

## Systematic Review Protocol

### Title

What behavioural outcomes (mitigatory or adaptive) are associated with climate change risk perceptions in Asia?

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### Keywords

proenvironmental behaviour, asia, climate change risk perception, climate change mitigation, climate change adaptation

### Background

Developing nations across the globe express higher concern about warming temperatures, biodiversity loss and the changing climate (Kim & Wolinsky-Nahmias, 2014; Lee et al., 2015). Although climate scientists have issued warning about limiting temperature rise to 1.5° C (Heogh-Guldberg et al., 2018), a world of up to 3°C of warming seems increasingly possible (Vinichenko et al., 2023). Global South communities are disproportionately impacted by climate change through increased heatwaves in India (Debnath et al., 2023), extreme flooding in Pakistan (Rannard, 2022) and prolonged drought and starvation in Kenya (Pietromarchi, 2021). Understanding personal and community-oriented climate risk perceptions are imperative to devise audience-specific climate communications, disaster resilience interventions, policy actions. Previously, climate risk perception has predicted behavioural intentions of mitigatory actions (Xie et al., 2019), climate activism (Smith & Leiserowitz, 2014) and adaptive behaviour (van Valkengoed & Steg, 2019). Past reviews and meta-analyses have focussed on climate risk perception in specific (van der Linden, 2017; Weber, 2016; Xia et al., 2022), and its relationship with other constructs such as cultural worldviews (Xue et al., 2014) or biospheric values (Martin, 2023). However, such reviews derive conclusions from predominantly western studies conducted in WEIRD (Western, Educated, Industrialist, Rich & Democratic; Henrich et al., 2010) populations. Although risk perception may be generalizable in the global south through its replications in Egypt (Elshirbiny, 2018) or Vietnam (Ngo et al., 2020), the associated mitigatory or adaptive behavioural outcomes have been seldom studied in the Asian population. Additionally, no previous studies have synthesized primary literature to identify sociodemographic correlates of climate concern in the current population. The current systematic review aims to identify sociodemographic correlates of climate risk perception and mitigatory or adaptive behavioural outcomes of interest predominantly in Asian populations.

### Theory of change or causal model

N/A

### Stakeholder engagement

Stakeholder engagement is envisioned to inform the systematic review throughout its process: from

reviewing primary research questions and protocol to advising on search comprehensiveness and directing us to relevant grey literature. The stakeholders approached for this review will be climate behaviour policymakers or advisors in India, academics in environmental psychology within and outside India and other private stakeholders. The draft protocol will be presented to stakeholders to provide their input via email consultation and suggested changes will be incorporated. Appendices of the final manuscript will contain a summary of suggested changes to the protocol and search strategy by the stakeholders.

### **Objectives and review question**

This review aims to synthesize the sociodemographic risk profile of climate concern in an under-represented Asian population and highlight associated mitigatory behavioural outcomes. Therefore, our primary research question is: What are the socio-demographic characteristics of individuals from Asia that express risk perception about the changing climate? And, our secondary research question is: What mitigatory or adaptive behavioural outcomes are associated with climate risk perception in Asia?

### **Definitions of the question components**

Population: Central, East and Southeast Asian populations (see Coding Criteria for Extraction for detailed list of countries). Exposure: The study must measure climate change risk perception, defined as “people’s beliefs, attitudes, judgements and feelings as well as behavioural and social dispositions they adopt towards hazards that threaten the things they value” (Pidgeon, 1998). Related constructs may be: concern about climate change, attitudes towards global warming or climate change and worry or threat evaluations about climate change. Outcome: The study results must include measurement of behavioural outcomes either mitigatory (i.e. actions/ measures taken to reduce causes of climate change such as greenhouse gas emissions reductions), adaptive (behaviours that help individuals/ communities adjust to impacts of climate change), intentions or willingness-to-pay. The study should also mention socio-demographic details (e.g. age, gender, education and/or political affiliation) associated with the population that expressed climate risk perception. See Eligibility Criteria (8.1) for study design criteria.

### **Search strategy**

We will use a search strategy that includes bibliographic and web-based search engines to identify relevant primary literature at the intersection of perceptions of climate risk and mental health outcomes. See below for identified sources (Bibliographic and web-based engines). Relevant literature will be identified through use of the search strategy mentioned below and also manually searching references of relevant literature identified during the search. Stakeholder input will also be sought to identify further relevant literature to be included.

### **Bibliographic databases**

We will conduct bibliographic searches through the following databases, all institutionally subscribed by AI, ZX & AJK: ScienceDirect, PubMed, APA PsycNet, EBSCO Psychology & Behavioral Sciences Collection, Scopus, ProQuest Scholarly Journal (Arts & Humanities, Asian & European Business Collection, Psychology database, Indian Multidisciplinary database, Environmental Science Database, Eastern and South Asia Multidisciplinary Database, Public Health Database, Social Science Database), Web of Science Core Collection (Social Sciences). The search options will seek full text and peer-reviewed articles in the English language only. Our search string is as follows: ("climate change" OR "climate var\*" OR "environ\* chang\*" OR "climat\* warm\*" OR "environ\* var\*") AND (belief OR "risk perception" OR attitude OR perception OR concern OR awareness OR knowledge) AND (behav\* OR mitig\* OR adapt\* OR action OR intention) AND ("asia" OR "south asia" OR "east asia" OR "central asia" OR "south east asia" OR "india" OR "pakistan" OR "thailand" OR "vietnam" OR "sri lanka" OR "singapore" OR "malaysia" OR "korea" OR "japan" OR "china" OR

"taiwan" OR "israel" OR "palestine" OR "philippines" OR "hong kong" OR "arab" OR "middle east" OR "bangladesh" OR "afghanistan" OR "iran" OR "united arab emirates" OR "qatar" OR "syria"). We will include literature published between 2010-2023 that are empirical research articles only.

### **Web-based search engines**

Web-based search engines such as Google Scholar will be used to gather grey literature (such as preprints, working papers, government reports) to increase a balanced picture of the available empirical literature. The same strategy as 8.1 will be used. However, the first 10 pages of results when sorted by relevance shall be considered in order to reduce inclusion of irrelevant references.

### **Organisational websites**

We will refer to public perceptions summary reports in an Asian population published by Yale Centre for Climate Change and World Resources Institute. Climate Change in the Chinese Mind reports are also considered.

### **Comprehensiveness of the search**

A list of benchmark studies was selected based on prior expertise of the review team beyond the search strategy. These studies have been identified because they have looked at the central construct of the systematic review ('climate risk perception') predominantly in south Asian or global south populations. Additionally, artificial intelligence tools such as "Consensus" and "Connected Papers" were used to identify a total of 15 relevant benchmark papers. Based on the search key terms of the benchmark articles, the search strategy was updated by adding additional keywords.

### **Search update**

On review of the protocol from stakeholders, the search strategy will be updated if it is considered severely limiting in its strategy to address the research questions. Corresponding author will advertise a call for relevant peer-reviewed literature through social media (i.e. twitter), on review of the literature the search terms may be updated for greater relevance in addressing research question.

### **Screening strategy**

Articles will first be screened for relevance to the research questions through title and abstract screening by at least 4 independent reviewers and at least 2 independent reviewers in parallel. Full-texts of articles with relevant abstracts will be retrieved, those that cannot be accessed will be mentioned in the final review. Full-texts of the retrieved texts will be reviewed by at least two independent reviewers, and by at least 2 independent reviewers in parallel, and a final report will be generated to identify included and excluded manuscripts at the title & abstract and full-text level.

### **Eligibility criteria**

Studies will be eligible based on the following inclusion criteria: Population: Study participants must be Central, East or South-east Asian populations. Exposure: All studies must include measurement of climate change risk perception or associated constructs such as climate change concern, attitudes towards global warming or climate change, worry or threat evaluations towards climate change or global warming. Outcome: All studies must include measurement and reporting of behavioural outcomes associated with climate risk perception, which may be mitigatory (e.g. household energy, mobility, dietary choice), adaptive (for e.g. recycling, farming adaptations, plastic reduction or hazard preparation behaviour), behavioural intention or "willing-to-pay". All studies must include at least one sociodemographic marker of population such as age, gender, political identification, education or income. Study design: Empirical study with primary data focusing on quantitative, qualitative, or mixed-methods research published in English between 2010-2023. Eligible studies include surveys, interviews, focus groups, observational studies, and experimental designs that

provide insights into the socio-demographic characteristics and behavioral outcomes related to climate change risk perception in Central, East, and Southeast Asia. Quantitative studies should employ statistical analysis to explore correlations or causal relationships between socio-demographic factors and climate risk perception, while qualitative studies should provide in-depth analysis of individual or group attitudes and behaviors. Mixed-methods studies that combine these approaches are particularly valuable for a comprehensive understanding of the complex interplay between socio-demographics and climate change responses. Studies must have a clear methodological framework and robust data collection and analysis procedures to ensure the reliability and validity of their findings.

### **Consistency checking**

At least four reviewers will together review at least 10 search results at the title and abstract levels and at least 10 searches at the full-text level to identify consistency of search results and their relevance to the eligibility criteria. The results of the consistency check will be compared between the reviewers and any disagreements will be resolved. If agreement of the reviewers is below 80%, an additional set of articles will be reviewed at full-text level until 80% agreement (or minimum kappa value of 0.4) is achieved.

### **Reporting screening outcomes**

Outcome of searching and screening will be reported through a ROSES flow diagram (ROSES, 2017) as created on the CADIMA platform (Kohl et al., 2018). The final manuscript will identify the eligibility criteria and reasons for exclusion at the title and abstract and full-text stages.

### **Study validity assessment**

Following previous systematic reviews that synthesized evidence on climate change outcomes (Charlson et al., 2021; Moll et al., 2022), we will use the National Heart, Lung, and Blood Institute's Quality Assessment tools (National Heart, Lung and Blood Institute, 2021) to evaluate internal validity of observational, cohort and cross-sectional design studies. For qualitative research studies, the Critical Appraisal Skills Programme's Qualitative Studies Checklist (CASP, 2023) will be used. At least 2 reviewers will individually code study validity into categories of 'poor', 'acceptable' or 'good' through the CADIMA (Kohl et al., 2018) platform. Results from studies that were categorized as 'poor' will not be included in the final results, but validity assessments will be included in Appendices

### **Consistency checking**

Consistency of study validity assessments will be established by asking the two independent reviewers to review the validity of 5 selected full-text studies to arrive at validity conclusions of poor, acceptable or good. Any disagreements will be discussed amongst the reviewers and any additional assessment criteria will be clarified. A minimum kappa value of 0.4 will be considered as acceptable to establish consistency.

### **Data extraction strategy**

Bibliometric data relevant to study author, year, title and DOI will be extracted. Study location, design and sample size will also be identified for all studies. To answer research question 1, the nature of operationalization of climate concern and sociodemographic correlates will be extracted and manually coded to support visualizations. To answer research question 2, behavioural outcomes specifically studied within each full-text will be extracted and summarized into mitigatory or adaptive behaviour categories. The final report will contain a tabular representation of data extraction, similar to Moll et al. (2022).

### **Meta-data extraction and coding strategy**

same as above

### **Consistency checking**

Data will be extracted by the first author (AI) and will be checked for consistency by another member of the team. If disagreements arise, data extraction strategy will be revised and adjusted to arrive at 100% agreement.

### **Potential effect modifiers/reasons for heterogeneity**

We expect the following to be reasons for heterogeneity in included studies: study location, study design, sample size, operationalization of climate concern, operationalization of behavioural outcomes and type of population studied (both geographical and specific groups of people). This list will be expanded on review of selected studies and reported in the final manuscript.

### **Type of synthesis**

Narrative only

### **Narrative synthesis methods**

Our narrative synthesis will include: a descriptive table of included studies, thematic assimilation summary relevant to research question 1 and 2. The descriptive table will include data extracted (as mentioned above) and validity assessments of included studies. The textual description will be thematically categorized to answer research question 1 by summarizing the sociodemographic correlates of climate concern. We will also evaluate the similarities and differences in conceptualization of climate concern across the studies and associated validity assessments. To answer research question 2, we will thematically summarize the most common behavioural outcomes reported and differences in the relationships identified between climate concern and mitigation or adaptation outcomes. We will provide a summary of the quality of studies included in the final review through a table included in the appendices.

### **Quantitative synthesis methods**

N/A

### **Qualitative synthesis methods**

N/A

### **Other synthesis methods**

N/A

### **Assessment of risk of publication bias**

N/A

### **Knowledge gap identification strategy**

An objective of the current review is to map the current evidence in the Asian population. Therefore, we will generate a figure mapping the studies conducted across Asian geographic locations. We will further identify key theoretical and methodological gaps in the study of climate concern and behavioural outcomes in Asian populations.

### **Demonstrating procedural independence**

Reviewers who have previously authored papers relevant to the current review will not be involved in the review process at any stage. The primary authors (AI, AJK) have not previously published on review topics. Author ZX has previously published a meta-analysis on climate perception and therefore, and will not take on retrieval or review roles for papers authored by them.

## Competing interests

No competing interests to declare

## Funding information

No funding associated with the review.

## Author's contributions

AI, AJK & ZX conceptualized the initial systematic review; AI wrote the systematic review protocol; AJK & ZX provided review and edited the systematic review protocol. Further author contributions will be updated in the final manuscript

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None

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