change. This report includes both formally evaluated interventions and informal or emerging approaches that reported qualitative or quantitative mental health outcomes. Noting that definitions in the literature (particularly where interventions may span multiple disciplines or be implemented outside of clinical settings), we adopted an inclusive approach to support the mapping and synthesis of diverse models of support.

Table 1. List of academic and grey literature databases and websites screened for the review

Literature type	Reference source
Academic literature	Medline
	Embase
	PsycINFO
	SCOPUS
Grey literature	Climate Change and Health Literature Portal
	The Kings Fund Library
	GOV.UK
	Local Government Association
	Mind
	Mental Health Foundation
	BBC News
	Sky News

Literature type	Reference source
	Policy Commons

4. OVID MEDLINE Search Strategy

The Ovid MEDLINE(R) ALL database was searched (from 1946 to 18 June 2024) using the below search strategy.

#	Searches	Results
1	exp *Climate Change/	22,031
2	((chang* or event*) adj3 (climate or weather or meteorological)).tw.	82,605
3	*Extreme Weather/ or exp *Hot Temperature/ or exp *Cold Temperature/	69,659
4	((extreme or severe) adj4 (climate or temperature* or weather or hot or heat or cold)).tw.	16,909
5	((increas* or hot or decreas* or cold or freezing) adj3 (temperature* or climate)).tw.	104,412
6	*Greenhouse Effect/	3,201
7	("greenhouse effect" or "global warming").tw,kw.	17,583
8	"urban heat island*".tw,kw.	1,207
9	("heat wave*" or heatwave*).tw,kw.	5,025
10	*Floods/ or exp *Rain/ or Cyclonic Storms/	10,704
11	(flood* or "heavy rain*" or storm* or cyclon* or hurricane* or typhoon*).tw,kw.	60,316
12	*Sea Level Rise/	114
13	((rising or rise or risen) adj2 "sea level*").tw.	2,506
14	*Droughts/	7,285
15	(drought* or "lack of precipitation" or "lack of rain*" or "low rainfall").tw,kw.	41,109
16	(dry adj2 (weather or winter* or summer*)).tw.	1,682
17	*Wildfires/	1,595
18	("wild* fire*" or wildfire* or "bush fire*" or "forest fire*").tw,kw.	6,587
19	*Vector Borne Diseases/	423
20	(vector* adj3 (disease* or exposure*)).tw.	13,590
21	(arbovirus or babesiosis or chikungunya or dengue or ehrlichiosis or encephalitis or "lyme disease" or malaria or plague or rickettsia* or "west nile virus" or "usutu virus" or zika).tw,kw.	23,3890
22	*Infections/	23,357

#	Searches	Results
23	"infectious disease*".tw.	123,895
24	(bacteri* adj2 (disease* or infection* or infectious)).tw.	82,146
25	*Virus Diseases/	29,113
26	((virus* or viral) adj2 (disease* or infection* or infectious)).tw.	262,435
27	*Parasitic Diseases/	6,001
28	(parasit* adj2 (disease* or infection* or infectious)).tw.	31,023
29	*Foodborne Diseases/	8,093
30	((foodborne or "food borne") adj2 (disease* or outbreak* or infection* or pathogen*)).tw.	18,572
31	*Escherichia coli/ or *Cryptosporidium/ or *Cryptosporidiosis/ or *Campylobacter/ or *Campylobacter Infections/ or *Salmonella Food Poisoning/ or *Salmonella Infections, Animal/ or *Listeria/ or *Listeriosis/ or *Norovirus/ or *Sapovirus/ or *Astroviridae Infections/	186,179
32	("e* coli" or cryptosporidi* or campylobacter* or salmonella or salmonellosis or listeri* or norovirus or "Hepatitis A" or sapovirus* or astrovirus* or "food poisoning").tw,kw.	522,716
33	(enteric adj2 (disease* or infection* or pathogen*)).tw.	10,843
34	enteropathogen*.tw,kw.	8,536
35	(gastrointestinal adj2 (pathogen* or disease* or infection*)).tw.	21,749
36	*Waterborne Diseases/	210
37	((waterborne or "water borne") adj2 (disease* or outbreak* or pathogen* or infection*)).tw.	3,941
38	*Vibrio Infections/ or *Leptospirosis/ or *Giardiasis/	16,101
39	(vibrio* or non-vibrio or cholera or leptospir* or giardia*).tw,kw.	80,340
40	*Water Supply/	21,450
41	(water adj2 (supply or supplies or access*)).tw.	19,361
42	*Water Insecurity/	85
43	(water adj2 (disrupt* or scarc* or shortage* or availab* or unavailab* or insecur*)).tw.	13,850
44	*Water Pollution/	9,114
45	(water adj2 (contamin* or pollut* or quality or potab*)).tw.	64,525
46	((airborne or "air borne") adj2 (disease* or outbreak* or pathogen* or infection*)).tw.	2,435
47	(respiratory adj2 (disease* or infection* or virus* or condition*)).tw.	137,050
48	*Asthma/ or *Pulmonary Disease, Chronic Obstructive/ or *Rhinitis, Allergic/	171,032

#	Searches	Results
49	(asthma or COAD or COPD or "chronic airflow obstruction" or "chronic obstructive airway disease*" or "chronic obstructive lung disease" or "chronic obstructive pulmonary disease*" or "allergic rhinitis" or "hay fever" or hayfever).tw,kw.	278,737
50	*Air Pollution/	35,273
51	(air adj2 (contamin* or pollut* or quality)).tw.	63,707
52	((carbon or methane) adj2 (emission* or emit*)).tw.	15,887
53	"greenhouse gas*".tw,kw.	19,608
54	"black carbon".tw,kw.	3,763
55	or/1-54	2,219,656
56	*Mental Health/ or exp *Stress, Psychological/ or *Resilience, Psychological/	149,292
57	((mental* or psychological or psychiatric or psychosocial or emotional) adj2 (health or ill* or disorder* or stress* or disease* or problem* or fatigue or distress or wellbeing or "well being" or resilien* or state* or condition* or adaptation)).tw,kw.	596,522
58	exp *Mental Disorders/	1,316,638
59	exp *Anxiety/ or *Depression/ or *Mania/ or exp *Dementia/ or exp *Suicide/	390,575
60	(anxiety or anxious* or depression or depressive or bipolar or schizophreni* or "post-traumatic stress disorder" or PTSD or "obsessive compulsive disorder" or psychosis or psychotic or "eating disorder*" or anorexi* or bulimi* or "binge eat*" or phobia* or phobic or "personality disorder*" or mania or manic or "cognitive* declin*" or "cognitive* dysfunction*" or dementia or alzheimer* or suicid* or afraid).tw,kw.	1,410,975
61	exp *Substance-Related Disorders/	256,397
62	((alcohol or substance or drug*) adj2 ("use" or misuse or abuse or dependen* or addict* or habit* or disorder*)).tw.	272,195
63	solastalgia.tw,kw.	56
64	((eco* or climate or environmental) adj2 (anxiety or fear or grief or anger or paralysis)).tw.	715
65	exp *"Quality of Life"/ or *Happiness/	129,358
66	("quality of life" or "life satisfaction" or "psych* satisfaction" or wellbeing or "well-being" or wellness).tw,kw.	626,635
67	or/56-66	3,005,851
68	55 and 67	89,070
69	((mental or psychological or health) and (impact* or effect* or affect* or risk* or harm* or detriment* or outcome* or pathway*)).tw.	2,122,700

#	Searches	Results
70	exp *Health Inequities/ or *Vulnerable Populations/	35,088
71	(equit* or inequit* or inequalit* or disparit* or equality).tw.	246,422
72	("at risk" or vulnerab* or underserved or disadvantaged).tw,kw.	495,140
73	exp *Age Factors/	11,899
74	exp *age groups/	107,077
75	(child* or adolescent* or "young people" or "older people" or senior* or elderly or elders or aged).tw.	2,925,353
76	*Men/ or *Women/	13,594
77	(men or women or gender).tw,kw.	1,924,543
78	exp *Socioeconomic Factors/	192,704
79	((socioeconomic or "socio economic" or "social and economic") adj2 (factor* or status or characteristic*)).tw.	93,462
80	("living standard*" or "standard* of living" or poverty or "low income").tw,kw.	93,056
81	*Food Insecurity/ or *Job Security/	1,303
82	((food or income or financial or job or employment) adj2 (secur* or insecur* or poverty or stability or stable or precarious or equality or inequality)).tw.	37,500
83	(livelihood* or farming or farmers).tw,kw.	58,818
84	*Social Stigma/	7,667
85	"social stigma*".tw,kw.	3,806
86	((displace* or relocat* or migrat* or resettle*) adj3 (people or population* or communit* or home*)).tw.	9,350
87	(climate adj2 (mobility or refugee*)).tw.	79
88	exp *Sleep/ or exp *dyssomnias/	126,528
89	(sleep* adj5 (insufficient or depriv* or "not enough")).tw.	13,676
90	insomnia.tw,kw.	35,362
91	*Quality-Adjusted Life Years/	3,009
92	("healthy years equivalent" or QALY or QUALY or "quality adjusted life year*").tw,kw.	21,777
93	*Disability-Adjusted Life Years/	212
94	(DALY* or "disability adjusted life year*" or "years lived with disability").tw,kw.	9,849
95	exp *Comorbidity/ or exp *Morbidity/	16,421
96	(comorbid* or "co morbid*" or multimorbid* or "multi* morbid*" or morbidity).tw,kw.	787,758
97	exp *Hospitalization/	108,310

#	Searches	Results
98	(hospitali?ation* or "hospital admission*").tw,kw.	302,674
99	((healthcare or "health care" or hospital or GP or doctor* or "primary care" or psycholog* or psychiatr* or counselling) adj2 (consult* or access* or present* or visit*)).tw.	90,461
100	exp *Mortality/	75,155
101	(mortality or death*).tw.	2,007,815
102	or/69-101	8,186,484
103	68 and 102	56,140
104	afghanistan/ or africa/ or africa, northern/ or africa, central/ or africa, eastern/ or "africa south of the sahara"/ or africa, southern/ or africa, western/ or albania/ or algeria/ or andorra/ or angola/ or "antigua and barbuda"/ or argentina/ or armenia/ or azerbaijan/ or bahamas/ or bahrain/ or bangladesh/ or barbados/ or belize/ or benin/ or bhutan/ or bolivia/ or borneo/ or "bosnia and herzegovina"/ or botswana/ or brazil/ or brunei/ or bulgaria/ or burkina faso/ or burundi/ or cabo verde/ or cambodia/ or cameroon/ or central african republic/ or chad/ or exp china/ or comoros/ or congo/ or cote d'ivoire/ or croatia/ or cuba/ or "democratic republic of the congo"/ or cyprus/ or djibouti/ or dominica/ or dominican republic/ or ecuador/ or egypt/ or el salvador/ or equatorial guinea/ or eritrea/ or eswatini/ or ethiopia/ or fiji/ or gabon/ or gambia/ or "georgia (republic)"/ or ghana/ or grenada/ or guatemala/ or guinea/ or guinea-bissau/ or guyana/ or haiti/ or honduras/ or independent state of samoa/ or exp india/ or indian ocean islands/ or indochina/ or indonesia/ or iran/ or iraq/ or jamaica/ or jordan/ or kazakhstan/ or kenya/ or kosovo/ or kuwait/ or kyrgyzstan/ or laos/ or lebanon/ or liechtenstein/ or lesotho/ or liberia/ or libya/ or madagascar/ or malaysia/ or malawi/ or mali/ or malta/ or mauritania/ or mauritius/ or mekong valley/ or melanesia/ or micronesia/ or monaco/ or mongolia/ or montenegro/ or morocco/ or mozambique/ or myanmar/ or namibia/ or nepal/ or nicaragua/ or niger/ or nigeria/ or oman/ or pakistan/ or palau/ or exp panama/ or papua new guinea/ or paraguay/ or peru/ or philippines/ or qatar/ or "republic of belarus"/ or "republic of north macedonia"/ or romania/ or exp russia/ or rwanda/ or "saint kitts and nevis"/ or saint lucia/ or "saint vincent and the grenadines"/ or "sao tome and principe"/ or saudi arabia/ or serbia/ or sierra leone/ or senegal/ or seychelles/ or singapore/ or somalia/ or south africa/ or south sudan/ or sri lanka/ or sudan/ or suriname/ or syria/ or taiwan/ or tajikistan/ or tanzania/ or thailand/ or timor-leste/ or togo/ or tonga/ or "trinidad and tobago"/ or tunisia/ or turkmenistan/ or uganda/ or ukraine/ or united arab emirates/ or uruguay/ or uzbekistan/ or vanuatu/ or venezuela/ or vietnam/ or west indies/ or yemen/ or zambia/ or zimbabwe/	1,433,356

#	Searches	Results
105	"Organisation for Economic Co-Operation and Development"/	682
106	australasia/ or exp australia/ or austria/ or baltic states/ or belgium/ or exp canada/ or chile/ or colombia/ or costa rica/ or czech republic/ or exp denmark/ or estonia/ or europe/ or finland/ or exp france/ or exp germany/ or greece/ or hungary/ or iceland/ or ireland/ or israel/ or exp italy/ or exp japan/ or korea/ or latvia/ or lithuania/ or luxembourg/ or mexico/ or netherlands/ or new zealand/ or north america/ or exp norway/ or poland/ or portugal/ or exp "republic of korea"/ or "scandinavian and nordic countries"/ or slovakia/ or slovenia/ or spain/ or sweden/ or switzerland/ or turkey/ or exp united kingdom/ or exp united states/	3,677,872
107	European Union/	18,514
108	Developed Countries/	21,818
109	or/105-108	3,694,762
110	104 not 109	1,339,889
111	103 not 110	50,524

Table 3. Inclusion and exclusion criteria (for title and abstract priority screening)

Domain	Include	Exclude
Country	UK and OECD for systematic reviews (SRs), or where data is provided within a larger study for these countries	Primary studies that are non-UK countries or outside of OECD
Population	All human populations	Animal studies
Settings	Any setting	N/A
Intervention or exposure	Climate change related hazard (or climate related extreme event) including: • climate change as a concept • flooding (including extreme heavy rainfall) • drought • extreme heat • extreme cold • wildfire • exposure to vectors (where there may be either a direct pathway or a perceived pathway between the exposure and mental health) • food security or insecurity (as a result of a weather or climate related event) • air pollution (where there is a climate measure included in the study)	• studies looking at air pollution with no link to other climate variables • impact of interventions on mental health • HIV/COVID-19 studies where there is no climate related link
Outcomes	Mental health including but not limited to either self-reported or clinical measures of: • stress, anxiety, depression, obsessive compulsive order, phobias, psychological distress, post-traumatic stress disorder, eating disorders,	Measures of: • happiness

Domain	Include	Exclude
	substance abuse disorders, personality disorders, resilience, quality of life, psychological and mental wellbeing, domestic violence or violent behaviour • proxy measures of mental health impacts (for example, increase in prescriptions for depression medication, increase in hospital admissions for mental health)	• neurodevelopmental disorders (including but not limited to autism and ADHD or ADD) • studies where mental health leads to physical health impacts or studies that focus on physical health impacts as their primary health outcome
Language	English	Non-English studies
Date of publication	All	N/A
Study design	• qualitative • quantitative • mixed methods	• guidelines • case reports
Publication type	• peer-reviewed research articles • preprint • grey literature (such as reports published by government, local government, and charities or non-governmental organisations) • relevant reviews for checking over the reference lists	• conference abstracts • opinion pieces • letters • posters • protocols

Table 4. Additional screening criteria for second screen on title and abstract

Due to the large amount of literature identified for inclusion after the initial priority screening exercise. It was decided to move to an umbrella review approach to target a smaller number of inclusions, as we had initially included reviews, this meant there was no major change to the methodology, except to conduct a second screen on title and abstract with the following criteria:

Include	Exclude
Reviews that follow an explicit methodology (for example, systematic, scoping, rapid, mapping and so on) and include a synthesis of the literature (that is, not just pulled together an overview).	Reviews that only provide an overview of the literature with no explicit methodology reported.
UK-based primary studies.	Non-UK-based primary studies.

Table 5. Data extraction code set for pathways studies

During data extraction in EPPI-Reviewer, data was extracted and highlighted under the following code sets.

Study type	Primary study: • quantitative • qualitative • mixed methods Review: • scoping • systematic • meta-analysis
Populations of interest	• affected occupations – includes first responders such as firefighters, healthcare staff, police, and counsellors, as well as those who work outside such as farmers and construction workers. • children and young people – children and young people aged 18 years and younger • deprived populations – any populations that are deemed 'deprived' by the study • ethnic minority communities – groups of particular interest are UK minority groups • general population – reviews that include a range of age groups or that do not specify specific age groups being considered • inclusion health groups –includes homeless people, those who are alcohol or drug dependent, migrants, Gypsy or Roma people, sex workers, those in detention, modern slaves, and socially excluded groups • LGBTQ+ populations – LGBTQ plus populations that are affected specifically because of their LGBT + status • older adults – adults aged 65 years and older • people with disabilities – people with either physical or learning disabilities • people with health conditions – people with pre-existing or long-term conditions or co-morbidities • pregnant or maternal population – pregnant and maternal population including those who are considering whether or not to have children

Climate-related exposures	• air pollution – air pollution where there is a climate measure in the study. • climate change concept – concerns about climate change as a concept or climate change as an overall exposure with no reference to specific events • compound events – events that occur simultaneously or overlap (for example, flooding which occurred during the COVID-19 pandemic or floods and other disasters) • drought – including prolonged periods of dry weather • environmental change – studies must make the change to climate change or climate related adverse weather events; also includes coastal erosion because of sea-level rise for example, or natural deforestation due to a climate-related event • extreme heat – extreme heat including urban heat islands and heatwaves, prolonged periods with above average temperatures • extreme cold – extreme cold either due to extreme temperatures or inability to adapt • flooding – including very heavy rainfall (excluding where rainfall is mentioned generally and not extreme or heavier than usual) • food insecurity – food insecurity at both individual and system level • hurricanes or storms – mitigation or adaptation interventions • increase in ambient temperature – where there is an overtime increase in ambient temperature (rather than extreme heat or heatwaves) • vector-borne diseases – diseases or pathogens caused by vectors including ticks and mosquitos • infectious diseases – climate-sensitive pathogens excluding vector-borne diseases including waterborne or foodborne pathogens such as *Vibrio*, *Campylobacter* or *Salmonella* • wildfires – including forest fires and bushfires • adaptation and mitigation interventions – actions that have been put in place to adapt to weather conditions rather that have an indirect impact on mental health
Outcomes	• anxiety – clinically diagnosed or mentioned as ‘anxiety’ (non-specific feelings of anxiety such as panic attacks are coded under psychological or mental wellbeing) • cognitive decline – includes different forms of dementia, for example Alzheimer’s

	• eating disorders • eco-anxiety – also includes ecological grief, solastalgia, eco-anger, eco-paralysis • depression – clinically diagnosed or mentioned as 'depression' (non-diagnosed depressive feelings such as hopelessness are coded under psychological or mental wellbeing) • increase healthcare use – proxy measure including increased psychiatric GP or hospital appointments or admissions related to mental health illness or increased use, demand or purchase of psychiatric medications • schizophrenia or other mood disorders –includes bipolar disorder, mania and including schizophrenia • obsessive compulsive disorder (OCD) • personality disorders • phobias • psychological and mental wellbeing –includes psychological or mental wellbeing, quality of life (QoL), sleep disturbance and mental exhaustion/burnout (for example in frontline workers), non-specific psychological distress such as panic attacks, hopelessness and so on) • post-traumatic stress disorder (PTSD) • suicide – includes completed suicide, attempted suicide and suicidal thoughts • substance abuse –includes alcohol, drugs, banned substances • stress • violent behaviour – includes violence inside or outside the home, as well as physical abuse and/or coercion
Pathways and moderators	• individual economic factors – includes loss of individual livelihood and mental health impacts resulting from financial stress, interaction with insurance services and loss of employment • community economic factors – includes economic development, volume, distribution, and diversity of economic resources • individual social factors – includes deprivation, social isolation, personal and family relationships • community social factors – includes social cohesion of the local community and neighbourhoods, sense of belonging

	• individual interruptions to services – includes carers unable to reach patients to provide care at home, someone unable to pick up medication from pharmacy due to being flooded, as well as non-healthcare services such as builders unable to continue work on a house • community interruptions to services – includes reduced or no transport system to attend appointments, GP surgeries closing and unable to provide local healthcare, schools closing and reducing access to education • individual cultural factors – includes impacts that can affect or prevent an individual practising their religion, for example • community cultural factors – includes culture of the community around certain things, for example, connection to the land • individual factors – includes where studies report a moderating or protective effect of age, sex or personality traits such as neuroticism
Key findings	• meta-analysis results • results in a graph • results in a table

Adapted AMSTAR-2 checklist and scoring system

Reviews were critically appraised using the AMSTAR-2 checklist, adapted for the review context. Domains with a C in square brackets [C] are classed as critical domains for the purpose of this review and will be used for overall scoring purposes.

1. Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol? [C]
   a) Yes – must have review question, search strategy description, inclusion or exclusion criteria, risk of bias (RoB) assessment, synthesis plan (and meta-analysis plan if appropriate), justification for any deviations to the protocol.
   b) No.
   c) Partial – must have stated about a protocol or a predefined plan that included review question, search strategy, inclusion or exclusion criteria, RoB assessment if applicable for review type.

2. Did the review authors explain their selection of the study designs for inclusion in the review?
   a) Yes – for example, they might have provided a sentence to say “only qualitative primary studies were included in this review because…”
   b) No.

3. Did the review authors use a comprehensive literature search strategy? [C]
   a) Yes – must have searched at least 2 databases, provided key terms and justified restrictions on literature inclusion, searched reference lists of reviews, consulted experts in the field, searched for grey literature where relevant, conducted the search within 24 months of completion of the review.
   b) No.
   c) Partial yes – must have searched at least 2 databases, provided key terms and justified restrictions on literature inclusion.

4. Did the review authors perform study selection in duplicate?
   a) Yes – either one of the following: either at least 2 reviewers were involved in the selection of eligible studies **or** 2 reviewers selected a sample of eligible studies and had a good level of agreement, with the remainder selected by a single reviewer.
   b) No.

5. Did the review authors perform data extraction in duplicate?
   a) Yes – for Yes, **one** of the following: at least 2 reviewers achieved consensus on which data to extract from included studies **or** 2 reviewers extracted data from a sample of eligible studies and achieved good agreement, with the remainder extracted by one

reviewer **or** piloted a few studies in duplicate and discussed before extracting individually.
b) No.

6. Did the review authors provide a list of excluded studies and justify the exclusions? [C]
a) Yes – provided a list of all studies excluded at the full text stage but also justified exclusion of these (for example, wrong study design).
b) No.
c) Partial yes – must have provided justification of exclusion of particular studies.

7. Did the review authors describe included studies in adequate detail?
a) Yes – described study designs, outcomes, any comparators if applicable, any populations in detail.
b) No.
c) Partial yes – described study designs, outcomes, any comparators if applicable, any populations generically.

8. Did the review authors use a satisfactory technique for assessing RoB in individual studies included in the review? [C]
a) Yes – used a tool specific to the study design to assess RoB of primary studies included.
b) No.
c) Partial yes – described limitations of studies more generically, no use of a validated tool.

9. Did review authors provide sources of funding for the review?
a) Yes – reported on the sources of funding for the review.
b) No.

10. If meta-analysis was performed did the review authors use appropriate methods for statistical combination of results? [C]
a) Yes – authors justified combination of results in meta-analysis, used an appropriate weighted technique, considered heterogeneity, used adjusted affect estimates rather than raw data for non-randomised studies.
b) No.
c) No meta-analysis conducted.

11. If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?
a) Yes – included only low risk of bias studies OR took measures to ensure the impact of RoB from studies was investigated in the overall pooled estimate.
b) No.
c) No meta-analysis conducted.

12. Did the review authors account for RoB in individual studies when interpreting or discussing the results of the review?

a) Yes – included only low RoB in the study **or** included a discussion of the likely impact of RoB on the results.
b) No.

13. Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review? (Heterogeneity is the state of the literature being diverse, so: were there lots of conflicting results?)

a) Yes – no heterogeneity in the results **or** if heterogeneity was evident, performed an investigation of the heterogeneity and discussed potential impact on the results; this is usually done in conjunction with meta-analysis but there may still be heterogeneity within results of a review that doesn't do meta-analysis.
b) No.

14. If a quantitative synthesis was performed (meta-analysis), did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review? [C]

a) Yes – performed a graphical or statistical test for publication bias and discussed the likelihood and magnitude of the impact of publication bias; this is usually depicted through a 'funnel plot'.
b) No.
c) No meta-analysis conducted.

15. Did the review authors report any potential sources of conflict of interest?

a) Yes – no competing interests reported **or** the authors described how they managed conflicts of interest.
b) No.

Scoring for critical domains

All reviews will be scored on the critical domains as follows:

- Yes = 1
- Partial = 0.5
- No = 0

For the overall rating across 4 domains (that is, reviews without meta-analysis) the below will be used for the overall rating:

- 4 = High (100%)
- 3 to 3.5 = Moderate (a very good quality scoping review may fit in here)
- 2 to 2.5 = Low
- 0 to 1.5 = Critically low

For the overall rating across 6 domains (that is, reviews with meta-analysis) the below will be used for the overall rating:

- 6 = High
- 4 to 5.5 = Moderate
- 2 to 3.5 = Low
- 0 to 1.5 = Critically low

Descriptive terms for the overall rating of studies

High

No or one non-critical weakness: the systematic review provides an accurate and comprehensive summary of the results of the available studies that address the question of interest.

Moderate

More than one non-critical weakness [Note]: the systematic review has more than one weakness but no critical flaws. It may provide an accurate summary of the results of the available studies that were included in the review.

Low

One critical flaw with or without non-critical weaknesses: the review has a critical flaw and may not provide an accurate and comprehensive summary of the available studies that address the question of interest.

Critically low

More than one critical flaw with or without non-critical weaknesses: the review has more than one critical flaw and should not be relied on to provide an accurate and comprehensive summary of the available studies.

Note: multiple non-critical weaknesses may diminish confidence in the review, and it may be appropriate to move the overall appraisal down from moderate to low confidence

Table 6. Inclusion and exclusion criteria for interventions review

Domain	Include	Exclude
Country	UK and other OECD countries relevant to the UK, may also be referred to as high income countries (HIC) - Members and partners | OECD.	Non-OECD countries (low- and middle-income countries (LMICs) or countries not relevant to the UK landscape)
Population	General population or population-specific (for example, children and young people). Also, interventions aimed at specific occupations (for example, an intervention aimed at aiding mental health of first responders).	Populations not relevant for UK specific landscape (for example, Indigenous populations)
Settings	All settings	No settings to be excluded
Intervention or exposure	All interventions including but not limited to strategies, tools, resources, programmes, practices, or approaches providing mental health support in relation to climate change or extreme weather events. Interventions that are climate related (for example a mitigation or adaptation interventions that were not primarily put in place for mental health) may be included but only where there is a measured mental health outcome as a result. For example, an urban greenspace intervention put in place as a climate mitigation strategy that also provides a finding such as 'reduced anxiety and depression by 13%' or 'conducted interviews with participants of which 40% reported improvements in their mental wellbeing'.	Climate mitigation or adaptation interventions that do not provide a measure of mental health as an outcome. For example, an urban greenspace intervention that was implemented as a climate mitigation strategy that reports a suggestive 'improved wellbeing' with no evidence of measurement of this. Mitigation or adaptation interventions in relation to biodiversity, air quality and green space without a link to climate change.

Domain	Include	Exclude
Outcomes	Must be provided in relation to mental health or have a measured mental health outcome. Including but not limited to: stress, anxiety, depression, obsessive compulsive order, phobias, psychological distress, post-traumatic stress disorder, eating disorders, substance abuse disorders, personality disorders, resilience, quality of life, psychological and mental wellbeing, domestic violence or violent behaviour. Proxy measures of mental health impacts (for example, increase in prescriptions for depression medication, increase in hospital admissions for mental health).	Interventions to improve physical health (for example reduction in respiratory illness)
Language	Published in English language.	Non-English language
Date of publication	Between May 2022 and the present.	Before May 2022
Study design	Any formal study design (cohort, randomised controlled trial and so on) at a group or population level (that is, must have been provided to more than one individual or to individuals as part of a wider programme). More informal study designs including for example development by a local initiative (for example, local authority or local charity) providing ‘climate cafes’ for example.	Individual case studies (for example, where a person has been provided with a specific clinical therapy individually and is not part of a wide population or group level intervention programme)
Publication type	Peer-reviewed literature, primary studies, grey literature reports.	Conference abstracts, systematic (and other types) reviews (though we will make note of them to scan their reference lists).

Table 7. Data extraction code set for interventions studies

During data extraction in EPPI-Reviewer, data was extracted and highlighted under the following code sets.

Study type	• case control • longitudinal • modelling • observational or cohort • randomised controlled trials • grey literature (including resources, guidance and websites)
Climate-related exposures	• air pollution – air pollution where there is a climate measure in the study. • climate change concept – concerns about climate change as a concept or climate change as an overall exposure with no reference to specific events • compound events – compound events that occur simultaneously or overlap (for example, flood and COVID-19 or flood and other disaster) • drought – drought including prolong periods of dry weather • environmental change – studies must make the change to climate change or climate related adverse weather events; this code might include coastal erosion because of sea level rise for example, or natural deforestation due to a climate related event; this code may be discussed on a case-by-case basis • extreme heat – extreme heat including urban heat islands and heatwaves, prolonged periods with above average temperatures • extreme cold – extreme cold either due to extreme temperatures or inability to adapt • flooding – flooding including very heavy rainfall (excluding where rainfall is mentioned generally and not extreme or heavier than usual) • food insecurity – food insecurity at both individual and system level • hurricanes or storms – mitigation or adaptation interventions • increase in ambient temperature – where there is an overtime increase in ambient temperature (rather than extreme heat or heatwaves) • vector-borne diseases – vector-borne diseases or pathogens, including climate-sensitive vectors such as ticks and mosquitos • infectious diseases – climate sensitive pathogens (excluding vector-borne diseases) including waterborne pathogens that cause disease like cholera, hepatitis A or other pathogens that cause meningitis, typhoid and so on • wildfires – including forest fires or bushfires

Outcomes	• aim of the intervention
	• target population – is it specific to a population, such as children and young people, elderly people or general population
	• level of action – macrosystem (policy, law, social structures), exosystem (institutions, media, local government), mesosystem (for example, peer groups and social networks), and microsystem (individual and immediate home environment) This is based on Bronfenbrenner's ecological theory as applied to public mental health research. See additional information here.
	• setting – schools, GP surgeries, community centres, app-based tools, online and so on
	• type of intervention:
	  • educational – for example, this might be a poster for raising awareness around eco-anxiety or a training course for teachers in providing support to children in relation to eco-anxiety
	  • clinical – for example, this might be psychological therapy such as CBT

	• arts – this might be interpretive dance by young people for expressing climate emotions • financial – for example, a scheme put in place to support farmers during periods of flooding or drought, or financial support for working through flooding claims • intervention components – activities (describing what is being done), frequency of contact, length of time, any materials used • co-design element – was the intervention co-designed with users or partners, such as users inputting to the development of materials • mental health outcomes of interest and tools used for the measurement • evaluation – was there any evaluation conducted and if so, how was it evaluated (for example, in terms of feasibility, accessibility, acceptability and cost-benefit analysis) and what were the main evaluation results?
Study limitations	• highlight any key limitations of the study identified by the authors

Additional data

Table 8. Intervention characteristics

Table 8a. Cognitive behavioural therapy (CBT)-based interventions

Study	Intervention type	Target population	Climate exposure	Provider	Country; setting
Cobham 2024	Trauma-focused CBT: • children identified through school-based screening for PTSD, anxiety, and depression (intervention assessed on n=19 children) • child programme: 8 weekly sessions (90 minutes), plus a booster session 2 to 4 weeks later • parent programme: 2 weekly sessions (90 minutes) at school • individual sessions with workbooks, imaginal exposure (storytelling), cognitive restructuring, emotion regulation, behavioural activation	Primary school children and parents	Flooding	In-person delivery by trained clinical psychology trainees and 2 experienced clinicians	• Australia (Queensland) • school classrooms
Goetz 2023	Unified Protocols for Transdiagnostic Treatment of Emotional Disorders in Children and Adolescents (UP-C/A): • intervention assessed on n=149 children • average of 6.4 sessions (range = 3 to 15), each 30 to 60 minutes • weekly or biweekly, in-person sessions • UP-A: 8 modules (teens), UP-C: 15 sessions of 5 modules (children) • components: emotion education, mindfulness, cognitive reappraisal, behavioural activation, exposure techniques • an optional parent module addressed behaviours such as discipline, overprotection, criticism, and emotional modelling	Children 5 to 17 years	Hurricanes (Hurricane Harvey 2017)	In-person delivery by master's level clinicians trained in UP-C/A	• United States (Texas) • co-located school based and primary care clinics in hurricane-affected areas
Weinzimmer 2024	Unified Protocol for Transdiagnostic Treatment of Emotional Disorders (UP): • intervention assessed on n=279 adults • 2 to 21 sessions (mean = 5.22), 30 minutes each, typically biweekly • tailored to clients' availability and needs, with focus on core UP components and 'top problems' rated collaboratively (0 to 10 scale)	Adults 18 to 65	Hurricanes (Hurricane Harvey 2017)	In-person delivery by master's level clinicians trained in UP through a 1.5-day workshop and ongoing supervision	• United States (Houston) • community health clinics
Lebenbaum 2024	Trauma-focused CBT (modelling study): • 12 sessions, 1.5 hours each over 3 months	Adults	Wildfires	Model assumed delivery by psychotherapists ($175 USD per hour)	• Canada (examples from Alberta and British Columbia used to model wildfires)

Study	Intervention type	Target population	Climate exposure	Provider	Country; setting
Belleville 2018; Frenette 2023; Binet 2022	Therapist-assisted online CBT (RESILIENT) 12 modules covering: • psychoeducation (PTSD, sleep, depression), prolonged and imaginal exposure, cognitive restructuring, behavioural activation, sleep hygiene, stimulus control, sleep restriction, problem solving, mindfulness and self-compassion • interactive tools: sleep diary, breathing exercises, cognitive tools, problem-solving guides Participants could access up to 12 weekly 30 minute therapist contacts via phone, video, or email • Intervention assessed on n=136 participants (n=69 intervention; n=67 waitlist control)	Adults	Wildfires (Fort McMurray fire 2016)	Virtual delivery through a digital platform and remote therapists ≤ 30 minutes per week	• Canada • RESILIENT web portal
Lindhe 2023; Lindhe 2024	Individually tailored and therapist supported CBT for eco-anxiety (ClimateCope): • modules included behavioural activation, anxiety management, nature connectedness, self-compassion, stress management, cognitive restructuring, and sleep strategies • weekly therapist guidance via asynchronous messaging (15 minutes per week per participant) • modules tailored using pre-treatment data and interviews • intervention assessed on n=60 participants (n=30 intervention; n=30 waitlist control)	Adults with climate distress	Climate-related distress	Virtual delivery through a digital platform and weekly therapist guidance through messaging (15 minutes per week)	• Sweden • ClimateCope via the Iterapi platform
Obuobi-Donkor 2024	CBT-based supportive text message intervention: • daily one-way text messages for 3 months • messages were designed by clinicians based on CBT principles to support self-care, manage negative thoughts, and build resilience • messages sent at 9am daily (local time) • self-enrolment by texting a keyword to a short code with option to opt-out at any time	Adults	Wildfires	Virtual delivery through text messages	• Canada • Text4Hope programme
Renn 2024	Trauma-focused CBT: • 10 group sessions (1 hour each) and 1 to 3 individual • core components: Cognitive restructuring, trauma narrative development, emotional regulation, relaxation exercises, problem-solving skills, social skills training • parent component: 2 optional sessions to increase trauma awareness and family support	Children 10 to 18 years	Hurricane (Hurricane Michael)	In person delivery in group based and individual sessions by trained clinician	• United States (Florida) • School-based primary and secondary schools

Study	Intervention type	Target population	Climate exposure	Provider	Country; setting
Gavrilova 2024	Digital Psychoeducation and CBT- based modules: • weekly check-ups (mood, anxiety, sleep tracking with feedback) • psychoeducation about the impact of disasters and common psychological reactions and experiential coping exercises (for example, mindfulness, relaxation, parenting tips) • CBT-based modules: behavioural Activation (for depression), written exposure therapy (for PTSD), CBT for sleep • links to national disaster support resources	Adults	Hurricanes (Hurricanes Harvey, Irma, Maria, Florence, Michael)	Virtual delivery through mobile app with tailored feedback provided	• 5 locations in the United States affected by category 4 and 5 hurricanes • mobile app Bounce Back Now (BBN)
Becker 2022	Trauma-informed dynamic psychotherapy tailored for PTSD: • weekly 50-minute individual sessions for between 40 to 48 weeks Techniques: establishing therapeutic alliance, emotional insight, processing trauma, uncovering unconscious conflict, and meaning reconstruction	Firefighters	Wildfires (2017 forest fires)	In-person delivery by a therapist in an isolated setting with suitable furniture in a building easily accessible by firefighters	• Portugal • fire stations

Table 8b. Acceptance and commitment therapy (ACT) and mindfulness interventions

Study	Intervention type	Target population	Climate exposure	Provider	• Country; setting
Gunn 2022; Gunn 2023	Fully automated self-guided resource based on Acceptance and Commitment Therapy (ACT): • 5 interactive modules delivered over 10 weeks • content includes psychoeducation, ACT-based exercises, farming metaphors, videos, audio tools, practical strategies, and reminders. • format: text, audio, video, quizzes, goal setting, personalised feedback • tailored tip sheets (for example, on sleep, conflict resolution, grief, drought stress) • optional SMS reminders and a toolbox feature for users to save preferred tools	Adult farmers and their families	• drought-related stress • rural occupational challenges Environmental uncertainty	Virtual delivery through a digital platform	• Australia • Ifarmwell platform
Muller 2024	Digital mindfulness meditation program: • 6 weeks mindfulness programme • 42 audio-guided meditations (10 to 12 minutes each) • 4 courses: ‘Mindful Living I,’ ‘Strengthening Resilience,’ ‘Being Happy’ (loving kindness or meta meditation), ‘Taking Care of Yourself’ • formats: focused attention (for example, breath, body) and open monitoring meditations • self-paced via the Balloon app on digital devices	Adults	• wildfires	Virtual delivery through a mobile app (entirely self-paced)	• Germany • Balloon mobile app

Heinz 2022	Mind-body programme using trauma-informed yoga and meditation: • iRest trauma-informed yoga • Classes included breathing techniques, restorative poses, and meditative practices • 59% of surveyed participants attended weekly	Adults	• wildfires	In person delivery taught by 60 trained instructors	• California, United States • community-based

Table 8c. Psychoeducation and mental health literacy interventions

Study	Intervention type	Target population	Climate exposure	Provider	Country; setting
Cowlishaw 2022	Skills based trauma informed psychosocial programme (SOLAR): • 5 weekly one-hour sessions • included skills-based components designed to address trauma related symptoms • developed by an International Expert Group in accordance with the UK Medical Research Council guidelines for developing a complex intervention	Adults	• compound events: wildfires, drought, pandemic related lockdowns	Delivered one-on-one by trained community members in person or remotely	• Victoria, Australia • community-based: SOLAR programme
Heinz 2022	Skills for psychological recovery programme: • daily mood tracking via Photo Affect Meter • self-guided, audio-assisted tools for stress, grief, anger, and self-care • psychoeducation on PTSD and disaster recovery • teen-specific modules addressing school and peer relationships • referrals to local and national crisis resources • push notifications and reminders to promote engagement	Adolescents	• wildfires (2017 Tubbs wildfire)	Delivered virtually via the mobile app	• California, United States • Sonoma Rises mobile app

Levesque 2024	Classroom-based educational intervention:
	• intervention co-developed with Green Minds MB (interdisciplinary experts across environmental, clinical and school psychology, environmental sciences and education)
	• focus on coping theory and experimental education models
	• 5 experiential learning activities:
	  ○ emotion mind mapping
	  ○ climate story sharing
	  ○ mindful outdoor stroll using 5 senses
	  ○ mindful breathing exercise
	  ○ activities to cultivate positive emotions
		Children and adolescents 11 to 14 years	• awareness of climate change	Delivered in classrooms by teachers	• Canada
					• school-based

Table 8d. Screening and linkage interventions

Study	Intervention type	Target population	Climate exposure	Provider	Country; setting
Crompton 2023	Opportunistic mental health screening embedded in a general health service with referral to specialist mental health programmes (SMHPs): • PTSD screening administered during general health calls for adults • Single item behavioural/emotional screening for children • Information provision and referrals for those identified at risk • referrals processed to local SMHPs within 24 to 72 hours	Adults and children	• Flooding	Phone-based screening	• Queensland, Australia • initial contact phone-based, treatment in-person
Schwartz 2022	Community outreach program facilitating linkage into formal mental health care: • providers contacted participants to introduce the program, identified barriers to mental health care and assisted in attending a mental health appointment • participants were considered 'linked' after their first mental health appointment • ongoing follow-up to support continued engagement • provided support such as transport reimbursement and coordination with local providers	Adults	• hurricanes • flooding (Hurricane Sandy)	Phone-based recruitment by linkage coordinators. Coordinators accompanied participants to their first mental health appointment with either state-funded post-Sandy mental health providers, clinical psychologists in private practice, substance abuse clinics, and mental health clinics offering a range of therapy options.	• New York, United States • phone-based recruitment, in-person treatment

Table 8e. Community-based, participatory-based or nature-based interventions

Study	Intervention type	Target population	Climate exposure	Provider	Country; setting
Hart 2011	Rural Adversity Mental Health Program (RAMHP); community development intervention: • delivered Mental Health First Aid training, community forums, and educational materials to improve understanding of mental health, promote early help seeking, and reduce stigma • developed tailored activities and outreach for Aboriginal communities, older farmers, women, young people, and those with substance use issues • employed community mental health workers and consultant psychiatrists to support interagency networks, strengthen referral pathways, and integrate services across health, agriculture, and finance sectors • offered direct support through a rural mental health telephone line, partnered on wellbeing events and adapted the model to respond to other events like floods, fires, and economic hardship	Adults in rural communities	• drought • environmental degradation • flooding	In person training, outreach events, support lines	• New South Wales, Australia • community-based

Study	Intervention type	Target population	Climate exposure	Provider	Country; setting
Eicholtzer 2023	Educational and participatory citizen science programme: • project aimed to test a new prototype camera to monitor small animals and conduct an ecological study in fire-prone vegetation • volunteer participants received and maintained 2 wildlife camera traps for 8 months • responsibilities included weekly maintenance (15 minute per week), data upload, optional data analysis via Zooniverse, participation in a Facebook group, and receiving monthly updates and educational materials	Adults	• biodiversity loss • awareness of climate change	In-person, delivered by a research team	• Victoria, Australia • community-based
Calabria 2024	Community-based psychosocial intervention (Climate Café): • climate cafés facilitated by the Climate Psychology Alliance, mostly virtual due to COVID-19, with 2 in-person cafés • single session or ongoing informal group spaces • facilitated by trained individuals • participants engage in open sharing, guided by prompts (for example, natural objects or images) • emphasis on validating feelings • sessions lasted approximately 2 hours	Adults	• climate-related distress	Mostly virtual online meetings, typically facilitated by 2 facilitators from the Climate Psychology Alliance	• UK • online meetings
Foley 2023	Nature prescribing intervention: Interventions discussed with nature prescribing providers included: • outdoor walks, forest bathing, gardening, horticulture therapy, and social engagement in green spaces	Adults Nature prescribing interventions were discussed with general practitioners, therapists, allied health professionals, and health service managers)	• climate-related distress	Delivery formats discussed with nature prescribers included self-led interventions, provider facilitated, individual, group-based and online	• Australia • varied clinical, indoor and outdoor settings

Table 8f. Structural adaptation interventions

Study	Intervention type	Target population	Climate exposure	Provider	Country; setting
Page 2024	Home energy efficiency and thermal comfort upgrades. Tailored upgrades based on a residential efficiency assessment including: • ceiling and underfloor insulation, draught proofing • reverse cycle heating or cooling installation or gas heater replacement • downlight changes and window coverings Cost: average AU$2,809 (maximum AU$3,500 per home)	Adults	• cold indoor temperatures	Structured interventions delivered by local government	• Melbourne, Australia • households

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UK Health Security Agency (UKHSA) prevents, prepares for and responds to infectious diseases, and environmental hazards, to keep all our communities safe, save lives and protect livelihoods. We provide scientific and operational leadership, working with local, national and international partners to protect the public's health and build the nation's health security capability.

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