

A systematic review of mental health and climate change in the Philippines

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ABSTRACT

The Philippines are at the forefront of climate change impacts, including those related to health and well-being, but information on mental health and well-being are typically underreported. To help address this research lacuna, we conducted a systematic literature review. We aimed to provide an overview of current research knowledge and research gaps regarding the impacts of climate change outcomes on Filipinos' mental health and well-being. Consulting 8 databases, we identified 951 records. The final analysis included 32 studies: 16 quantitative, 11 qualitative, 2 longitudinal, 2 experimental, and 1 published report. A narrative synthesis has been performed to synthesize the findings from included studies. Studies were presented in four sections: 1) Risks to mental health following a natural disaster, 2) Determinants of post-traumatic stress disorder risks, 3) Resilience and post-traumatic growth following natural disasters, and 4) Personal experiences and other mental health outcomes. Reviewed data show that climate change outcomes strongly and negatively impact Filipino's mental health and well-being. Climate change outcomes also, negatively affect mental health through indirect (e.g., sleep disorders) and long-term pathways for example by being exposed to stressors such as migration, conflict, and violence. A set of coping strategies was identified which include banding together, mobilizing health experts, and expanding the local relationships with health workers. Future prospective studies should assess the effects of rising sea levels and vector-borne diseases among frontline communities. More interventional studies assessing preventive interventions and health promotion initiatives should be carried out to mitigate mental health disorders and improve well-being, thus contributing to improved health outcomes.

1. Introduction

The Philippines is listed as one of the countries most threatened by climate change (Eckstein, 2021). Its geographical location as a tropical archipelago on the western Pacific Rim, widely understood as the region most at risk of climate variability in the world, is exposed to various slow and sudden onset climatic and weather changes (Weinreb and Stecklov, 2021). Based on the Global Climate Risk Index 2021, the Philippines ranked fourth as the country most affected by climate-related extreme weather events weather-related loss events, i.e., storms, floods, and heatwaves (Eckstein, 2021). The Philippines lies in the world's most

cyclone-prone region, averaging 19–20 cyclones each year, of which 7–9 make landfall (USAID, 2018). Sea levels in the Philippines are rising faster than the global average, increasing the hazard posed by storm surges and threatening permanent inundation of low-lying areas (USAID, 2018). Also, the Philippines continuously faces inland river flood risk. It is projected that by 2030, an additional 187,300 people may be at risk of river floods annually due to climate change (Eckstein, 2021). Aside from being highly vulnerable to natural disasters, the Philippines depends on climate-sensitive natural resources and vast coastlines where all major cities and the majority of the population reside (USAID, 2018).

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According to the Climate Change Performance Index 2024 (CCPI), the Philippines is a high-performing country in this year's CCPI, ranking sixth. However, the connection between the nationally determined contributions and climate policy implementation remains unclear (Burck et al., 2023). This echoes findings from other studies, (Aruta et al., 2022; Liu, 2023; Rogelj et al., 2021) that highlighted potential weaknesses in policy design, bureaucratic hurdles, and lack of funding are all potential culprits for this gap. Additionally, the CCPI report's experts concluded that the Philippines has the potential for stronger climate ambition (Burck et al., 2023). They recommended that the country openly support global calls to phase out fossil fuels, and the Philippines's current approach might not be aggressive enough in tackling greenhouse gas emissions. This aligns with the growing international consensus on the urgency of a global fossil fuel phase-out, as highlighted by McDonnell (2024). Thus, the Philippines appears to be taking some positive steps on climate change, but there is a need to bridge the gap between nationally determined contributions goals and policy implementation.

Climate change is expected to severely and adversely impact mental health at a global scale. Climate change has a wide range of impacts on human health, such as accelerating the transmission of infectious diseases, increasing mortality due to heatwaves and air pollution (Watts et al., 2019), as well as harming human mental health and well-being (Bernard, 2019; McMichael, 2003). For instance, exposure to flooding has been associated with a variety of negative mental health outcomes, such as post-traumatic stress disorder (PTSD), depression or anxiety disorders, and overall poor well-being (Crandon et al., 2022). Also, climate change and climate change adaptation bring a set of circumstances in which cultural and livelihood changes, as well as any migration, might be forced and would deviate from the environmental baseline upon which people have previously developed their cultures, settlements, and livelihoods (Weinreb and Stecklov, 2021).

The matter is even more urgent given that the Philippines has an extremely high prevalence of mental health problems, even without considering climate change's added mental health consequences. Around 6 million Filipinos are estimated to live with depression or anxiety disorders, making the Philippines the third-highest prevalence of mental health disorders worldwide (Martinez et al., 2020a). Suicide rates are estimated to be 3.2 per 100,000 people but may be higher due to underreporting or misclassifying suicides as "undetermined" deaths (Redaniel et al., 2011). Despite these figures, the government spends only 0.22 % of total health expenditures on mental health, there is a shortage of mental health professionals (Maravilla and Tan, 2021), and the Philippines public health is critically threatened by climate change (Lally et al., 2019). Moreover, previous research has focused on secondary prevention, surveying mental health outcomes and interventions after a natural disaster (Alibudbud, 2023a; Edwards et al., 2021; Guinto et al., 2021), thus overlooking primary prevention strategies to reduce the risk of mental health problem onset. In parallel, authors highlighted that climate change could worsen mental health disparities in Filipino gender minorities (Alibudbud, 2023b), and mental health policies need to be updated from a climate change perspective (Guinto et al., 2021).

To our knowledge, there is an absence of a robust systematic review examining the Philippines' mental health concerning climate change. The first concerns the over-representation of research among high-income countries. From a global ecological and social justice perspective, there is a strong need for research and policy learning about the relationship between climate change and mental health among low to medium-income countries. Second, despite the established connection between extreme weather events and adverse mental health effects, the majority of research in this domain focuses on the mental health consequences of specific events (e.g., Typhoon Haiyan in the Philippines in 2013), treating each risk as an isolated incident unrelated to the greater problem of climate change (Edwards et al., 2021). This paper thus reviews work on mental health in relation to climate change in the Philippines.

2. Method

The methods used to collect and summarize data adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses standards. The study protocol was registered in PROSPERO (CRD42021283522).

2.1. Eligibility criteria

We included all studies exploring the relationship between climate change or climate-related disaster exposure and mental health outcomes in the Philippines. Studies were included if they a) included only human participants (of any age), b) measured the subsequent mental illness and well-being outcomes with validated questionnaires or interviews (including PTSD, depressive and anxiety symptoms, substance use disorders, insomnia symptoms, stress, traumatic experience, psychotic disorders, eating disorders and psychological well-being or resilience), c) they examined the effects of climate change characteristics (including—but not limited to—typhoons, rising sea levels, greenhouse gases, air pollution, water pollution, drought, landslides, climate migrations, salinification and heatwaves), d) we included peer-reviewed grey literature (including theses, dissertations, reports) published in English, Filipino, or French up until the end of December 2022 without limiting the start date.

2.2. Exclusion criteria

Studies were excluded from the systematic review if they did not meet the above-cited inclusion criteria or pertained to a) disaster risk management and preparedness, b) farming or other animal-related health, as well as, c) earthquake and volcanic-related disasters.

2.3. Information sources and search strategy

Seven relevant electronic databases: ProQuest, PubMed, PsycINFO, GreenFILE, JSTOR, Scopus, and Philippine E-journals were investigated from their date of inception to September 2021 and then updated in December 2022. Additionally, relevant reviews were scanned within the Health Research and Development Information Network, a research database of the Philippine Council for Health Research and Development, as well as OpenGrey, and the following academic journals: Disaster Prevention and Management, Disaster Medicine and Public Health Preparedness. Search strategies are described in Supplementary files.

2.4. Screening

After duplicates were removed, titles and abstracts of all studies identified were examined independently (RTV, KH, PB) to determine those meeting the selection criteria. Any conflicts about article eligibility were discussed between the three reviewers, and a mutual agreement was reached. The remaining records were then assessed by two reviewers (RTV, KH) at the full-text level to confirm eligibility.

2.5. Data collection and analysis

Data extraction was completed for all included studies. A narrative synthesis (Rodgers et al., 2009) was carried out to synthesize the findings from included studies. This method was preferred to accommodate the analysis of a wide range of study designs. The authors (RTV, KSO, KH, PB) conducted a preliminary synthesis in the form of thematic analysis (Bernard et al., 2021). Results were then discussed and structured into themes (RTV, KSO, KH, PB). In response to reviewer feedback, a methodological quality assessment of the included articles (reviewed by RV and PB) was conducted. When discrepancies arose, a third independent reviewer (HK) was brought in for resolution. The assessment

utilized the 8-item Joanna Briggs Institute Critical Appraisal Checklist for Analytical Cross-Sectional Studies (Aromataris et al., 2022). Each criterion was evaluated categorically as "yes," "no," "unclear," or "not applicable." Our evaluation exclusively focused on observational and quantitative studies.

3. Results

As described in the study flowchart (Fig. 1), the initial electronic searches identified 951 records; then 91 duplicates were removed. After screening 860 titles and abstracts, 159 records were assessed at the full-text level. We included 32 records in our final sample, including 16 quantitative studies, 11 qualitative studies, 2 longitudinal studies, 2 experimental studies, and 1 published report. The oldest included paper was published in 2010, and the most recent in 2022. Table 1 presents the main findings extracted from the final sample. A more detailed description of the included records is presented in the Supplementary file.

3.1. Methodological quality

A detailed assessment of the methodological quality for each quantitative study ($N = 18/32$) is presented in Fig. 2. The methodological quality was generally good, except for the confounding factors' management.

Notes. Green = yes, orange = unclear, red = no, white = not applicable

3.2. Main themes identified in the systematic review

In line with our aim, we identified four main themes related to the mental health impacts of natural disasters in the Philippines. The first theme explores the prevalence of various mental health disorders after these events. Studies included in this theme examined the rates of PTSD (i.e., symptoms persisting [>30 days] after exposure to actual or threatened serious injury, sexual or interpersonal violence, death, natural or man-made disasters, war, life-threatening illnesses, severe accidents) (Geoffrion et al., 2022), depression, anxiety, and sleep disorders.

The second theme focuses on factors that increase the likelihood of developing PTSD following a disaster. This theme highlights the importance of perceived threats, injuries (self or witnessed), sleep disturbances, negative thoughts, and the intensity of the event itself as contributing to PTSD risk.

The third theme summarizes the factors and interventions promoting resilience and post-traumatic growth after a post-natural disaster. Here, resilience can be defined as "the ability of adults in otherwise normal circumstances who are exposed to an isolated and potentially highly disruptive event to maintain relatively stable, healthy levels of psychological and physical functioning" (Bonanno et al., 2010). Studies included in this theme explored the significance of healthcare access, financial security, feelings of safety, and social support networks in fostering psychological resilience. Interventions promoting coping mechanisms, such as Psychological First Aid and culturally adapted therapy, are also presented within this theme.

The final theme delves into the diverse mental health impacts of natural disasters on different populations. This theme highlights the vulnerability of specific groups, such as women, children, and individuals with pre-existing mental health conditions. For instance,

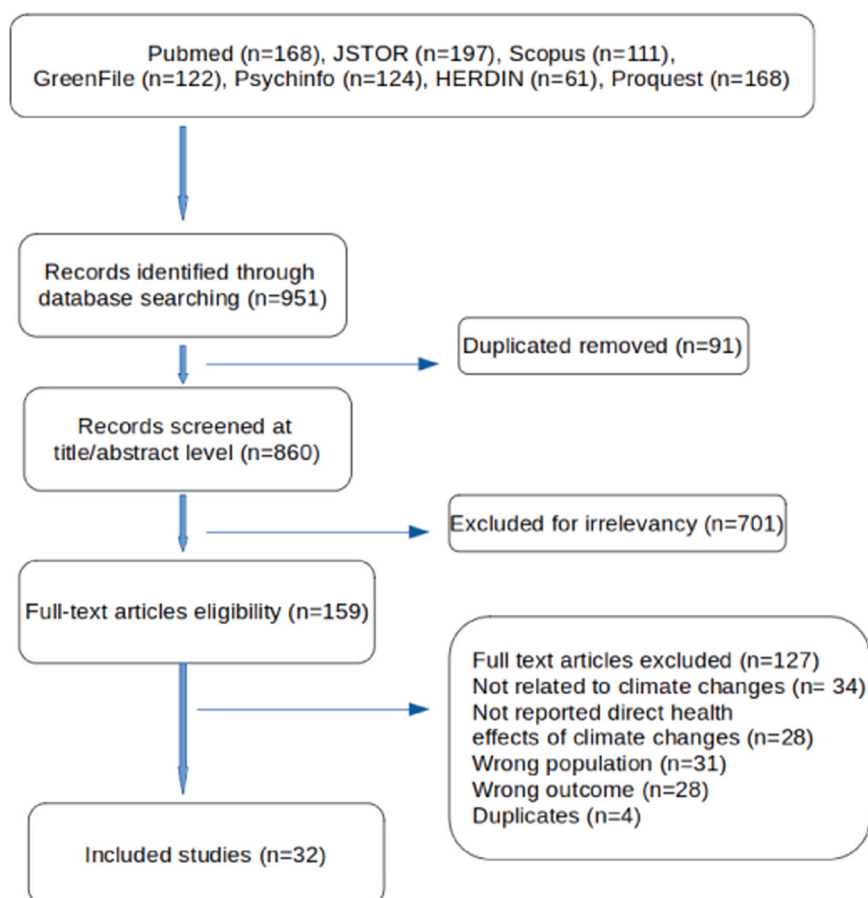


Fig. 1. Study flowchart.

Table 1

Short summary of included studies.

Study & Design	Principal aim of the study	Data collection method/s	Study location	Main findings
Scenario-based study (Banaguas et al., 2015)	To investigate the worst-case scenarios that happened to these islands, which include biophysical and socio-economic stresses as well as psychological dreads and secular activities.	Monte Carlo Modeling simulation was used for the quantifications of future risk (CMIP 5 Models) Participatory Action Research	Calamianes Group of Islands (Busuanga, Coron, and Culion) of Palawan	Some apprehension on the self, traditional male gender role and egalitarian gender roles between family members have been highlighted. Children expressed frustration and stress towards the local government's lack of aid. Participants experienced apprehension and anxiety concerning the preservation of their wellbeing especially of the children. Psychological consequences may be moderated by the magnitude of natural disasters and environmental changes. Supportive social relationships were and will be beneficial for emotional health.
Qualitative survey* (Baticula et al., 2014)	To identify and understand the coping strategies of selected Filipinos victimized by typhoon Ondoy across lifespan.	Semi-structured interviews	Marikina City	The participants employed mitigating measures and turning to faith. Moreover, the study established eidetic symbols based on the unique responses of the participants when asked for an object which can summarize or symbolize their experiences during the typhoon. It is apparent that the symbols mentioned pertains to hope, stability, fortitude, and religiosity.
Qualitative study* (Botor Joel and Brozula, 2017)	To explore what mothers would consider as descriptors of mental health; factors influencing mental health, and coping.	Participants were asked to fill-out a questionnaire with five open-ended questions	Post-Haiyan communities in the Southern Tagalog regions	Mothers did not receive any training on mental health but were able to share concepts of mental health that fall under those relevant categories that characterized mentally (un)healthy persons.
Qualitative study (Busquit, 2018)	To examine the human experiences and used survival techniques after the Typhoon Pablo.	In depth interview guide (3-year after the typhoon)	Cateel, Boston, and Baganga (Davao Orientals)	New schools and home supported by the government was the most effective strategy to improve mental health and well-being in exposed people.
Quantitative study (Chan et al., 2016)	To compare the psychological outcomes of typhoon Haiyan between (un)exposed adults	Adults included were in health, public, education sectors and religious organizations. (> 1.5 months post-exposition) (uni- and multi-variate analyses)	Tacloban City	The exposed group reported significantly higher Disaster-related Stressor exposure levels compared to the unexposed group. Physical injury ($\beta = .17$) and life-threat cluster ($\beta = .20$) were also significantly and positively associated with PTSD risk.
Cohort Study (Edwards et al., 2021)	To estimate the associations between natural disasters and children's development outcomes and caregivers' health outcomes.	Questionnaire at home A two-stage sample selection scheme was used (< 3 years post-exposition).	3 island groups of Luzon, Visayas, and Mindanao	A cumulative impact of natural disaster was found for violence in household (for children) and higher depressive symptoms, parenting stress and food insecurity (for caregivers).
Qualitative study* (Espina and Canoy, 2021)	To examine mobile-spatial realities interspersed in diverse temporal trajectories by tracking the embodied rhythms of people and objects evoked by retelling post-disaster resettlement stories.	Mental models, focus group discussion, multiple walking interviews.	Ridgeview Park, Barangay Cabalawan, Tacloban City	Participants described their living conditions as more spacious, and they have privacy in doing activities of daily living. In contrast with their post-disaster mental map, the respondents reported a high-stress level brought about by poor living conditions and unsecured mobility in the resettlement area.
Quantitative study (Hamama-Raz et al., 2017)	To examine the correlates of subjective well-being after Haiyan Typhoon	Self-report measures using an online system (3-week post-exposition) (multivariate analyses)	Tacloban City, Eastern Samar	The following factors (home damage ($\beta = -0.09$), witness injury ($\beta = -0.07$), self-related health ($\beta = 0.18$), self-blame ($\beta = -0.20$), and problems in relations ($\beta = -0.13$) were significantly associated with subjective well-being.
Quasi-experimental trial (Hechanova et al., 2018)	To evaluate a resilience intervention program aimed to strengthen the resilience, adaptive coping, and well-being of displaced disaster survivors.	Interventional study comparing a treatment group with a control group Mixed method	Tacloban City	A significant improvement of anxiety and resilience was found at the end of intervention. There were no significant changes in adaptive coping.
Qualitative study* (Hechanova et al., 2015)	To examine the experiences, adaptations, observations, and insights on the utilization of psychological first aid after typhoon	Interviews/open-ended surveys Thematic analysis	Metro Manila, Cebu, Iloilo.	The psychological first aid providers were satisfied with their experiences because of the survivors' positive feedback and ease of use compared to the Critical Incident Stress Debriefing.
Quantitative study (Hickman et al., 2021)	To investigate of the climate anxiety in children and young people globally and its relationship with perceived government response.	International online research panel (Kantar's Life Points) Eligible if they were aged 16–25	Philippines	49 % were extremely worried about climate change 35 % were very worried. > 50 % reported each of the following emotions: sad, anxious, angry, powerless, helpless, and guilty > 45 % of respondents said their feelings about climate change negatively affected their daily life

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Table 1 (continued)

Study & Design	Principal aim of the study	Data collection method/s	Study location	Main findings
Qualitative study* (Hugelius et al., 2017)	To explore health professionals' experiences of working during and in the immediate aftermath of a natural disaster.	Interviews carried out 5-month after the disaster. Phenomenological hermeneutic methods.	Tacloban City	The main theme, being professional and survivor described both positive and negative emotions and experiences from being a helper, part of the responding organization, and a victim.
Quantitative study (Inumpa, 2010)	To determine the prevalence of post-traumatic stress symptoms among victims of typhoon Pepeng and examine the quality of life after the typhoon	Screening questionnaire Multivariate analyses (2 years post-exposition)	Little Kibungan, Village, Puguís. La Trinidad, Benguet, Barangay Ambassador	Prevalence rates of moderate to severe posttraumatic stress symptoms were ranged from 73.5 % to 76.1 %. These symptoms were associated with a lower level of quality of life.
Qualitative research (Javier and Agaton, 2021)	To describe the effects of double (COVID 19 and typhoons) disaster on students' mental health	Online interview	6 tertiaries from different regions	The occurrence of natural disasters during the lockdowns from pandemic brought high level of stress to students in adjusting to distance education, completing academic requirements, and accessing technology for online learning
Qualitative study (Kwan, 2018)	To identify the factors and processes (specifically during the mitigation phase of the disaster management) that shape and influence older people's psychological resilience	A set of case studies combined with participatory action approach	Apitong (a community in Tacloban City)	Respondents said that their capacity to rebuild a better life post-disaster was related to health care access, low medicine price, a more secure and autonomous housing.
Quantitative study (Labarda and Chan, 2018)	To examine the associations between sleep disturbances with post-traumatic stress and general psychological Distress after the 2013 Super Typhoon Haiyan.	Structural regression modeling (sample 1, 18-month post-exposition) (sample 2, 30-month post-exposition)	Tacloban City	Higher sleep disorders level was the significantly associated with a higher level of post-traumatic stress ($\beta = 0.57$; $\beta = 0.40$) in both samples of respondents exposed to Haiyan typhoon. Higher sleep disorders level was the significantly associated with a higher level of psychological distress ($\beta = 0.50$) in sample assessed 10-month after the typhoon.
Quantitative survey (Labarda et al., 2020)	To examine the association among displacement frequency after the disaster, health status, and psychological adjustments among Typhoon Haiyan survivors.	Random cluster sampling with replacement from 13 rural and urban towns in Eastern Philippines Multivariate analyses (4 years post-exposition)	13/45 towns were randomly selected	Displacement frequency after a disaster was a significant predictor of poorer subjective health and higher stress after controlling for gender, age and traumatic exposure severity. 28.9 % had probable depression, 46.0 % had a probable anxiety disorder, 19.4 % had moderate to severe stress, and 12.7 % had probable PTSD. Displacement frequency did not predict PTSD, depression, and anxiety.
Quantitative study* (Lañas-Sta and Justine, 2018)	To determine the prevalence of ASD and PTSD among residents exposed to typhoon Ondoy (September 2009) and extreme Habagat rains (August 2012).	2 screening ASD questionnaires Participants with a score above the cut-offs, were met for a psychiatric interview. Univariate and multivariate analyses	Barangay Tumana, Marikina	There was a 10 % and 5 % prevalence rate for ASD and PTSD, respectively. There was a psychiatric co-morbidity prevalence rate of 4 %. Previous traumatic events were not significantly different between participants with or without PTSD risk
Lavenda et al., 2017, Quantitative study (Lavenda et al., 2017)	To examine the DSM–5 ASD diagnostic criteria of exposure in the post-natural disaster.	Random stratified sampling methods, weights for age and sex were used (3 years post-exposition)	Representative sample of Filipinos	A respondent exposed to a traumatic event had higher levels of intrusion, negative mood, dissociation, avoidance, and arousal symptoms than not exposed respondents. Respondents with ASD were more likely to have impairments in one life domain.
Two-wave study (Liang et al., 2023)	To examine the factor structure of the insomnia severity index and longitudinal association with stress and anxiety in Typhoon survivors	By two waves of questionnaires (7 months apart) Random cluster sampling of relocated people (4 years post-exposition)	Tacloban	High insomnia score was associated with more long-term stress symptoms
Quantitative study* (Mordeno and Hall, 2017)	To assess competing models of PTSD symptomatology. To identify the PTSD prevalence, and related factors.	University students self-rated their PTSD symptoms Multivariate analyses	Univeristy students	Prevalence of possible PTSD was 46 %. Higher level of Self negative cognition was associated with all subscales of PTSD questionnaire.
Quantitative study* (Mordeno et al., 2017)	To assess competing models of PTSD and examine their respective associations with GAD symptoms in post-disaster relocates.	All study instruments underwent forward and backward translation. Multivariate analyses	Relocated people from the 5 areas (70 % response rate).	The PTSD model with better fit indices was based on following subcomponents: intrusion, avoidance, negative affect, anhedonia, externalizing behavior, anxious arousal, and dysphoric arousal. Most of them were associated with higher level of GAD symptoms.
Quantitative study* (Mordeno et al., 2018)	To investigate the mediating role of sensory-based trauma memory quality in the relationship between the centrality of event and mental health outcomes among survivors of a natural disaster.	Mediation analyses were conducted	Iligan	Intensity of traumatic events was associated with higher depressive and stress symptoms. These associations were mediated by sensory-based trauma memory quality level.

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Table 1 (continued)

Study & Design	Principal aim of the study	Data collection method/s	Study location	Main findings
Quantitative study* (Nalipay and Mordeno, 2018)	To determine whether the positive meta-cognitions and -emotions are associated with PTSD symptoms, and explore potential mediators.	Structural equation modelling	College student survivors of Typhoon Haiyan	More positive meta-cognitions and emotions were associated with lower PTSD symptoms. These associated were mediated by the level of post-traumatic cognitions.
Quantitative study (Nalipay et al., 2017) (Nalipay et al., 2016)	To investigate the role of social complexity—the generalized belief about changing social environments and inconsistency of human behaviors, as a predictor of post-traumatic growth.	Data collection after typhoon Haiyan Multivariate analyses (3-month post-exposition)	Tacloban City	The generalized beliefs about the social world (particularly for religion beliefs) play an important role in the development of post-traumatic growth. The adaptative cognitive functions may play a moderator role between beliefs and post-traumatic growth.
Qualitative study (Nguyen, 2019)	Examining the precarious situation of women and girls in line with climate-related disasters	In-depth interviews and secondary data, including documents and reports provided by humanitarian agencies, local organizations	Leyte and Eastern Samar provinces in Visayas	Vulnerabilities of women and girls to violence in times of disaster are highest with the emergence of "states of exception"—a "zone of absolute indeterminacy"—a spatial disjuncture, or "single catastrophe" between the sphere of human life and the juridical order.
Qualitative study (Sato et al., 2016)	To determine health needs and coping mechanisms among pregnant women during and shortly after the typhoon	Focus group discussions Data were analyzed using qualitative content analysis. (4-month post-exposition)	Tacloban City	3 themes were identified: having no idea what would happen during the evacuation, lacking essentials to survive, and being unsure how to deal with health concerns.
Quantitative study (Sylwanowicz et al., 2018)	To examine the ability of a novel responder mental health self-triage system to explain PTSD in emergency medical responders after a natural disaster.	Emergency medical responders were recruited after the Typhoon Haiyan. Univariate analyses (1-month post-exposition)	Tacloban City	30 % and 7 % of the responders had a high PTSD and depression risk. 3 risks s were associated with higher PTSD and PHQ scores: deaths/injured co-workers, perception of life in danger, and overwhelmed by required medical skills
Qualitative study (Tuazon, 2018)	To explore the experiences and needs of students and teachers of the University of the Philippines who were either directly affected by Typhoon Haiyan or served as responders to the typhoon survivors.	Purposive sampling Thematic analysis Online open-ended questionnaire that elicited narrative experiences post-typhoon Haiyan.	University of the Philippines Visayas Tacloban College,	Salient themes identified: 1. need for basic needs (food, water, safety) including academic resources, 2. lack the deliberate psycho-social processing of the disaster experience for both survivors and responders, 3. unequal access to help, 4. problems in communication in the organization, and 5. victimhood.
NGO Report analyses (Valerio, 2014)	To examine the impact of typhoon Haiyan in the lives of women and girl survivors	Analyses of local reports, local activities (e.g., Family Planning), and case studies	Philippines	Experiences of natural disaster situations must guide the humanitarian response that serves women and girls' sexual and reproductive health needs and works to limit dramatic psychological consequences of sexual and gender-based violence.
Retrospective study (Weintraub et al., 2016)	To describe the monthly volume of Mental Health activities, beneficiaries, and characteristics of people seeking mental health care; profile.	Patients who sought Médecins Sans Frontières' -supported Mental Health care between November 2013 and March 2014.	Guiuan, Mercedes, Salcedo, General Mac Arthur and Hernani, Eastern Samar	Women also were agents of change after the typhoon, e.g., group of women supported affected women to rebuild their life and contact the Family Planning Organization 64 % of adults with severe mental illness diagnostic following a typhoon had psychotic symptoms. The typhoon itself was considered the trigger factor of mental health symptoms in 14 % of cases.

* = Studies without providing details about the timing since exposure presents incomplete information about the consequences of natural

findings about family dysfunction and eco-anxiety are presented. This theme also emphasizes how personal experiences like self-perceived health, property damage, and social interaction disruptions contribute to overall well-being after a disaster.

3.2.1. Risks of mental health disorders following a natural disaster

A total of five quantitative and cross-sectional studies (Inumpa, 2010; Labarda et al., 2020; Lañas-Sta and Justine, 2018; Nalipay et al., 2018; Sylwanowicz et al., 2018), one retrospective study (Weintraub et al., 2016), and one quantitative longitudinal studies (Edwards et al., 2021), regarding the associations the exposition to a natural disaster and mental disorder prevalence were identified. Adults, children, students and first respondents were included in these studies. The risk of PTSD was quantified in short, medium and long term. The prevalence of potential PTSD ranged from 10 % (Inumpa, 2010; Lañas-Sta and Justine, 2018; Sylwanowicz et al., 2018) to 76 % (Weintraub et al., 2016). Only one study examined the acute stress disorder showing a prevalence of 5 % (Labarda et al., 2020). Prevalence of subclinical depressive disorders ranged from 7 % (in first responders) (Sylwanowicz et al., 2018) to

29 % (exposed adults) (Labarda et al., 2020). Prevalence of self-reported sleep disorders and anxiety disorders were respectively 33 % (Edwards et al., 2021) and 46 % respectively (Labarda et al., 2020). Details about the time between exposure and data collection are provided in Table 1.

3.2.2. Determinants of post-traumatic stress disorder risks after natural disasters

In total, seven quantitative studies (Chan et al., 2016; Inumpa, 2010; Labarda and Chan, 2018; Mordeno et al., 2018, 2017; Mordeno and Hall, 2017) examined the factors associated with PTSD risks after natural disasters. The following factors were associated with a higher risk of PTSD or acute stress disorder in exposed adults: experience(s) of threat to life during the natural disaster (Mordeno and Hall, 2017), injury or witnessing injury during or after the natural disaster, self-reported insomnia symptoms, negative cognitions (e.g., intrusive thoughts, flashbacks, rumination), water damage to the home, and the perceived intensity of the traumatic event (Inumpa, 2010; Labarda and Chan, 2018; Mordeno and Hall, 2017).

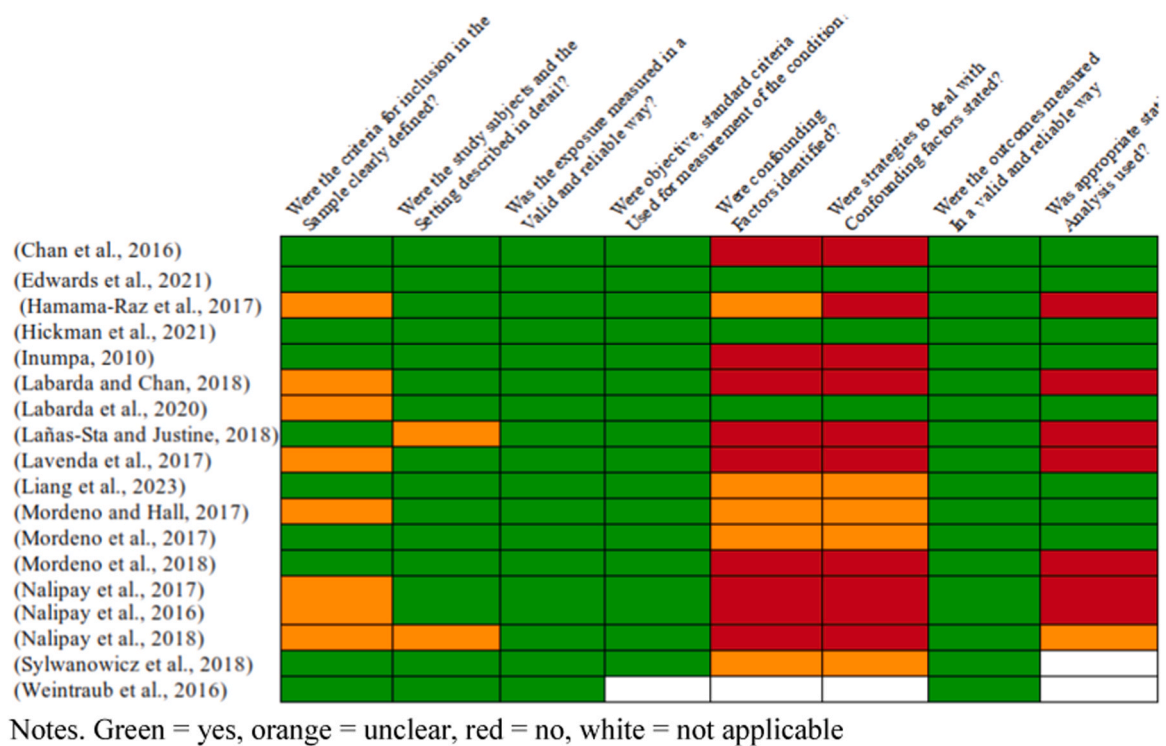


Fig. 2. Graphical representation of methodological quality.

3.2.3. Resilience and post-traumatic growth post-natural disaster

A total of six qualitative studies (Baticula et al., 2014; Busquit, 2018; Hechanova et al., 2018, 2015; Javier and Agaton, 2021; Nguyen, 2019), two quantitative and cross-sectional investigations (Nalipay et al., 2017, 2016) and one experimental study (Banaguas et al., 2015) addressed resilience and post-traumatic growth after a natural disaster. Among exposed populations living in rural or urban contexts, greater resilience in the short and medium term was associated with greater healthcare access, low medical price, and better personal security perception (Hechanova et al., 2015). Strong cooperation between pregnant women was also reported as an essential factor for greater psychological resilience to exposure to natural disasters during the perinatal period (Sato et al., 2016).

Two studies in our sample report on interventions geared to promote coping with traumatic experiences. One study examined the effects of a Psychological First Aid intervention during a natural disaster with a set of face-to-face interviews (Hechanova et al., 2015). Moreover, Hechanova et al. (2018) explored the impact of culturally adapted cognitive and behavioral therapy on mental health outcomes among Haiyan survivors through a quasi-experimental study. This intervention significantly reduced self-reported anxiety ($\eta^2 = 0.4$, small effect size) and enhanced psychological resilience ($\eta^2 = 0.5$, small effect size) immediately post-intervention and at a 6-month follow-up, compared to a control group. However, no significant effect was observed on participants' self-reported adaptive coping. A qualitative study describing effective coping strategies during double disasters (pandemic and typhoon) listed helping one another out, reserving energy for essential purposes and leaning on faith (Javier and Agaton, 2021).

3.2.4. Personal experiences and other mental health outcomes

Five qualitative studies (Botor Joel and Brozula, 2017; Espina and Canoy, 2021; Hugelius et al., 2017; Nguyen, 2019; Tuazon, 2018), four quantitative investigations (Batool, 2015; Hamama-Raz et al., 2017; Hickman et al., 2021; Liang et al., 2023), one non-governmental organization reports analysis (Valerio, 2014) and doctoral thesis (Kwan, 2018) identified various mental health outcomes (e.g., sleep quality,

insomnia, well-being, eco-anxiety) associated with experiencing post-natural disasters. The personal experiences related to climate events were collected among mothers, health professionals, young women, and students. Five studies examined three critical mental health topics, respectively. First, a statistical analysis carried out using a "Médecins Sans Frontières" database (Weintraub et al., 2016) suggested that repeated natural disasters can trigger symptom exacerbation among adults with severe mental illness or possible first psychotic episodes. Second, natural disasters have been described as political or social "states of exception" during which women and girls are overexposed to sexual violence and have a higher risk of acute stress disorders (Batool, 2015; Hugelius et al., 2017; Nguyen, 2019; Tuazon, 2018; Valerio, 2014). Third, children living among exposed families experienced family violence in the past 12 months (41 %), and 33 % of children reported witnessing violence in the past 12 months (Edwards et al., 2021). Furthermore, 30 % of these children who experienced stunted growth (i.e. >2 standard deviations below the World Health Organization Child Growth Standards median) in this study with a national representative sample. Fourth, an international study concluded that children and young people from Philippines were among those who worry the most about climate change in comparison to nine other countries (including countries from the global south) (Hickman et al., 2021). Finally, well-being after a natural disaster is impaired by a negative self-health perception, close physical damages and social interaction problems (Hamama-Raz et al., 2017).

4. Discussion

This systematic review summarizes the empirical evidence of major climate change consequences on mental health in the Philippines. The prevalence of mental disorders identified in the included articles is generally higher than that among studies carried out in high-income countries (Crandon et al., 2022). Findings are particularly alarming given that the Philippines is the fourth most affected country by climate-related natural disasters (Eckstein, 2021), and projection studies suggest continued overexposure to natural disasters in the following

decades (WHO, 2015). Another study projected a dramatic increase in the probability of experiencing an increased heat waves by 2050 (from 52 % to 76 %), with a disproportionate risk for people living in Mindanao where annual heatwave duration could exceed 5 months (World Bank Group; Asian Development Bank, 2021). It is also important to note that sea level rising is remarkably high in the Philippines (three times the global average) (Siringan and Maria, 2024). This endangers more than 822 coastal municipalities, 25 major coastal cities. Thus, 13 million Filipinos may need relocation by 2040 (Siringan and Maria, 2024).

Globally, results from our narrative analysis suggest that climate change consequences on mental health are associated with abrupt and sudden mental health damages (e.g., after a typhoon), and progressive and irreversible changes (called creeping or secular changes) among young people, women, and adults with prior experience of deprivation or mental health issues (Guinto et al., 2021; Lawrance et al., 2021). However, the included papers disproportionately focused on natural disaster consequences (N = 30/32), as previous reviews reported (Berry et al., 2018; Crandon et al., 2022; Ma et al., 2022). This could lead to an underestimation of the risks to the mental health of Filipinos because creeping changes such as rising sea levels, ocean acidification, changes to ecosystems, and modifications to land and freshwater also have deleterious effects on mental health. For instance, previous investigations suggest that food and water insecurity are determinants of depression and anxiety symptoms as well as poor well-being (Steel et al., 2009; Weaver and Hadley, 2009).

Our systematic narrative review highlights that climate change can raise exposure to violence for women and children. Indeed, accrued threats to Filipino children's physical integrity concerning climate change also constitute substantial risks to their mental health. Several contextual changes jeopardized the situation of children. After a typhoon, for example, many family members often congregate in a single residence, where children sharing beds with extended relatives risk sexual assault (Wingo et al., 2010). Exposure to frequent natural disasters was associated with an increased likelihood of children witnessing violence or being hurt by an adult or parent (Edwards et al., 2021). Parents' difficulty managing their own emotions during these tremendously stressful events could significantly amplify violence directed against children. Ultimately, children exposed to violence are more prone to develop physical and psychological problems such as depression, eating disorders, PTSD, and chronic pain (Hayward and Ayebe-Karlsson, 2021).

Gender and domestic conflicts are also a central theme in our review. Floods and cyclones exacerbated women's workloads, making tasks of daily life more time-consuming. Additionally, more creeping progressive changes (e.g., water scarcity and salinization) force women to walk long distances to obtain water for drinking and cooking (Espina and Canoy, 2021). This is due to the fact that some women in the Philippines, especially in rural areas, are tasked with household chores and childcare while their husbands are at work (Espina and Canoy, 2021; Lally et al., 2019). On top of this accrued mental and cognitive load, women who struggle to serve meals on time may face verbal and physical abuse from their husbands, violence when asking for money to purchase food, and greater stress when requesting food from neighbors, specifically during natural disasters (Hayward and Ayebe-Karlsson, 2021). However, other studies indicate that men may also face additional specific vulnerabilities. A study conducted in the Philippines showed the psychological effects of social gender roles on men, who experience anxiety and distress due to their duty to protect and provide for family members during a typhoon or urban risks following migration (Nguyen, 2019).

Our review identified several articles examining the impacts of resettlement on life conditions. A temporary relocation can negatively impact people's mental health and well-being because they lose a sense of place, identification, and belonging (McMichael and Katonivualiku, 2020). However, migration within the Philippines was understudied. Two included studies suggested a negative impact on their mental

health. Indeed, immigrants face verbal abuse, violence, theft, and threats of deportation in the host society (Labarda et al., 2020). This is associated with a decrease in self-confidence and a higher risk of sleep disorders (Tuazon, 2018). Adaptation to climate change has caused significant migration patterns of Filipinos to other areas. The Filipino migrants (within their island regions or country) often settle in slums or informal settlements for better economic opportunities. Living in slums induce feelings of inferiority and shame, reducing self-esteem and increasing the risk of mental health disorders (Tuazon, 2018).

5. Implication and recommendations

The Philippines has been identified as being at the forefront of the health impacts of climate change. However, mental health in the context of climate change has yet to feature prominently and systematically in Philippine-related research. A set of recommendations can be established to help the Philippines build a climate-resilient public mental health.

At a policy level, information campaigns and specific trainings should be developed to raise awareness of the mental health consequences of climate change among stakeholders, the general public, and underrepresented populations (Berry et al., 2018).

A significant increase of mental healthcare expenditure should be made. These investments should increase the number of mental health care providers, and drastically improve the mental health training and the number of first responders and volunteers in at-risk communities. Indeed, the current ratio of 2 or 3 mental health care providers for 100,000 Filipinos combined with only 3–5 % of the health budget spent on mental health care are two structural barriers for a climate resilient health system (Maravilla and Tan, 2021). This financial support should facilitate the access to care providers for minoritized groups, women (particularly during the perinatal period), and people experiencing inadequate welfare support as a priority (Vergunst and Berry, 2022). This recommendation aims to ensure equitable access to essential services, prevent a major mental health disorders prevalence and poor resilience at midterm. Furthermore, mental health training for first responders and volunteers providing aid during or after a natural disaster should be generalized (Crandon et al., 2022). Ultimately promoting more effective strategies for PTSD prevention and management. It is a critical and necessary step toward a more comprehensive approach to disaster management. By recognizing the signs of mental distress and learning how to offer adequate support, responders can play a pivotal role in reducing the stigma associated with seeking help and fostering resilience within affected communities (Malla et al., 2019).

For health system leaders, non-governmental organizations, and local communities, the decentralized community-based mental health services approach should be reinforced and integrated but not limited to the vulnerable communities affected by climate change outcomes. These interventions should be implemented in (no) crisis contexts. For instance, the training of lay health workers to provide mental health services to young people with major mental disorders in their own communities or evacuation centers, supported by clinical professionals has been found to be effective strategy (Malla et al., 2019). By expanding the scope of these interventions beyond crisis contexts, such initiatives can foster a more inclusive and sustainable framework for addressing mental health needs. Moreover, this approach can help bridge the mental health service provision gap, especially in resource-limited settings. By integrating this decentralized model, health system leaders and non-governmental organizations can ensure more comprehensive and accessible mental health support for vulnerable populations, ultimately contributing to the overall well-being, and resilience of communities impacted by climate change.

In a preventive and harm reduction strategy, effective psychosocial programs with low-cost implementation strategies (e.g., face-to-face combined with short text messages from a prevention perspective) should be developed and tested (e.g., with a pragmatic randomized

controlled trial design), particularly during the perinatal period and early childhood (Vergunst and Berry, 2022). Several included studies highlighted the global negative impacts of climate change on pregnant women or children. However, from a developmental life-course perspective, these effects can cumulatively and additively increase mental health disorder risk for multiple generations. These programs can effectively reach and engage vulnerable communities, fostering climate adaptation, and resilience, thus promoting healthier developmental trajectories (Berry et al., 2018). By integrating such preventive measures, stakeholders can work towards alleviating the mental health burden on communities and fostering overall well-being in the face of climate-related challenges.

A key research gap identified in this review is the limited exploration of the mental health of vulnerable populations specifically in the context of climate change. Future research should prioritize investigating effective and scalable intervention to support vulnerable groups such as women, children, and those displaced by climate change. Additionally, a more in-depth analysis of the biases and limitations of previous studies is needed. This could include exploring potential selection bias, limitations in generalizability due to study location or population demographics, and the potential influence of methodological approaches on the reported findings. By acknowledging these limitations, researchers can design future studies that are more comprehensive and representative of the Filipino population.

Finally, researchers should co-produce policy and knowledge in a complex and not a linear system perspective (see an example in (Berry et al., 2018)). For instance, they should reinforce or develop culturally adapted mental health and psychosocial support in natural disaster risk reduction management perspective to facilitate their future social acceptance and effectiveness in the general population and especially more marginalized subgroups (Bernard, 2019). This may also provide opportunities to strengthen social cohesion and community empowerment (Hayward and Ayebe-Karlsson, 2021). Ultimately, this collaborative and culturally sensitive approach holds promise for creating sustainable and impactful interventions that effectively address the mental health and psychosocial needs of communities affected by natural disasters.

6. Limits

The findings in this review are subject to at least six limitations. First, we did not identify studies examining the impacts of infectious and vector-borne diseases and air pollution (Baguigo, Cebu, and Manila) on mental health outcomes. This is particularly important because the prevalence of malaria and dengue fever is expected to rise with global warming in the Philippines (WHO, 2015). Second, air pollution combined with high ambient temperature has been associated with more severe psychiatric symptoms and higher visits to mental health services in Asian countries. However, we did not find studies examining their effects on the mental health system or care providers. Third, even if indigenous peoples of the Philippines (e.g., Ifugao, Lumad and Mangyan) have a lack of access to health care and are overexposed in case of natural disasters, we did not find a peer-reviewed journal examining these groups. Fourth, self-stigma has been found as a major barrier to help-seeking for mental health disorders in the Philippines (Martinez et al., 2020b). Consequently, reported prevalence or intervention effectiveness may be under- and over-estimated, respectively. Fifth, only 11/21 studies examining the effects of natural disasters on psychological outcomes reported the time lag between exposure to a natural disaster and the measurements taken. Finally, reviewed studies spanned the period of the COVID-19 pandemic, which is likely to have exacerbated existing mental health challenges in the Philippines (Bollettino et al., 2023). Thus, the pandemic's impact on mental health service delivery and access also warrants consideration as a potential limitation (Bollettino et al., 2023).

7. Conclusion

This systematic review sought to address the pressing need for a comprehensive evaluation of the existing research on climate change's influence on the Filipino population's mental health and overall well-being. The findings underscore climate change's profound mental health risks, emphasizing the urgency for further investigation. However, the current body of literature remains relatively limited, highlighting the necessity for more robust studies in this domain. To develop a full picture of mental health and climate change in the Philippines, additional studies will be needed. Future prospective studies should assess the effects of sea level rising, accrued infectious and vector-borne diseases among frontline communities. Also, indigenous peoples should be included in the development of future interventions. More interventional studies assessing preventive interventions should be carried out to prevent mental health disorders and improve well-being in a context of (un)planned climate migration and before at risk seasons (e.g., monsoon). Moreover, this review identified limited public spending on mental health care as a barrier. However, a recent study (Alibudbud, 2023a) suggests potential for improvement in this area. While this policy is encouraging, further research is needed to definitively determine the current state of mental health care funding. Regardless, continued monitoring and advocacy efforts remain crucial to ensure sustained investment in mental health resources for a climate-resilient health system.

CRedit authorship contribution statement

Villarino Resti Tito: Writing – review & editing, Writing – original draft, Supervision, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Hozhabri Kazem:** Writing – review & editing, Writing – original draft, Validation, Data curation. **Saint-Onge Kadia:** Writing – review & editing, Validation, Methodology, Conceptualization. **Bernard Paquito:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Conceptualization.

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Declaration of Competing Interest

The authors declare no conflict of interest.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ajp.2024.104191.

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