

MOTIVATION

Wildfire Smoke as a Unique Climate Hazard

- Human exposure becoming **widespread**
- Expansion and intensification driven by climate change
- Poses **significant health risks** (contributes to estimated 30,000 deaths/year, Ma et al., 2024)
- Unique **spatial and temporal dynamics**:
 - Transboundary, impacts experienced far from origin
 - Coverage and duration range from mild to extreme
 - Danger does not correlate with visible factors

THEORY

Protection Motivation Theory (PMT)

- Originally developed in public health to explain how individuals react proactively to threats (Rogers, 1975)
- Used as a framework to explore the cognitive and psychological factors that contribute to risk perception

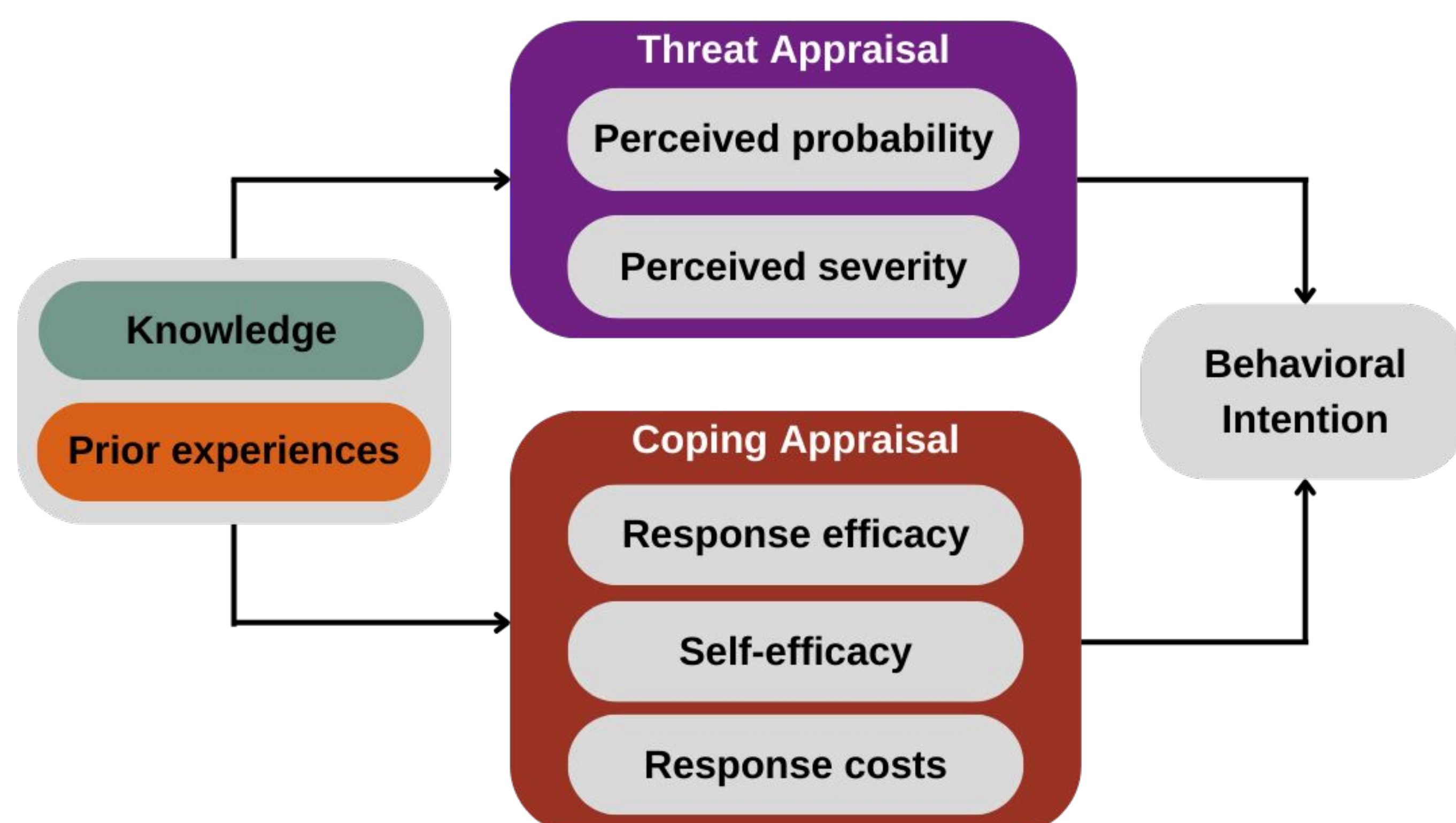


Figure 1. Schematic representation of the Protection Motivation Theory.

OBJECTIVES

Guiding Questions

- How have people experienced smoke events?
- How do they perceive risk of smoke?
- What role does knowledge or information play in risk perception about smoke?
- How do people perceive their ability to reduce their risk of exposure?

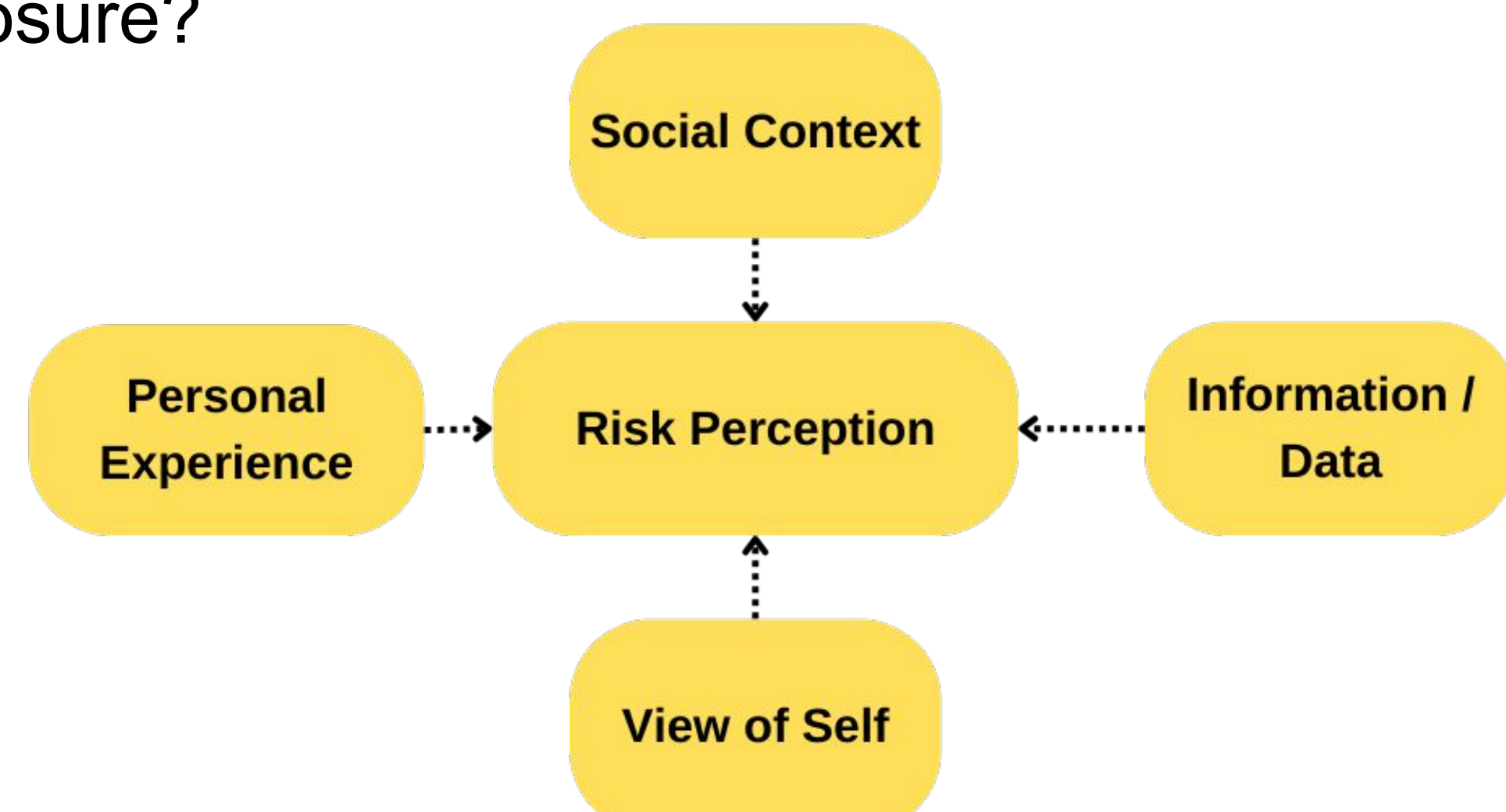


Figure 2. Conceptual diagram of the four areas identified in the literature review as contributors to individual-level risk perception of wildfire smoke.

METHODS

Literature Review Process

- Conducted per PRISMA 2020 protocol for systematic reviews (BMJ, 2021)
- Search terms included: “wildfire smoke” + (“risk perception”, “behavioral response”, “human behavior”, “protective behavior”, “experience”, “knowledge/information”, “social vulnerability”, “threat appraisal”, “coping appraisal”)
- Searches through: Scopus, ProQuest, Web of Science, Google Scholar
- 133 records initially compiled; duplicates removed and article abstracts and full text were screened for relevance
- Resulted in 64 articles for inclusion in literature review

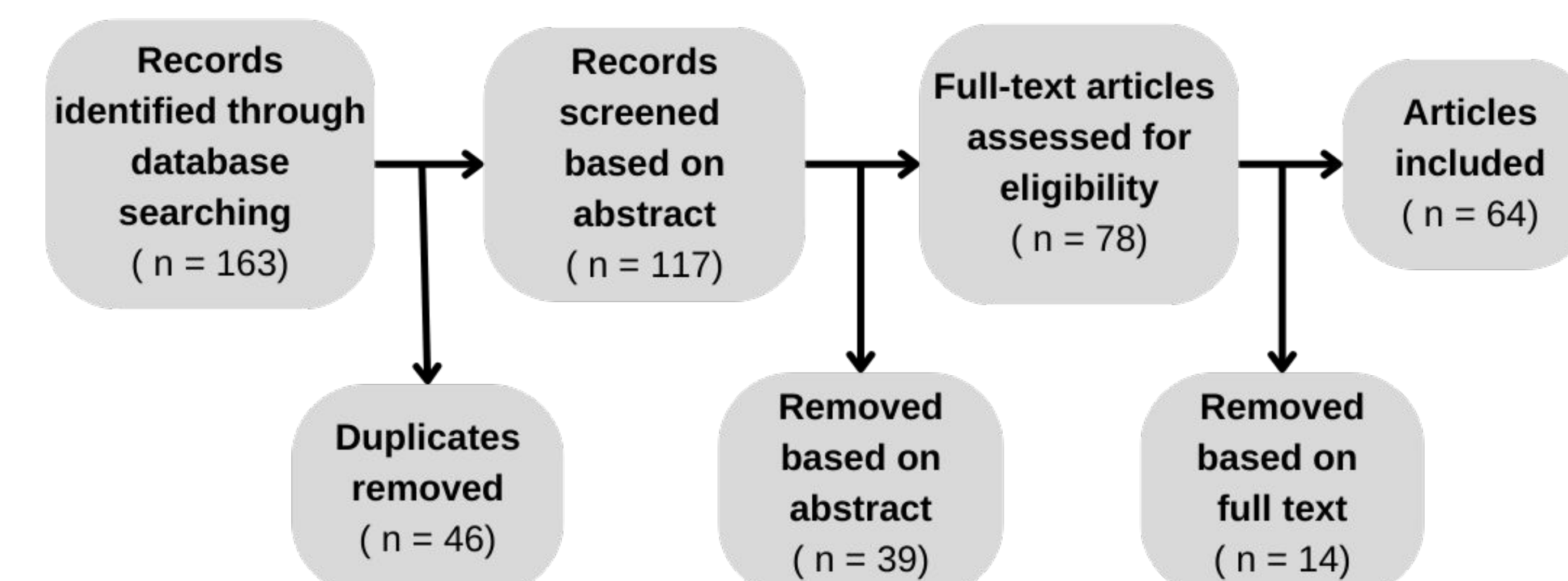


Figure 3. Flow diagram of literature review search process

FINDINGS

Knowledge / Information

- Targeted information about health impacts of climate change increased knowledge & behavioral intention (Kreslake et al., 2016)
- Wearable air quality technology made people more aware of air quality and led to concern (Park et al., 2023) and small-scale behavior change (Bales et al., 2019)
- Disconnect between knowledge and coping appraisal: people may understand that risks exist but not know which actions could help protect them (Burke et al., 2022; Williamson et al., 2022)

Prior Experiences

- Descriptions of particular symptoms and emotions (e.g., respiratory symptoms; fear, stress, lethargy) and reported actions (e.g., staying inside, circulating air with fan or air conditioning)
- Mixed findings in the literature as to whether experiences with wildfire smoke heightened, reduced, or had no relationship with risk perception (Ghasemi et al., 2020; Champ & Brenkert-Smith, 2016; Larsen et al., 2021)
- Not just direct personal experiences - social networks and connections shape where and how people learn about smoke and shape threat perceptions (Santana et al., 2021)
- Health impacts of smoke are slow onset, reducing threat salience
- Impacts are often experienced by others in distant locations

Threat Appraisal

- Residents of study areas did recognize wildfire smoke as a health threat (e.g., Batdorf and McGee, 2023; Duan and Bombara, 2023)
- Individuals who are more vulnerable to smoke may not perceive themselves to be – i.e., mismatched view of self
- Recognizing risk is higher for some “other” group with health conditions (Mirabelli et al., 2018, Santana et al., 2021) could be interpreted as reduced concern for “healthy” individuals
- Some evidence that people’s sense of health is fairly well-calibrated with risk (Hano et al., 2020)

Coping Appraisal

- High costs of most effective interventions (e.g., whole-house air filtration/AC) posed barrier for some based on socioeconomic status, housing status, and other demographic factors (Batdorf & McGee, 2023; D’Evelyn et al., 2022; Riden et al., 2020).
- Norms around wildfire smoke may be in flux as smoke is a relatively novel hazard (Prince et al., 2024), potentially influencing self-efficacy
- Disruption to social bonds as people stay inside/at home could dissolve community cohesion and lower efficacy (Humphreys et al., 2022)

CONCLUSIONS

Future Research Directions

- Further exploring the role of how people construct their own vulnerability on risk perceptions around smoke
- How do attributes of the hazard itself influence risk perception and response? Additional exploration of “status quo bias” with respect to smoke and the role of rapid change in frequency and severity of wildfire smoke as contributors to risk perceptions
- Need for studies that incorporate a comprehensive view of the factors reviewed – studies largely looked at one or a few areas
- Literature explores wildfire smoke independently (or, in some cases, alongside wildfire risks). In reality, climate hazards are often experienced together or in close succession. How do people think about protecting themselves when experiencing several hazards at once, which may have conflicting safety advice or require a tradeoff between short-term and long-term safety?

BACKGROUND

Wildfire Smoke as a Unique Climate Hazard

- **Exposure to wildfire smoke is becoming more widespread** as climate conditions drive the expansion and intensification of the fire season.
- Wildfire smoke poses **significant health risks**, especially for vulnerable populations (young children, older adults, individuals with respiratory or cardiovascular conditions).
- The **spatial and temporal dynamics** of wildfire smoke make it **difficult to perceive and comprehend**. Smoke can range from mild to extreme in both coverage and duration, and damage from smoke does not necessarily correlate with visible factors meaning that the risk may be hard to perceive even as it is being experienced.

OBJECTIVE

Research Motivation

- Understanding how people currently comprehend and cope with wildfire smoke exposure is an important and under-studied area.

Guiding Questions

- How have people **experienced smoke events and associated risk**?
- How do they **perceive their ability to reduce their exposure** to smoke?
- What are the **cognitive and psychological factors** reported in the literature that contribute to poor risk perception around wildfire smoke?

METHODS

Literature Review Process

- Keyword construction: “wildfire smoke” + (“risk perception”, “behavioral response”, “human behavior”, “protective behavior”, “experience”, “data/information”)
- Ran searches through four databases: Scopus, ProQuest, Web of Science, and Google Scholar
- Duplicates removed and article abstracts and full text were screened for relevance, per process outlined below

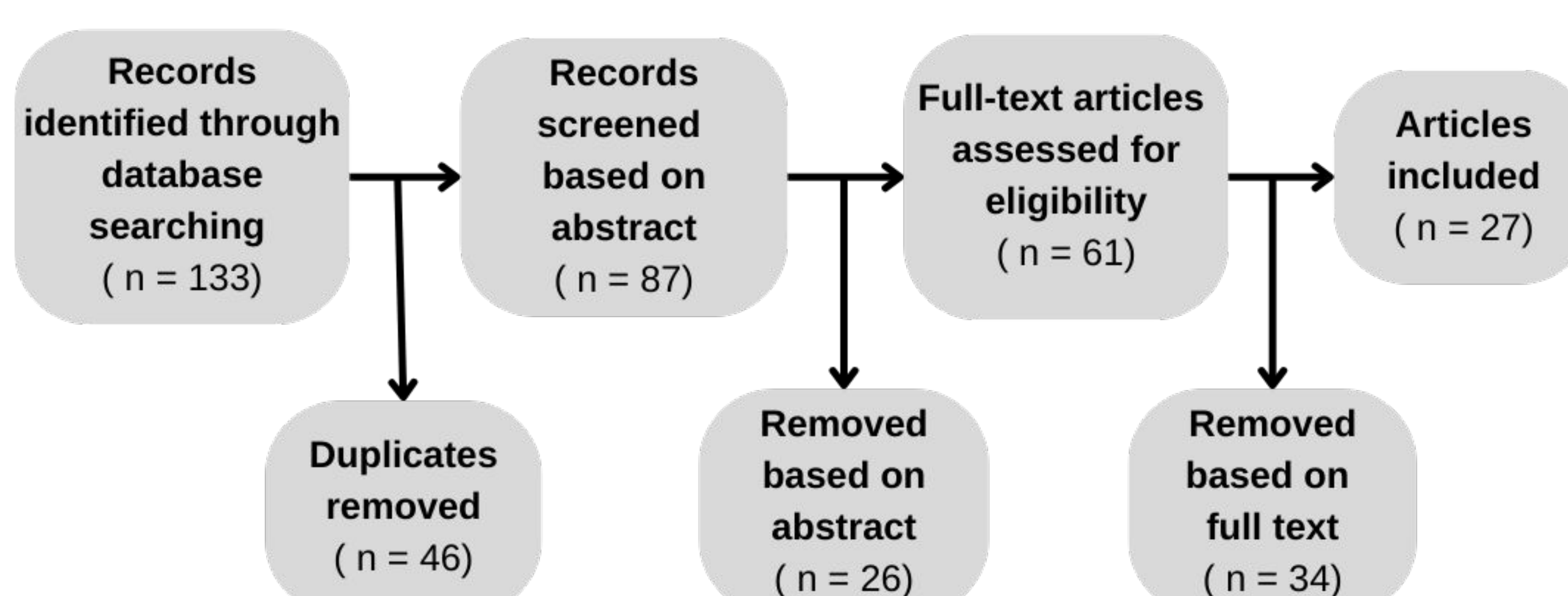


Figure 1. Flow diagram of literature review search process

FINDINGS

Individual Responses to Wildfire Smoke

Smoke Experiences

- A number of published studies explore the experiences, health-related and otherwise, of individuals who have experienced wildfire smoke. These papers largely descriptively discussed *who* has experienced *particular symptoms or emotions* (e.g., respiratory symptoms; fear, stress, lethargy) and what they *reported doing* (e.g., staying inside, circulating air with a fan or air conditioning system) as a result of smoke exposure (see, for example, Burke et al., 2022; Dodd et al., 2018; Hoshiko et al., 2023; Palinkas et al., 2023; Rappold et al., 2019)
- Also discussion of community-level behavior: creating indoor recreation areas for public use (Dodd et al., 2018), establishment of community air monitoring networks (Durkin et al., 2020), health ambassador programs (Herbert et al., 2023), creation of clean air centers and deployment of portable air cleaners (Davison et al., 2021)

Barriers to Protective Behavior

- **Behavioral barriers:** poor risk perception, psychological factors (see below)
- **Structural barriers:** information provision, socioeconomic status, occupation, housing status, mobility, race/ethnicity, other demographic factors (Batdorf & McGee, 2023; D’Evelyn et al., 2022; Riden et al., 2020).

Health Communications

- Literature mixed about whether smoke communications to date have been effective in sharing information about potential threats and disseminating information about how people can protect themselves – i.e., people may know the risks of wildfire smoke but may be left confused about how to protect themselves (Williamson et al., 2022)

Risk Perceptions of Smoke

Through the review, four factors were identified in the literature as especially relevant to construction of risk perception:

1. Personal Experience

Surprisingly mixed findings in the literature as to whether experiences with wildfire smoke heightened, reduced, or had no relationship with risk perception (see, for example, Ghasemi et al., 2020; Champ & Brenkert-Smith, 2016; Larsen et al., 2021). Relationship of time and pace to risk perception: slow-onset, far-off impacts

2. Information / Data

Providing targeted information about health impacts of climate change can increase knowledge & behavioral intention (Kreslake et al., 2016). Wearable air quality technology made people more aware of air quality and led to concern (Park et al., 2023) and small-scale behavior change (Bales et al., 2019).

3. View of Self / Construction of “Vulnerability”

Potential for mismatch between those who public health messaging and experts consider “vulnerable: and the people those messages are aimed at. A perception that risk is higher for some “other” group (Mirabelli et al., 2018, Santana et al., 2021) could be interpreted as a reduced need for concern for “healthy” individuals, though there is some evidence that people’s sense of health is fairly well-calibrated with risk (Hano et al., 2020)

4. Social Context

Social networks and connections shape where and how people learn about smoke and shape threat perceptions (Santana et al., 2021). Norms around wildfire smoke may still be in flux as smoke is a relatively novel hazard (Prince et al., 2024), disruption to physical bonds could dissolve community cohesion (Humphreys et al., 2022).

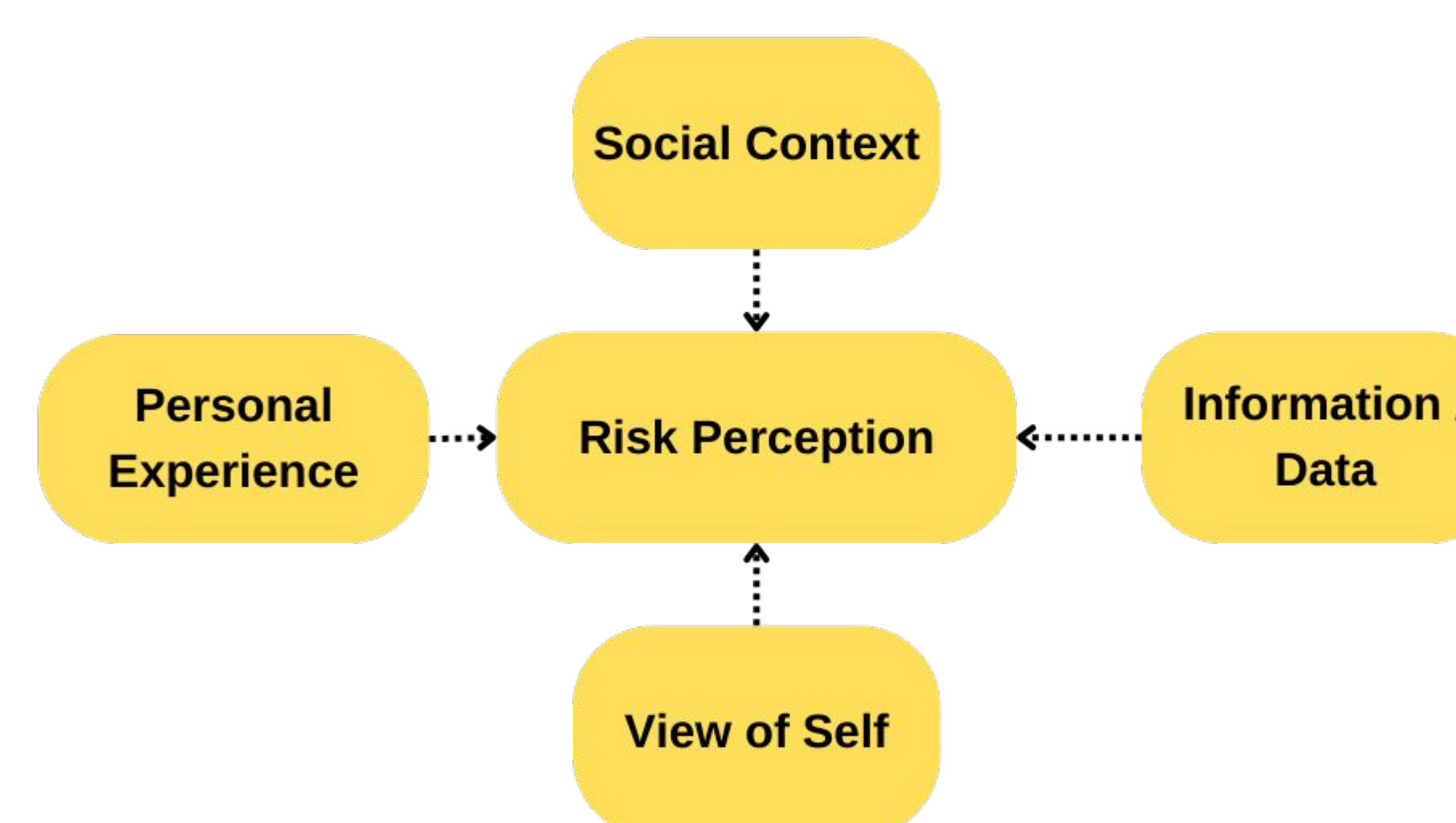


Figure 2. Conceptual diagram of the four areas identified in the literature review as potentially contributing to individual-level risk perception of wildfire smoke.

THEORY

Protection Motivation Theory (PMT)

- Several papers explored in the literature review utilized specific psychosocial frameworks to explore risk perception and behavioral responses to wildfire smoke.
- PMT was originally developed in public health to explain how individuals react proactively to threats (Rogers, 1975).

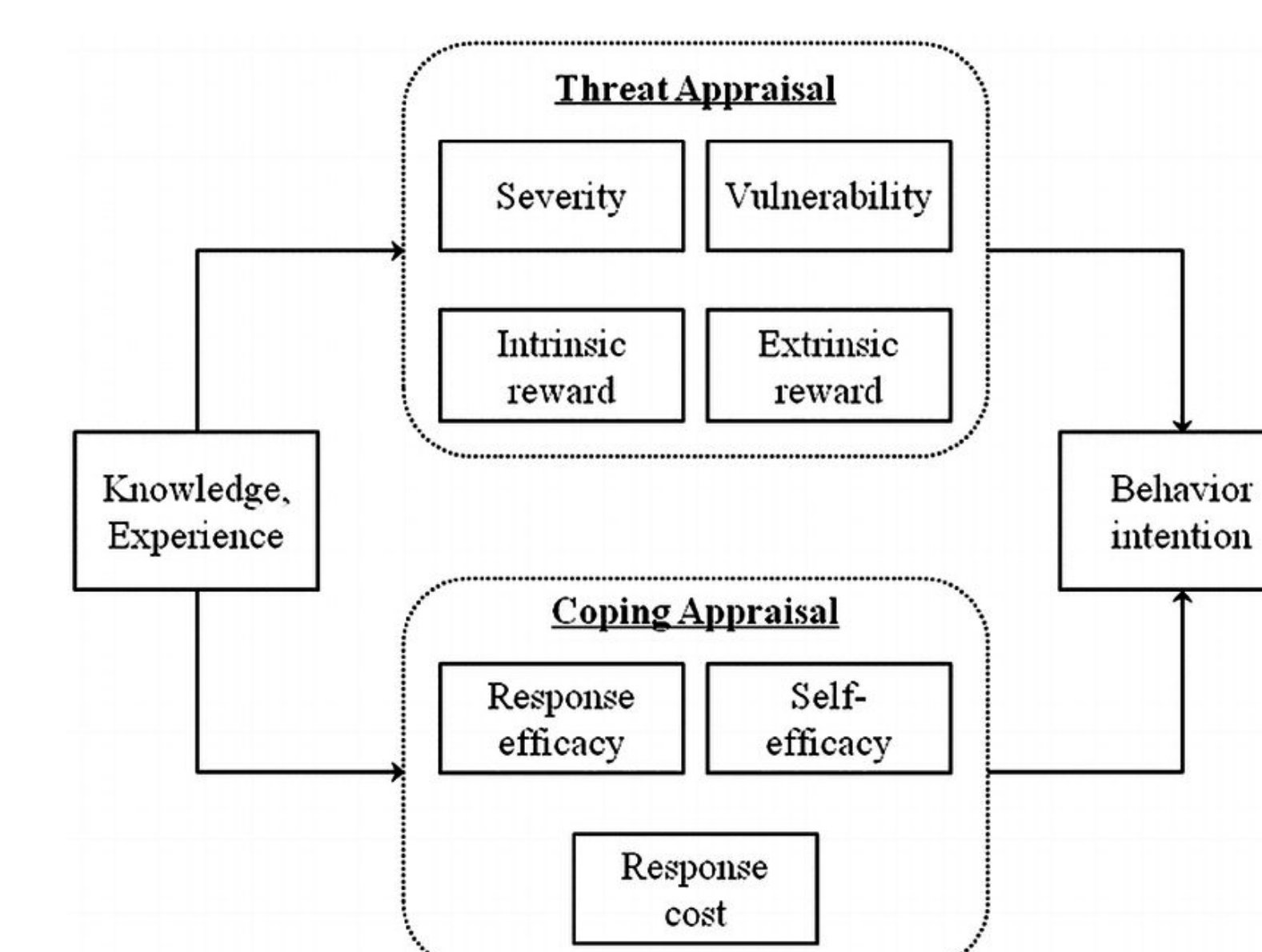


Figure 3. Schematic representation of the Protection Motivation Theory. Figure reproduced from Xiao et al., 2014.

Incorporating Additional Factors

- Bringing together themes from across the review, Santana et al. (2021) explore wildfire smoke protective actions and develop a conceptual model that bridges the PMT, information, personal experience, social processes, and individual factors.

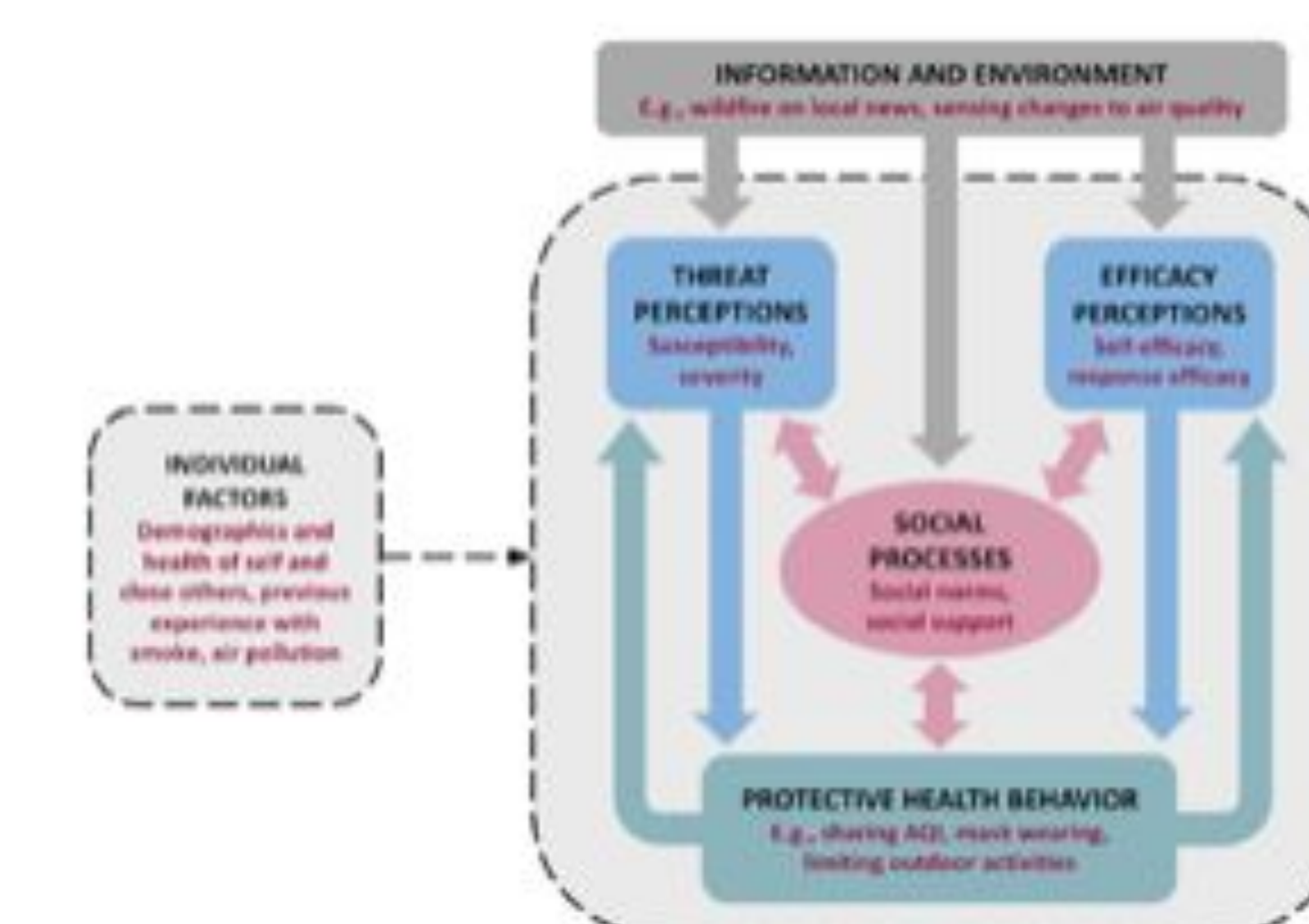


Figure 4. Conceptual framework of wildfire smoke protective behavior. Figure reproduced from Santana et al., 2021.

CONCLUSIONS

Future Research Directions

- Exploring qualitative conceptual frameworks with quantitative survey data
- Further exploring the role of self-view on risk perceptions around smoke
- Explore “status quo bias” and the role of time and pace of wildfire smoke as contributors to risk perceptions
- Need for studies that incorporate a holistic view of the factors reviewed – studies largely looked at one or a few areas.