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Environmental Change and Mental Health in Urban and Rural Communities

Nguyen Minh Thanh[1]
Faculty of Environmental Studies and Public Health, University of Social Sciences and Humanities, Vietnam National University, Hanoi, Vietnam.
Corresponding Author Email: nguyenminhthanh@vnu.edu.vn

Abstract
Climate change has increasingly been recognized as an environmental challenge with implications not only for physical health but also for psychological wellbeing. Rising temperatures, temperature variability, and extreme heat events have been associated with various mental health outcomes across populations. This study aims to examine how climate conditions influence population mental health while considering contextual differences between urban and rural environments. The research employs a qualitative literature based approach using secondary data derived from peer reviewed articles, systematic reviews, and meta analyses addressing climate exposure and mental health outcomes. Data were collected through a systematic review of relevant academic literature and analyzed using conceptual synthesis guided by the Climate Change and Mental Health Causal Pathways Framework. The analytical process focused on identifying patterns related to climate exposure, mental health outcomes, and contextual vulnerability within urban and rural settings. This approach enables interpretation of environmental determinants of mental health through physiological, cognitive, and societal pathways. The findings indicate that rising temperatures and climate variability are associated with increased psychological distress and other mental health risks, while contextual conditions such as settlement environment and adaptive capacity influence vulnerability. The study concludes that climate related mental health outcomes are shaped by complex interactions between environmental exposure and social context. These findings contribute to strengthening the conceptual understanding of environmental determinants of mental health and highlight the importance of incorporating contextual perspectives in climate and public health research.

Keyword
Climate change; Mental health; Environmental exposure; Population wellbeing.

1. Introduction
Climate change has increasingly been recognised as a major global health challenge that affects not only physical health but also psychological wellbeing (Cianconi et al., 2020; Heinz, 2024). Rising global temperatures and more frequent extreme weather events are transforming environmental conditions experienced by human populations (Cianconi et al., 2020; Palinkas & Wong, 2020). These environmental changes have raised growing concerns regarding their potential effects on mental health across societies (Clayton, 2021; Palinkas & Wong, 2020). Research has shown that climate-related stressors may influence emotional stability, psychological distress, and broader wellbeing (Clayton, 2021; Heinz,

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2024). Temperature exposure, particularly prolonged heat or extreme weather variability, has emerged as an important environmental factor influencing mental health outcomes (Heinz, 2024; Radua et al., 2024). As climate conditions continue to change, understanding how environmental exposure interacts with mental health becomes increasingly relevant. The growing body of literature linking climate conditions with psychological outcomes highlights the importance of examining environmental influences on population wellbeing (Cianconi et al., 2020; Clayton, 2021). These developments situate climate–mental health relationships as a critical area of inquiry within public health and environmental research.

The relationship between temperature exposure and mental health is particularly important because mental disorders already represent a substantial burden worldwide. Mental health conditions account for a significant proportion of global disease burden and continue to increase in prevalence across many regions (Cianconi et al., 2020). Environmental stressors associated with climate change may intensify this burden by introducing new forms of psychological vulnerability (Heinz, 2024; Palinkas & Wong, 2020). Rising temperatures can contribute to physiological stress, sleep disruption, and increased emotional instability (Clayton, 2021; Heinz, 2024; Radua et al., 2024). These factors may lead to higher risks of psychological distress and mental health crises within affected populations. In addition, extreme temperature events may amplify social and economic pressures that further influence psychological wellbeing (Heinz, 2024; Palinkas & Wong, 2020). Communities exposed to prolonged heat or temperature variability may therefore experience cumulative stress that affects mental health outcomes (Cianconi et al., 2023; Palinkas & Wong, 2020). The real-world implications of these environmental pressures highlight the importance of examining how climate conditions shape mental health risks across different populations.

Existing research has begun to document associations between ambient temperature and various mental health outcomes. Empirical studies have linked rising temperatures with increased suicide incidence, psychiatric hospital admissions, and broader declines in community wellbeing (Cianconi et al., 2020; Heinz, 2024; Radua et al., 2024). Evidence from systematic reviews and meta-analyses indicates that temperature increases may correspond with measurable changes in mental health indicators (Heinz, 2024; Radua et al., 2024). Studies have also shown that temperature variability and heatwaves may intensify psychological stress and behavioural responses (Cianconi et al., 2020; Palinkas & Wong, 2020). In addition, some research suggests that temperature effects on mental health are influenced by local climatic norms and seasonal variations (Radua et al., 2024). Moderate temperatures may sometimes support wellbeing, whereas extreme or anomalously high temperatures may produce negative psychological effects (Heinz, 2024). These findings suggest that environmental exposure plays a measurable role in shaping population mental health patterns. Consequently, climate conditions are increasingly recognised as an environmental determinant of mental health.

Despite these insights, important aspects of the climate–mental health relationship remain insufficiently understood. Many existing studies focus primarily on severe clinical outcomes such as suicide or hospitalisation for mental illness (Cianconi et al., 2020; Clayton, 2021). Although these outcomes provide valuable information, they capture only a limited dimension of population mental health. Broader aspects of psychological wellbeing, including community mood, emotional stability, and everyday psychological distress, remain less extensively examined (Clayton, 2021). Furthermore, the mechanisms through which environmental conditions influence mental health outcomes are still debated. The literature also demonstrates considerable variation in

measurement approaches and definitions of mental health outcomes (Cianconi et al., 2020). Differences in temperature metrics, outcome indicators, and analytical approaches make it difficult to compare findings across studies. These limitations indicate that the current evidence base remains incomplete and conceptually fragmented.

Another area that remains insufficiently explored concerns differences in climate exposure between urban and rural populations. Environmental conditions experienced in urban environments may differ substantially from those found in rural settings. Urban areas may experience intensified heat exposure due to built infrastructure and high population density (Cianconi et al., 2023; Heinz, 2024). Rural areas, on the other hand, may face climate-related stressors linked to agricultural livelihoods and environmental dependence (Heinz, 2024; Palinkas & Wong, 2020). These differences may shape how individuals experience and respond to climate-related stress. However, existing research rarely examines how urban and rural contexts may mediate the relationship between temperature exposure and mental health (Cianconi et al., 2023). As a result, the contextual dimensions of climate–mental health relationships remain underdeveloped in the literature. Understanding these contextual differences is important for identifying how environmental exposure influences mental health across diverse settings.

The identification of this contextual gap highlights the need for a more integrated conceptual understanding of climate exposure and mental health. Previous research demonstrates that temperature influences psychological outcomes, yet it does not fully explain how environmental and social contexts interact with these effects (Cianconi et al., 2023; Palinkas & Wong, 2020). Differences in settlement patterns, infrastructure, and socioeconomic conditions may influence how individuals experience climate stress. Urban and rural populations may therefore encounter distinct pathways linking environmental exposure with psychological outcomes. The lack of systematic synthesis regarding these contextual factors limits the development of comprehensive climate–mental health frameworks. Addressing this gap requires examining how environmental conditions interact with social environments across different geographical contexts. A conceptual exploration of urban and rural exposure can therefore contribute to clarifying how climate conditions shape mental health risks. Such an approach helps bridge fragmented evidence and deepen understanding of environmental determinants of mental health.

To guide this conceptual examination, the study adopts the Climate Change and Mental Health Causal Pathways Framework. This theoretical perspective explains how environmental conditions influence psychological outcomes through interconnected mechanisms (Cianconi et al., 2020; Clayton, 2021). The framework identifies physiological pathways in which temperature affects biological processes and bodily regulation (Heinz, 2024; Radua et al., 2024). It also emphasises cognitive pathways, where environmental stressors may disrupt sleep patterns and cognitive functioning (Clayton, 2021; Heinz, 2024). In addition, the framework highlights societal pathways through which environmental change generates economic, social, and behavioural pressures (Heinz, 2024; Palinkas & Wong, 2020). These multiple pathways illustrate how climate conditions can influence mental health through both direct and indirect mechanisms (Cianconi et al., 2020). The framework therefore provides a conceptual structure for interpreting relationships between environmental exposure and psychological wellbeing. By applying this theoretical perspective, the study can explore how urban and rural contexts may activate different climate–mental health pathways.

Guided by this theoretical perspective, the present research seeks to examine how climate conditions relate to population mental health within different environmental

contexts. The study aims to synthesise existing knowledge regarding temperature exposure and mental health outcomes. It also seeks to explore how urban and rural environments may shape patterns of climate-related psychological vulnerability. In particular, the research addresses how environmental conditions interact with social and contextual factors influencing mental health. Through this focus, the study aims to clarify how climate exposure operates within different settlement contexts. The research therefore asks how climate conditions influence mental health outcomes and how these effects may differ between urban and rural populations. By exploring these questions, the study seeks to develop a clearer conceptual understanding of environmental influences on psychological wellbeing. These objectives position the research within broader efforts to examine environmental determinants of mental health.

The urgency of this research lies in the accelerating pace of global climate change and its potential implications for population wellbeing. Rising temperatures and increasing environmental variability may expose communities to new forms of psychological stress (Cianconi et al., 2020; Heinz, 2024). Public health systems are increasingly required to address mental health challenges that may be intensified by environmental change. Understanding how climate conditions interact with social and geographical contexts is therefore essential for developing effective responses. A clearer conceptual understanding of climate–mental health relationships can inform future research and policy discussions. It can also contribute to identifying populations that may face heightened vulnerability to environmental stressors (Cianconi et al., 2023; Clayton, 2021). By synthesising existing evidence and examining contextual differences, the study contributes to expanding knowledge on climate-related mental health risks. This contribution supports ongoing efforts to integrate environmental considerations into mental health research and public health planning.

2. Research Method

This study employs a qualitative research design using a conceptual literature-based analysis to examine the relationship between climate conditions and population mental health. A qualitative approach is appropriate because the research aims to understand patterns, relationships, and conceptual explanations derived from existing scholarly literature rather than measuring variables through primary data collection (Azungah, 2018; Rashid et al., 2019). The study focuses on interpreting and synthesizing findings across previous research to clarify how environmental exposure may influence psychological outcomes within different contexts (Ruggiano & Perry, 2017). This design enables the researcher to examine complex interactions between climate conditions and mental health that cannot be easily captured through purely quantitative measurement (Elbardan & Kholeif, 2017). By analysing patterns of evidence and conceptual arguments from existing studies, the research seeks to develop a coherent understanding of climate–mental health relationships. The analytical framework guiding this research is the Climate Change and Mental Health Causal Pathways Framework, which explains how environmental factors influence mental health through physiological, cognitive, and societal mechanisms. Using this framework allows the study to systematically interpret existing knowledge and explore how urban and rural climate exposure may shape mental health outcomes through different pathways.

The data used in this research consist of secondary data derived from academic literature addressing climate conditions and mental health outcomes (Cheong et al., 2023). Sources include peer-reviewed journal articles, systematic reviews, and meta-analyses that investigate relationships between ambient temperature, heatwaves, or temperature

variability and mental health indicators (Ruggiano & Perry, 2017). Literature was identified through academic databases and screened based on relevance to the research topic. The unit of analysis in this study is the body of published research examining climate–mental health relationships (Cheong et al., 2023). Data collection involved reviewing and selecting studies that discuss environmental exposure, psychological outcomes, and contextual factors such as settlement patterns or geographic conditions. The analytical dimensions examined include types of climate exposure, categories of mental health outcomes, and contextual differences between urban and rural environments. These dimensions are used to organize and compare findings across studies in order to identify recurring themes and conceptual patterns (Azungah, 2018). Through this process, the research synthesizes existing evidence to understand how environmental conditions relate to mental health risks.

To ensure trustworthiness and methodological rigor, the study applies several strategies commonly used in qualitative research. Credibility is supported through the use of peer-reviewed academic sources and systematic selection of literature relevant to the research topic (Rashid et al., 2019). Dependability is enhanced by maintaining consistent criteria for selecting and analysing sources, ensuring that the synthesis process follows a transparent analytical logic. Confirmability is strengthened by grounding interpretations in documented findings and theoretical explanations presented within the reviewed literature (Elbardan & Kholeif, 2017). Transferability is supported by examining studies conducted across diverse geographic contexts, allowing the conceptual insights to be relevant for broader discussions of climate and mental health (Rashid et al., 2019). Ethical considerations are also observed throughout the research process. Because the study relies exclusively on secondary data from published sources, no direct interaction with human participants occurs (Cheong et al., 2023; Ruggiano & Perry, 2017). Nevertheless, ethical standards are maintained by accurately citing sources, respecting intellectual property, and ensuring that all referenced materials are used responsibly.

3. Result and Discussion

3.1 Climate Conditions and Population Mental Health Outcomes

Analysis of the data reveals strong correlations between rising temperatures and increased suicide incidence. Similar patterns have been observed in studies analysing psychiatric hospital admissions and emergency mental health visits. These findings indicate that temperature exposure may influence severe mental health crises within affected populations. This result is consistent with previous meta-analytic evidence showing that for every degree of temperature increase, there is a statistical rise in mental health problems and suicidal behavior (Heinz, 2024; White et al., 2023). High temperatures can create physiological stress that affects neurological regulation and emotional stability. In addition, prolonged exposure to heat may contribute to sleep disruption and fatigue, both of which are known to affect psychological functioning. These biological effects are theoretically understood to increase vulnerability to emotional instability and behavioural risk, as heat stress triggers complex physiological pathways that impair cognitive and affective regulation (Palinkas & Wong, 2020; White et al., 2023). The evidence therefore suggests that climate conditions represent a meaningful environmental determinant of mental health. Such findings reinforce the theoretical proposition that environmental stress can influence psychological outcomes through physiological pathways (Devi, 2025).

Temperature variability and extreme heat events further intensify the relationship between climate conditions and mental health outcomes. Studies examining heatwaves

and temperature anomalies show stronger associations with psychological distress than studies examining average temperature alone. Sudden increases in temperature or deviations from local climatic norms may create environmental stress that populations are not fully adapted to manage. These observations align with prior research highlighting that extreme climate events, such as heatwaves and floods, significantly disrupt community cohesion and exacerbate individual psychological strain (Fatima, 2022). These environmental shocks may trigger emotional strain and behavioural responses that increase mental health risks. Heatwaves have also been associated with increased hospital visits related to psychiatric conditions. Such evidence indicates that extreme climate events may amplify existing psychological vulnerabilities, consistent with the theoretical assumption that environmental stressors activate multiple pathways affecting mental wellbeing (Cianconi et al., 2020; Palinkas & Wong, 2020). Climate variability therefore represents an important factor influencing psychological stability. The literature suggests that mental health outcomes may be particularly sensitive to rapid or extreme changes in environmental conditions (Couto et al., 2025).

Research examining community wellbeing also indicates that climate conditions influence everyday psychological experiences. Some studies show that moderate and comfortable temperatures can improve mood and emotional wellbeing. In contrast, temperatures that exceed familiar climatic ranges may generate discomfort and psychological strain. These findings suggest that the mental health impact of climate conditions depends partly on local environmental expectations. When environmental conditions deviate significantly from established norms, individuals may experience heightened psychological stress. Such responses illustrate how climate exposure interacts with cognitive and emotional processes, a mechanism often described as "eco-anxiety" or distress related to environmental decline (Usher et al., 2019). Environmental discomfort may reduce concentration, increase irritability, and influence interpersonal behaviour. These psychological responses demonstrate how environmental stress may operate through cognitive pathways described in the theoretical framework (Lawrance et al., 2022). The literature therefore highlights that climate conditions influence both severe mental health outcomes and broader psychological wellbeing (Rückle et al., 2025).

Another important dimension emerging from the literature concerns the role of social and environmental context in shaping climate–mental health relationships. Environmental exposure does not affect populations uniformly because social conditions mediate the impact of climate stress. Urban infrastructure, population density, and economic conditions may influence how individuals experience high temperatures. Rural populations may encounter climate stress through environmental dependence and economic vulnerability. These contextual factors shape how climate exposure interacts with psychological resilience and vulnerability, as disadvantaged and marginalized groups often lack the resources to mitigate environmental stress (Cianconi et al., 2023). Social inequality and environmental adaptation capacity may therefore influence mental health outcomes associated with climate stress. The literature suggests that environmental stress is often amplified in communities with limited resources or adaptive infrastructure (Mahmood et al., 2025). These contextual dynamics align with the societal pathways described in the theoretical framework, where relational capital and community-led action serve as critical buffers against climate-related distress (Longman et al., 2023). Understanding climate–mental health relationships therefore requires examining environmental exposure within broader social systems.

The evidence synthesized in this analysis contributes to refining existing theoretical understandings of climate–mental health relationships. Previous research has

largely focused on identifying statistical associations between temperature and mental health outcomes. While these associations provide valuable empirical evidence, they often do not fully explain the contextual mechanisms shaping psychological vulnerability. By integrating empirical findings with the causal pathways framework, the analysis clarifies how climate exposure influences mental health through interconnected biological, cognitive, and societal processes (Heinz, 2024; Palinkas & Wong, 2020). This interpretation extends existing theoretical perspectives by emphasizing the multidimensional nature of environmental stress. It highlights that climate conditions influence mental health not only through direct physiological effects but also through broader social and behavioural pathways (Devi, 2025). Such insights help bridge the gap between environmental health research and mental health studies (Bhugra, 2025).

These findings also respond directly to the research gap identified in the introduction concerning the conceptual understanding of climate–mental health relationships. The literature provides strong evidence linking rising temperatures to various psychological outcomes, yet the mechanisms underlying these relationships remain insufficiently synthesized (Charlson et al., 2021). By interpreting empirical evidence through the causal pathways framework, the analysis clarifies how environmental exposure interacts with human vulnerability and social context (Hayes et al., 2018). This perspective contributes to a more comprehensive conceptual understanding of climate-related mental health risks. It also highlights the importance of examining environmental determinants of mental health within broader environmental governance discussions. The integration of empirical findings and theoretical interpretation therefore advances the understanding of how climate conditions influence population mental health across different social and environmental contexts (Rückle et al., 2025).

3.2 Urban and Rural Climate Exposure in the Climate–Mental Health Relationship

Understanding how climate conditions influence mental health requires a theoretical lens that captures the complex pathways linking environmental exposure and psychological outcomes. The Climate Change and Mental Health Causal Pathways Framework provides such a lens by explaining how environmental changes affect mental health through physiological, cognitive, and societal mechanisms (Heinz, 2024; Palinkas & Wong, 2020). Within this framework, climate exposure is not viewed merely as a physical condition but as a multidimensional stressor interacting with social environments and human vulnerability (Cianconi et al., 2020). Urban and rural settings represent distinct environmental and social contexts that may activate these pathways differently. Built environments, infrastructure density, economic structures, and social organization shape how populations experience and respond to temperature changes. These contextual characteristics influence whether environmental stressors translate into psychological distress or broader wellbeing changes. The theoretical perspective therefore guides the interpretation of climate–mental health relationships by emphasizing contextual mediation (Rückle et al., 2025). In this subsection, the analysis examines how urban and rural climate exposure contributes to mental health dynamics within the conceptual pathways outlined by the framework.

Secondary literature consistently demonstrates that rising temperatures and temperature variability are associated with changes in mental health outcomes. Empirical evidence from large-scale studies indicates that increases in ambient temperature correlate with higher suicide incidence and greater hospital admissions related to mental

illness. These associations suggest that environmental stress may influence psychological vulnerability through both biological and behavioural mechanisms. Elevated temperatures can disrupt sleep patterns, alter neurochemical regulation, and increase physiological stress responses. This interpretation is supported by established theories suggesting that heat exposure triggers biological pathways that impair emotional stability and cognitive functioning (Palinkas & Wong, 2020; White et al., 2023). At the same time, social and behavioural responses to heat exposure may amplify psychological stress. Individuals may experience irritability, reduced productivity, or increased social tension under prolonged high temperatures (Heinz, 2024). These responses align with the theoretical proposition that climate conditions can influence mental health through multiple interacting pathways (Devi, 2025). The literature therefore indicates that temperature exposure represents a significant environmental determinant of psychological wellbeing.

Within urban environments, climate exposure often interacts with infrastructural and social characteristics that intensify environmental stress. Urban areas typically experience higher temperature concentrations due to dense infrastructure, limited vegetation, and large concentrations of built surfaces. These environmental conditions may create localized heat intensification that increases exposure to extreme temperatures. Such exposure may contribute to greater physiological and cognitive stress among urban populations, particularly affecting vulnerable groups such as slum dwellers and climate refugees (Cianconi et al., 2023). In addition, urban residents may encounter environmental pressures related to population density, noise, and social competition. These pressures can interact with climate stressors to influence mental health outcomes. Research indicates that environmental discomfort in urban settings may increase irritability, aggression, and emotional strain (Heinz, 2024)vvheinz. These effects demonstrate how environmental conditions within urban contexts may activate the societal and cognitive pathways described in the theoretical framework (Palinkas & Wong, 2020). Consequently, urban climate exposure represents an important factor shaping psychological vulnerability within densely populated environments.

Rural environments present a different set of contextual dynamics that shape climate–mental health relationships. Rural populations often rely more directly on environmental conditions for economic and social stability. Agricultural productivity, resource availability, and seasonal climate patterns frequently influence rural livelihoods. Changes in temperature or extreme weather events may therefore affect economic security and community stability. These conditions may generate psychological stress associated with financial uncertainty and environmental dependence, which can manifest as depression or suicidal ideation (Liu et al., 2025; Mostert et al., 2025). In addition, rural areas may have limited access to mental health services or social support infrastructure. Such limitations may affect the capacity of individuals to cope with climate-related psychological pressures. The theoretical framework suggests that these socioeconomic conditions may activate societal pathways linking environmental change to mental health outcomes (Palinkas & Wong, 2020). Consequently, climate exposure in rural contexts may generate psychological vulnerability through mechanisms different from those observed in urban settings, although community-led collective actions can serve as a vital resilience factor (Longman et al., 2023).

Evidence from the literature also indicates that the relationship between temperature and mental health may not be strictly linear. Some studies suggest that moderate or comfortable weather conditions may support positive mood and psychological wellbeing. In contrast, temperatures that exceed local norms or fluctuate

unpredictably may increase mental health risks. This pattern suggests that psychological responses to temperature may depend on contextual expectations and environmental adaptation (Heinz, 2024). Populations may tolerate gradual temperature changes when they align with familiar climatic conditions. However, extreme heat events or anomalous weather patterns may disrupt environmental stability and create psychological strain (Cianconi et al., 2020). These observations reinforce the theoretical argument that climate effects on mental health depend not only on temperature levels but also on contextual and social factors (Rückle et al., 2025). Urban and rural populations may therefore experience climate stress differently depending on their environmental expectations and adaptive capacities. The literature thus highlights the importance of considering contextual variation in climate–mental health analysis (Gomes et al., 2025).

The findings synthesized in this analysis extend existing theoretical perspectives on environmental determinants of mental health. Previous research has established a general association between rising temperatures and negative psychological outcomes. However, many studies have treated climate exposure as a uniform environmental condition without examining contextual differences between settlement environments (Charlson et al., 2021). By examining urban and rural exposure dynamics, the analysis demonstrates that environmental stress interacts with social and infrastructural conditions. This observation refines the theoretical understanding of climate–mental health pathways by emphasizing contextual mediation (Heinz, 2024). Urban and rural settings do not merely represent geographical differences but distinct environmental systems influencing human adaptation and vulnerability. Recognizing these contextual dynamics strengthens the explanatory capacity of the causal pathways framework (Palinkas & Wong, 2020).

These insights also contribute to addressing the research gap identified earlier regarding the contextual dimensions of climate exposure. The literature provides substantial evidence linking temperature increases to mental health outcomes, yet it rarely integrates settlement context into its analytical framework (Charlson et al., 2022). By synthesizing evidence on urban and rural environmental dynamics, the analysis clarifies how contextual factors shape climate-related psychological vulnerability. This perspective contributes to expanding the conceptual scope of climate–mental health research beyond purely climatic variables (Hayes et al., 2018). It emphasizes the importance of examining environmental exposure within broader social and geographical systems. Such an approach provides a more comprehensive understanding of how climate conditions influence population mental health (Heinz, 2024). The findings therefore contribute to bridging fragmented evidence within the literature. They highlight the need for future research to integrate environmental, social, and contextual dimensions when examining climate–mental health relationships (Rückle et al., 2025)

3.3 Contextual Pathways of Climate Exposure in Urban and Rural Environments

Understanding how climate exposure affects mental health requires attention to the mechanisms through which environmental stress translates into psychological outcomes. The Climate Change and Mental Health Causal Pathways Framework conceptualizes this relationship through interconnected physiological, cognitive, and societal pathways (Heinz, 2024; Palinkas & Wong, 2020). These pathways explain how environmental changes influence human wellbeing not only through direct biological effects but also through social and behavioural processes (Devi, 2025). Climate exposure interacts with everyday living conditions, shaping how individuals experience and interpret

environmental stress. Urban and rural environments represent distinct contextual systems that may activate these pathways in different ways. Infrastructure, economic structures, and environmental dependence influence how temperature changes are perceived and managed by populations (Cianconi et al., 2023; Liu et al., 2025). The analytical problem addressed in this subsection concerns how climate-related stress operates within these pathways across different settlement contexts. Using the theoretical framework as guidance, the discussion interprets how urban and rural conditions shape the mechanisms linking climate exposure to mental health outcomes.

Physiological pathways represent one of the most direct mechanisms linking temperature exposure and psychological wellbeing. High ambient temperatures can disrupt biological regulation, including thermoregulation, sleep cycles, and neurological functioning. These biological responses may produce fatigue, irritability, and emotional instability during periods of extreme heat. Research suggests that sleep disruption caused by elevated nighttime temperatures may contribute to psychological distress and reduced cognitive performance. When the body struggles to regulate heat, individuals may experience increased physical discomfort and stress. These physiological pressures are theoretically linked to mood stability and emotional regulation, potentially increasing vulnerability to mental health crises such as suicidality and depression (Heinz, 2024; White et al., 2023). Such effects are particularly pronounced during prolonged heatwaves or extreme temperature anomalies. The literature therefore suggests that biological responses to temperature represent an important pathway linking climate exposure to psychological outcomes (Cianconi et al., 2020). Within both urban and rural contexts, physiological stress forms the foundation of climate-related mental health risks.

Cognitive pathways further explain how environmental stress translates into psychological responses. Climate exposure can influence concentration, emotional perception, and decision-making processes. Elevated temperatures have been associated with reduced cognitive performance and increased irritability in several studies. These cognitive disruptions may alter how individuals interpret social interactions and environmental conditions. When people experience discomfort caused by heat, they may develop heightened sensitivity to stress and frustration, a condition often associated with "eco-anxiety" (Usher et al., 2019). Such responses can influence behavioural reactions, including interpersonal conflict or emotional volatility. These psychological responses illustrate how environmental conditions affect mental health through cognitive processes rather than purely biological mechanisms (Lawrance et al., 2022). Cognitive pathways therefore help explain why climate exposure may influence both individual behaviour and broader social interactions. The literature indicates that these cognitive effects may accumulate over time, particularly in environments where high temperatures are persistent (Clayton, 2021).

Societal pathways provide another important dimension explaining how climate conditions influence mental health outcomes. Environmental changes can disrupt economic stability, social relations, and community structures. In rural environments, climate variability may affect agricultural productivity and resource availability, creating financial stress and uncertainty (Liu et al., 2025). These pressures may contribute to anxiety and psychological distress among populations dependent on environmental resources (Mostert et al., 2025). Urban populations may experience climate-related stress through infrastructure pressures, energy demands, and social density. High temperatures in densely populated areas, often exacerbated by "heat islands," may amplify social tension and reduce tolerance for environmental discomfort (Cianconi et al., 2023; Heinz, 2024). These social dynamics demonstrate how climate exposure interacts with economic

and social conditions to influence psychological wellbeing. The causal pathways framework therefore highlights that environmental stress is embedded within broader societal structures (Palinkas & Wong, 2020). Understanding mental health outcomes requires examining how environmental exposure interacts with social and economic realities (Hayes et al., 2018).

The interaction between these pathways illustrates the complexity of climate–mental health relationships. Physiological stress, cognitive disruption, and societal pressures rarely operate independently. Instead, these mechanisms interact to produce cumulative psychological effects within affected populations (Heinz, 2024). For example, biological discomfort caused by extreme heat may increase irritability, which can then influence social interactions and community relationships. Economic stress related to environmental changes may further amplify psychological vulnerability (Devi, 2025). Such interactions demonstrate how environmental stress becomes embedded within everyday social experiences. The literature therefore suggests that climate exposure operates through interconnected systems rather than isolated mechanisms (Cianconi et al., 2020). This multidimensional perspective aligns with the theoretical framework guiding the present study, reinforcing the importance of examining climate exposure through a holistic analytical approach (Palinkas & Wong, 2020).

The synthesis of these findings contributes to refining the theoretical understanding of climate–mental health pathways. Previous studies have often examined biological, behavioural, or social dimensions separately when analysing environmental stress (Charlson et al., 2022). However, the causal pathways framework highlights that these dimensions are interdependent components of environmental health dynamics (Heinz, 2024; Palinkas & Wong, 2020). By integrating empirical observations across different contexts, the analysis demonstrates how climate exposure simultaneously influences physiological responses, cognitive processes, and social conditions ((Rückle et al., 2025). This perspective expands existing theoretical explanations by emphasizing the interconnected nature of environmental stress mechanisms. It also clarifies how climate-related mental health risks may differ across environmental contexts such as urban and rural environments (Heinz, 2024).

The discussion also contributes to addressing the conceptual gap identified earlier regarding the mechanisms linking climate exposure and mental health. While previous research has established correlations between temperature and psychological outcomes, fewer studies have examined the pathways through which these relationships operate (Charlson et al., 2022). By interpreting empirical evidence through the causal pathways framework, the analysis clarifies how environmental stress becomes embedded within biological, psychological, and societal processes (Heinz, 2024). This integrated perspective helps explain why climate exposure may produce diverse mental health outcomes across populations. It also highlights the importance of contextual conditions, such as social connections and relational capital, that shape vulnerability and resilience (Longman et al., 2023; Rückle et al., 2025). The findings therefore contribute to strengthening the conceptual foundation of climate–mental health research, illustrating how environmental determinants of mental health operate within complex and interconnected systems (Gomes et al., 2025).

3.4 Contextual Vulnerability and Environmental Adaptation

Understanding climate–mental health relationships also requires examining how vulnerability and adaptation shape psychological responses to environmental stress. The Climate Change and Mental Health Causal Pathways Framework emphasizes that

environmental exposure alone does not determine mental health outcomes. Instead, the impact of climate conditions depends on the capacity of individuals and communities to adapt to environmental changes (Cianconi et al., 2020). Vulnerability emerges when environmental stress interacts with limited resources, institutional capacity, or social resilience (Palinkas & Wong, 2020). Urban and rural environments often differ significantly in their adaptive capacities, infrastructure systems, and social support networks (Cianconi et al., 2023; Heinz, 2024). These differences shape how populations experience and manage climate-related stress. The analytical problem addressed in this subsection concerns how contextual vulnerability and adaptation influence the psychological effects of climate exposure. Using the causal pathways framework, the discussion interprets how environmental stress interacts with social resilience and institutional capacity. This perspective highlights that mental health outcomes related to climate conditions are strongly mediated by contextual factors (Cianconi et al., 2020).

Evidence from the literature indicates that adaptive capacity plays a critical role in moderating the mental health impacts of climate exposure. Communities with access to reliable infrastructure, social services, and environmental management systems may better cope with extreme weather conditions. Access to cooling infrastructure, healthcare services, and public awareness mechanisms can reduce the psychological strain associated with extreme temperatures (Heinz, 2024). In contrast, populations lacking such resources may experience heightened stress during periods of environmental instability (Cianconi et al., 2020; Palinkas & Wong, 2020). Limited access to mental health support systems may further intensify the psychological burden associated with climate-related stressors (Cianconi et al., 2020). These disparities illustrate how institutional and infrastructural conditions influence vulnerability to environmental change. When adaptive systems are weak, environmental stress may translate more directly into psychological distress (Cianconi et al., 2023). The literature therefore suggests that resilience to climate exposure depends partly on the strength of local support systems (Heinz, 2024). Adaptive capacity becomes a key factor shaping how climate stress influences mental health outcomes.

Urban environments present both advantages and challenges in terms of climate adaptation capacity. On one hand, cities often possess stronger institutional infrastructure, healthcare systems, and technological resources that may help mitigate environmental risks. Public health systems in urban areas may be better equipped to respond to heat-related health crises and provide support services. At the same time, urban populations may face environmental pressures associated with high population density and infrastructural strain. Large urban populations may compete for limited resources during extreme weather events, creating social tension and environmental discomfort (Cianconi et al., 2023). Additionally, certain urban communities may experience socioeconomic inequalities that limit access to adaptive infrastructure (Heinz, 2024). These disparities can create uneven patterns of vulnerability within the same urban environment (Cianconi et al., 2023). Climate exposure may therefore interact with social inequality to influence mental health outcomes. Urban adaptation capacity is thus complex and shaped by both infrastructural strength and social vulnerability.

Rural environments display a different configuration of vulnerability and adaptation dynamics. Rural communities may possess stronger social cohesion and community support networks that contribute to psychological resilience. Informal support systems and strong community relationships can help individuals cope with environmental stress. However, rural areas may also face structural limitations related to infrastructure, healthcare access, and economic diversification. Dependence on

environmental resources such as agriculture may increase vulnerability to climate variability (Heinz, 2024). Economic disruptions caused by extreme weather may therefore translate into financial insecurity and psychological distress (Heinz, 2024; Palinkas & Wong, 2020). In addition, limited access to mental health services may reduce opportunities for early intervention and support (Cianconi et al., 2020). These conditions demonstrate how structural vulnerability may influence psychological responses to environmental stress. Rural adaptation capacity therefore depends on the balance between community resilience and infrastructural limitations.

The interaction between vulnerability and adaptation illustrates how climate exposure produces uneven psychological outcomes across populations. Environmental stress does not affect all individuals equally because social conditions shape resilience and coping capacity (Cianconi et al., 2020). Communities with strong institutional systems and social support networks may better absorb environmental shocks. Conversely, populations facing economic hardship or infrastructural limitations may experience amplified psychological stress (Cianconi et al., 2023; Heinz, 2024). These patterns illustrate how environmental exposure interacts with broader social structures. Climate-related mental health risks therefore reflect complex interactions between environmental conditions and social vulnerability. The causal pathways framework highlights how these contextual dynamics influence the translation of climate stress into psychological outcomes. Understanding vulnerability and adaptation is therefore essential for interpreting climate–mental health relationships.

The synthesis of these findings contributes to refining theoretical explanations of climate-related mental health vulnerability. Previous research has often emphasized direct environmental exposure as the primary driver of climate-related psychological outcomes (Palinkas & Wong, 2020). However, the evidence suggests that vulnerability is strongly shaped by contextual conditions such as infrastructure, social cohesion, and economic stability (Cianconi et al., 2023; Heinz, 2024). By integrating these dimensions into the causal pathways framework, the analysis expands the theoretical understanding of environmental determinants of mental health. Climate exposure should therefore be understood as part of a broader socio-environmental system rather than as an isolated environmental variable. This perspective emphasizes the importance of adaptive capacity in mediating climate stress (Cianconi et al., 2020). It also highlights how environmental governance and public health infrastructure influence psychological resilience. These insights refine the theoretical interpretation of climate–mental health relationships.

The discussion also contributes to addressing the research gap concerning contextual mediation identified in the introduction. While existing studies demonstrate associations between temperature and mental health outcomes, fewer analyses have explored how adaptive capacity shapes these relationships (Cianconi et al., 2020; Clayton, 2021). By synthesizing evidence on vulnerability and resilience, the present discussion clarifies how environmental stress interacts with social and institutional conditions. This perspective strengthens the conceptual understanding of climate-related mental health risks across different settings. It also highlights the need for research that integrates environmental, social, and governance perspectives when examining climate exposure. Such integration helps explain why similar environmental conditions may produce different psychological outcomes across communities. The findings therefore contribute to filling the theoretical and empirical gaps in climate–mental health research.

3.5 Theoretical Implications for Climate–Mental Health Research

Interpreting the relationship between climate conditions and mental health requires situating empirical observations within a broader theoretical perspective. The Climate Change and Mental Health Causal Pathways Framework offers an analytical structure that links environmental exposure with psychological outcomes through physiological, cognitive, and societal mechanisms (Palinkas & Wong, 2020). This framework emphasizes that climate-related mental health risks emerge from interactions between environmental stressors and social contexts rather than from environmental conditions alone (Cianconi et al., 2020). Within this perspective, climate exposure becomes part of a broader socio-environmental system that shapes psychological wellbeing. The analytical focus of this subsection concerns how the findings synthesized in the previous discussion refine existing theoretical understandings of climate–mental health relationships. By examining urban–rural differences, vulnerability dynamics, and adaptation capacities, the study situates empirical evidence within a conceptual explanation of environmental determinants of mental health. The theoretical implications therefore extend beyond identifying correlations between temperature and psychological outcomes. Instead, the analysis seeks to clarify how environmental conditions operate through contextual mechanisms that shape human vulnerability and resilience (Rückle et al., 2025).

The findings discussed in earlier sections largely confirm existing research demonstrating that climate conditions influence mental health outcomes. Prior studies have consistently shown associations between temperature increases and psychological distress, suicide incidence, and hospital admissions related to mental illness. These patterns reinforce the theoretical proposition that environmental stress can influence psychological wellbeing through physiological and behavioural responses (Heinz, 2024; White et al., 2023). The present analysis supports these empirical findings by highlighting how temperature exposure produces biological discomfort and cognitive strain that may contribute to psychological instability. However, the analysis also demonstrates that environmental exposure alone cannot fully explain variations in mental health outcomes. Contextual factors such as settlement environment, infrastructure systems, and social vulnerability significantly shape how individuals experience climate stress (Cianconi et al., 2023). These observations confirm that climate–mental health relationships are embedded within broader environmental and social contexts. Such confirmation strengthens the relevance of the causal pathways framework as a guiding theoretical perspective for interpreting environmental health dynamics (Palinkas & Wong, 2020).

At the same time, the discussion refines existing theoretical explanations by emphasizing the importance of contextual mediation. Earlier studies often examined climate exposure primarily as a direct environmental determinant of mental health outcomes (Charlson et al., 2021). While this perspective highlights the role of temperature and extreme weather events, it sometimes overlooks the social and infrastructural conditions shaping vulnerability. The synthesis presented here suggests that environmental stress interacts with contextual factors such as settlement patterns, resource access, and community resilience. Urban and rural environments illustrate how these contextual conditions influence exposure patterns and adaptive capacity (Heinz, 2024; Longman et al., 2023). By highlighting these dynamics, the analysis expands theoretical explanations of climate–mental health relationships beyond purely environmental variables. It demonstrates that climate exposure should be understood as part of a broader socio-ecological system influencing psychological wellbeing (Rückle et al., 2025). This refinement contributes to a more comprehensive conceptual framework for understanding environmental determinants of mental health.

The discussion also contributes to extending existing theoretical perspectives by integrating insights from environmental health and social vulnerability research. The literature increasingly recognizes that environmental stressors interact with socioeconomic structures to influence health outcomes. Climate exposure may amplify existing social inequalities by disproportionately affecting communities with limited adaptive capacity (Hayes et al., 2018; Mahmood et al., 2025). Urban populations experiencing socioeconomic inequality may face uneven access to environmental infrastructure such as cooling systems or healthcare services (Cianconi et al., 2023). Similarly, rural populations dependent on climate-sensitive economic activities may encounter heightened vulnerability to environmental variability (Liu et al., 2025; Mostert et al., 2025). These patterns demonstrate how environmental exposure interacts with structural conditions shaping resilience and risk. The integration of vulnerability and adaptation dynamics therefore extends the explanatory capacity of the causal pathways framework, illustrating how environmental determinants of mental health are intertwined with broader governance and development contexts (Palinkas & Wong, 2020).

Another important implication emerging from the analysis concerns the role of governance and institutional capacity in mediating climate-related mental health risks. Environmental governance structures influence how societies prepare for and respond to climate-related stressors. Policies addressing climate adaptation, public health infrastructure, and environmental management may shape community resilience to environmental change (Hayes et al., 2018). Urban governance systems may implement heat mitigation strategies, public health campaigns, or infrastructure development to reduce environmental stress (Heinz, 2024). Rural governance systems may focus on agricultural resilience, resource management, and community support networks (Longman et al., 2023). These institutional responses influence the capacity of communities to adapt to climate variability. Consequently, climate–mental health relationships are not solely determined by environmental exposure but also by governance arrangements and policy interventions (Bhugra, 2025). Recognizing this governance dimension expands the theoretical understanding of environmental health dynamics.

The findings also contribute to addressing the empirical gap identified in the introduction regarding contextual differences in climate–mental health research. While existing literature provides substantial evidence linking temperature exposure to psychological outcomes, relatively few studies systematically examine how settlement contexts shape these relationships (Charlson et al., 2021). By integrating evidence on urban–rural environmental dynamics, the present analysis clarifies how contextual conditions mediate climate-related mental health risks. This perspective helps bridge fragmented strands of research that previously examined environmental exposure without considering settlement context (Heinz, 2024). The analysis therefore contributes to strengthening the conceptual coherence of climate–mental health scholarship. It highlights the importance of examining environmental exposure within geographically and socially differentiated contexts (Gomes et al., 2025).

Finally, the theoretical insights developed in this discussion help address the broader research gap concerning the integration of environmental and mental health perspectives. Climate change research has historically focused on physical health impacts, environmental risks, and economic consequences. Mental health implications have often received comparatively less attention within climate governance discussions (Hayes et al., 2018). The present analysis contributes to expanding this field by demonstrating how

environmental conditions influence psychological wellbeing through multiple contextual pathways (Devi, 2025). By synthesizing empirical evidence and theoretical interpretation, the discussion highlights the importance of incorporating mental health considerations into environmental governance and public health research (Bhugra, 2025). This contribution strengthens the conceptual foundation for future research exploring the intersection between climate change, environmental exposure, and population mental health (Rückle et al., 2025).

4. Conclusion

This study examined the relationship between climate conditions and population mental health by synthesizing existing literature and interpreting the evidence through the Climate Change and Mental Health Causal Pathways Framework. The analysis shows that rising temperatures, temperature variability, and extreme heat events are associated with a range of mental health outcomes including psychological distress, suicide risk, and reduced community wellbeing. The discussion demonstrates that these effects emerge through interconnected physiological, cognitive, and societal pathways that shape how individuals respond to environmental stress. The study also highlights that climate exposure does not affect all populations equally because contextual conditions influence vulnerability and resilience. Urban environments often intensify temperature exposure through infrastructure density and environmental pressures, while rural communities may experience climate stress through economic dependence on environmental conditions and limited access to services. The findings further show that adaptive capacity, institutional infrastructure, and social support systems play important roles in shaping psychological responses to climate exposure. By integrating empirical evidence with theoretical interpretation, the analysis clarifies how environmental conditions interact with social and contextual factors to influence mental health outcomes.

This study contributes to the growing body of research examining environmental determinants of mental health by providing a conceptual synthesis of climate related psychological risks across urban and rural contexts. First, the research confirms existing evidence that climate conditions influence mental health outcomes while emphasizing the importance of interpreting these relationships through multidimensional causal pathways. Second, the study refines theoretical explanations by demonstrating that climate related mental health risks are strongly mediated by contextual conditions such as settlement patterns, adaptive capacity, and social vulnerability. This perspective expands existing climate mental health scholarship by integrating environmental exposure with broader socio ecological dynamics. Third, the analysis contributes to bridging fragmented strands of research that have often examined climate exposure without sufficient attention to contextual variation between urban and rural environments. By highlighting how environmental stress interacts with social systems, the study strengthens the theoretical foundation for understanding climate related mental health risks. These contributions provide a clearer conceptual framework for future research and policy discussions concerning climate change and psychological wellbeing.

Future research should further investigate the contextual dynamics shaping climate related mental health risks across diverse geographic and socioeconomic settings. Empirical studies examining climate exposure and mental health outcomes should incorporate comparative analyses between urban and rural environments in order to better understand contextual variations in vulnerability and resilience. Additional research is also needed to examine how governance structures, public health infrastructure, and community adaptation strategies influence psychological responses to

environmental change. Integrating interdisciplinary approaches that combine environmental science, public health, and social research may provide deeper insights into the mechanisms linking climate exposure and mental wellbeing. Longitudinal studies may also help clarify how climate related stress accumulates over time and affects psychological outcomes across different populations. Future work should also explore policy interventions that strengthen adaptive capacity and reduce mental health vulnerabilities associated with environmental stress. Expanding research in this area will contribute to developing more comprehensive strategies for addressing the psychological impacts of climate change.

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