

Evolving Inclusion: A Global Review of Disaster Risk Reduction (DRR) for Individuals with Chronic Illnesses (ICI) in Developing Countries

Meenal Nand^{1,4*}, Jamie Ranse², Masoud Mohammadnezhad³ and Febi Dwirahmadi¹

¹ Centre for Environment and Population Health, School of Medicine and Dentistry, Griffith University, Queensland, Australia

² School of Nursing and Midwifery, Griffith University, Queensland, Australia

³ Faculty of Health, Education and Life Sciences, Birmingham City University, Birmingham, United Kingdom

⁴ College of Medicine, Nursing and Health Sciences, Fiji National University, Fiji Islands

*Correspondence: Meenal Nand, Centre for Environment & Population Health, School of Medicine and Dentistry, Griffith University, Queensland, Australia.

Email: meenal.nand@griffithuni.edu.au; nandmeenal@hotmail.com

Abstract:

Disasters disproportionately impact individuals with chronic illnesses (ICI) in developing countries, where health systems are often under-resourced and fragmented. Despite global commitments such as those in the Sendai Framework for Inclusive Disaster Risk Reduction (IDRR), the integration of chronic illness care and the meaningful participation of ICI in DRR preparedness remain limited. This systematic review examined how developing countries have progressed in addressing the health needs and inclusion of ICIs within DRR strategies, focusing on the role of primary healthcare (PHC), and the barriers and facilitators to participation. A comprehensive literature search was conducted across six databases for English-medium peer-reviewed articles published between 2000 and 2024. Using PRISMA guidelines, 17 studies were selected based on PCCO criteria and assessed for quality using the MMAT tool. Thematic synthesis revealed that most research and interventions remain focused on post-disaster response, with limited attention to preparedness and mitigation for ICIs. PHC is critical in ensuring continuity and access to chronic care before, during, and after disasters, but persistent gaps exist in PHC disaster preparedness, integration, and equity. Common barriers included health system weaknesses, poor PHC integration, financial and physical access challenges, and social vulnerabilities. Facilitators included strong social support networks, community

outreach, innovative PHC models, public-private partnerships, and inclusive policy frameworks. Despite growing recognition of the needs of ICIs within DRR, meaningful inclusion and proactive planning are limited. Strengthening PHC systems, promoting community-centred approaches, and ensuring the voices of ICIs are central to DRR policy and practice are essential for achieving equitable disaster resilience in developing countries and ensuring no one is left behind in disaster events.

Keywords:

Inclusion, Disaster Risk Reduction, Chronic Health Illness, Primary Healthcare, Developing Countries

1. Introduction

Globally, Individuals with Chronic Illnesses (ICIs), including diabetes, cardiovascular disease, chronic respiratory conditions, and cancer, face elevated disaster risk due to disrupted routine care, medication supply chains, and electricity-dependent therapies, a gap recognised in the Sendai Framework for Disaster Risk Reduction (SFDRR) and the WHO Health-EDRM Framework [1,2]. In developing countries, these vulnerabilities are intensified by under-resourced primary healthcare, fragile logistics and cold-chains, and financial/geographic barriers, causing treatment interruptions and preventable complications, underscoring the need to embed chronic care continuity into preparedness, response, and recovery [1,3].

Non-communicable diseases (NCDs) account for 74% of the global disease burden. It is even higher in developing countries, particularly Low- and Middle-Income Countries (LMICs), where over 80% of NCD-related deaths occur, and 86% of premature deaths (those occurring before the age of 70) are attributed to NCDs [4]. Chronic illnesses necessitate continuous management medications, regular monitoring, and specialist care, which are frequently disrupted during crisis situations, resulting in preventable complications and excess mortality [5,6]. As a result, incorporating chronic illness care into Disaster Risk Reduction (DRR) plans is a critical, but frequently overlooked approach to developing resilient and inclusive health systems

The Sendai Framework for Disaster Risk Reduction 2015–2030 emphasises the need for a people-centred, inclusive, and accessible approach to DRR, urging that the needs of vulnerable populations, including those with chronic health conditions, be systematically

addressed [4]. Inclusive Disaster Risk Reduction (IDRR) refers to the systematic integration of the needs and participation of all populations, especially marginalised groups such as ICIs, people with disabilities, the elderly, women, and children, into DRR strategies and policies [2]. However, evidence suggests that policies promoting inclusive DRR for ICIs exist; their practical implementation remains uneven across developing countries [7]. In many cases, inclusion efforts are either absent or limited to short-term emergency response, lacking long-term integration into health systems. According to Maskrey et al (2023), although some disaster management frameworks in LMICs acknowledged vulnerable populations, they are rarely translated into operational strategies during actual disaster events [8]. ICIs are often absent from DRR planning processes, with health needs subordinated to acute trauma and communicable disease management during emergency responses [3].

Advancing inclusive disaster preparedness and response for ICIs relies on strong Primary Healthcare (PHC) systems. PHC is the first point of contact for healthcare and is crucial in providing continuous, community-based management of chronic diseases [9]. Strengthening PHC capacity to maintain essential services during disasters is central to ensuring that ICIs receive timely interventions, medications, and psychosocial support. However, in many developing countries, PHC systems lack the necessary resources, training, disaster preparedness protocols and capacity to adequately serve chronically ill populations during emergencies [6,10,11].

IDRR is critical in disaster management because disasters exacerbate social and health inequities. Rather than one-size-fits-all planning, inclusive DRR implements a rights-based, people-centred approach that allows for meaningful participation in decision-making, ensures accessible and affordable primary healthcare services, and monitors equitable outcomes using disaggregated data and accountability. Inclusive DRR enhances system resilience by including continuity-of-care strategies, while also lowering preventable morbidities and mortalities among ICIs who frequently get left behind [12].

There was a focus on four key dimensions to assess inclusivity in the studies under review. Firstly, examining the extent to which ICIs and other vulnerable groups are involved in DRR planning and decision-making processes [13]. Secondly, assessing equitable access to health services during disasters [14]. Third, it will analyse whether DRR policies explicitly incorporate vulnerable populations and align with inclusive international frameworks [15].

Fourth, it will evaluate if interventions effectively reduce health disparities and build resilience among marginalised populations [16].

Developing countries face unique challenges in operationalising inclusive DRR frameworks. High poverty rates, geographic isolation, resource limitations, and weak health infrastructures amplify disaster risks for vulnerable groups [17,18,19]. Moreover, social exclusion, limited community engagement, and fragmentation between health and disaster management governance often marginalise the voices and participation of individuals living with chronic illnesses in disaster planning processes [20,21,22]. Understanding the extent of participation of ICIs and identifying the barriers and facilitators to their engagement is essential to inform equitable, context-specific DRR strategies that leave no one behind.

Despite growing international emphasis on health system resilience, a substantial knowledge gap remains regarding how DRR strategies in developing countries have progressed toward inclusivity for ICIs. This systematic review addresses this gap by answering the primary research question: “How have DRR initiatives in developing countries included ICIs in addressing their health needs and facilitating their participation?” To achieve this, three sub-questions guide the review: (1) What do existing studies describe IDRR for ICIs in the context of developing countries? (2) What is the role of PHC in DRR in addressing the needs of ICIs? Moreover, (3) What is the extent of participation of ICIs in DRR, and what are the barriers and facilitators to their participation? By synthesising findings from diverse disaster contexts, this review aims to advance the global dialogue on inclusive disaster preparedness and contribute actionable insights for policymakers, healthcare providers, and DRR practitioners committed to building more equitable, resilient health systems in developing countries.

2. Methods

2.1 Search strategy and information sources

This systematic review was performed to answer “In developing countries, how has the inclusion of ICI in DRR progressed in addressing their health needs and ensuring their active participation?” which was developed using the PCCO format where (P) which is the Population referred to ICIs, (C) which is the Concept looked at inclusion component of ICIs in DRR efforts, (C) is indicating the Context from the developing countries point of view which according to World Bank (2024) includes Upper-Middle-Income Countries (UMICs) and LMICs and Outcome (O) which is addressing the health needs of ICIs [23].

This systematic review follows the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline, as it provides a clear and standardised framework for planning, conducting, and reporting reviews including explicit eligibility criteria, comprehensive search strategies, transparent study selection, risk-of-bias appraisal, synthesis methods, and certainty assessments to enhance completeness, transparency, and reproducibility [24]. The review protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) under registration number [CRD42025627512](https://www.crd42025627512).

To derive articles, a preliminary electronic search was conducted using the four domains, namely DRR, ICIs, PHC and Developing Countries in Medline via Ovid. After that, a final combined search which was restricted to title, abstract, and keywords and search themes were combined using the Boolean operator “AND” and “OR.” was conducted on the 5th of November, 2024 using the search string as shown in Table 1 was used to generate more literatures using the databases Medline via Ovid, Scopus, Web of Science, ProQuest Central, Embase and CINAHL (EBSCOhost). The focus of the search was studies published between January 1st, 2000, and November 1st, 2024, in English.

Table 1. Search string of the review

"Disaster Management" OR "Disaster Preparedness" OR "Disaster Response" OR "Disaster Recovery" OR "Disaster Mitigation" OR "Hazard*" OR "Disaster*" OR "Disaster planning" AND "Chronic Disease" OR "Chronic Illness" OR "Chronic Conditions" OR "Long-Term Conditions" OR "Disease Management" OR "Self-Management" OR "Multimorbidity" OR "Multiple chronic conditions" AND "Primary Healthcare*" OR "Primary Health Care" OR "Primary Care" OR "Family Medicine" OR "General Pract*" OR "Family Practice" OR "Emergency Healthcare" OR "Community Health*" OR "Health Promotion" OR "Preventive Care" OR "Health Services" OR "First Contact Care" OR "First Responder*" OR "Paramedic" AND "Develop* Countr*" OR "Low Middle Income*" OR "low Income*" OR "middle income*" OR "Developing State*" OR "Least develop*" OR "Emerging Econom*" OR "Low Resourc*" OR "Resourc* Constraint"

2.2 Inclusion and exclusion criteria

Table 2 presents the included and excluded studies along with their key characteristics.

Table 2. Inclusion and exclusion criteria of the study

Inclusion	Exclusion
Developing countries	Developed & high-income countries
ICIs	Individuals with non-documented chronic illness
Involvement of ICIs in DRR initiatives	Communicable Diseases and COVID-19 articles
NCD-related articles	Studies that do not address DRR
COVID-19 related health emergencies and disasters	Studies that do not address inclusion, participation, or integration of health needs in DRR
Studies show how health services and interventions for chronic illnesses are integrated into DRR plans and responses, including access to medication, continuity of care, and emergency support.	Studies that do not focus on a disaster context
Studies that examine natural disasters and their impact on ICIs	Systematic reviews, scoping reviews and meta-analyses that are peer-reviewed
Qualitative, quantitative and mixed-method studies,	Opinion pieces, commentaries, editorials and non-peer-reviewed sources such as newspapers
Articles in the English medium	Articles that are not in English medium
Articles published from January 1 st 2000 to November 1 st 2024	Articles that were published before 2000

2.3 Study selection

Study eligibility was assessed using the PCCO framework, ensuring alignment with the review objectives. Screening and study management were conducted using the Covidence systematic review software [25]. After duplicate removal, titles and abstracts were independently screened by two reviewers for eligibility. Full-text articles were assessed independently against the inclusion criteria. Conflicts were resolved through discussion or adjudication by a third reviewer within Covidence's workflow management system.

2.4 Study risk of bias assessment

The included studies were appraised for methodological quality using the Mixed Methods Appraisal Tool (MMAT, 2018), ensuring consistency across qualitative, quantitative, and mixed methods designs (Supplementary Table) [26]. Each study was assessed for clarity of research questions, appropriateness of methodology, adequacy of sampling, quality of data collection, and robustness of analysis. Most studies demonstrated moderate-to-good

methodological rigor, although common limitations included sampling biases, self-reported data, and underreporting of generalizability.

2.5 Data extraction

For every study included in this research, the study characteristics, as well as information on participants, methodology and results, were extracted in Microsoft Excel and analysed thematically [27]. The study information included: contributing authors, type of study, year and the country of study. Participants ' characteristics include ICI in DRR initiatives. Methods included setting, population, sampling method and data collection method, with the results in Table 5 (supplementary table). These studies' significant findings and conclusions were extracted and grouped under themes. The primary researcher (MN) compiled a data extraction sheet from the included research, focusing on thematic characteristics. Secondary researchers (FD, JR and MM) reviewed the extracted data for accuracy and completeness.

3. Results

In the preliminary search undertaken in Medline (OVID), a combined total of 32 papers was retrieved. After that, a final search was conducted, which showed that 17 studies were selected in the review to formulate the themes made in this study, which is illustrated in the PRISMA Flowchart (Figure 1).

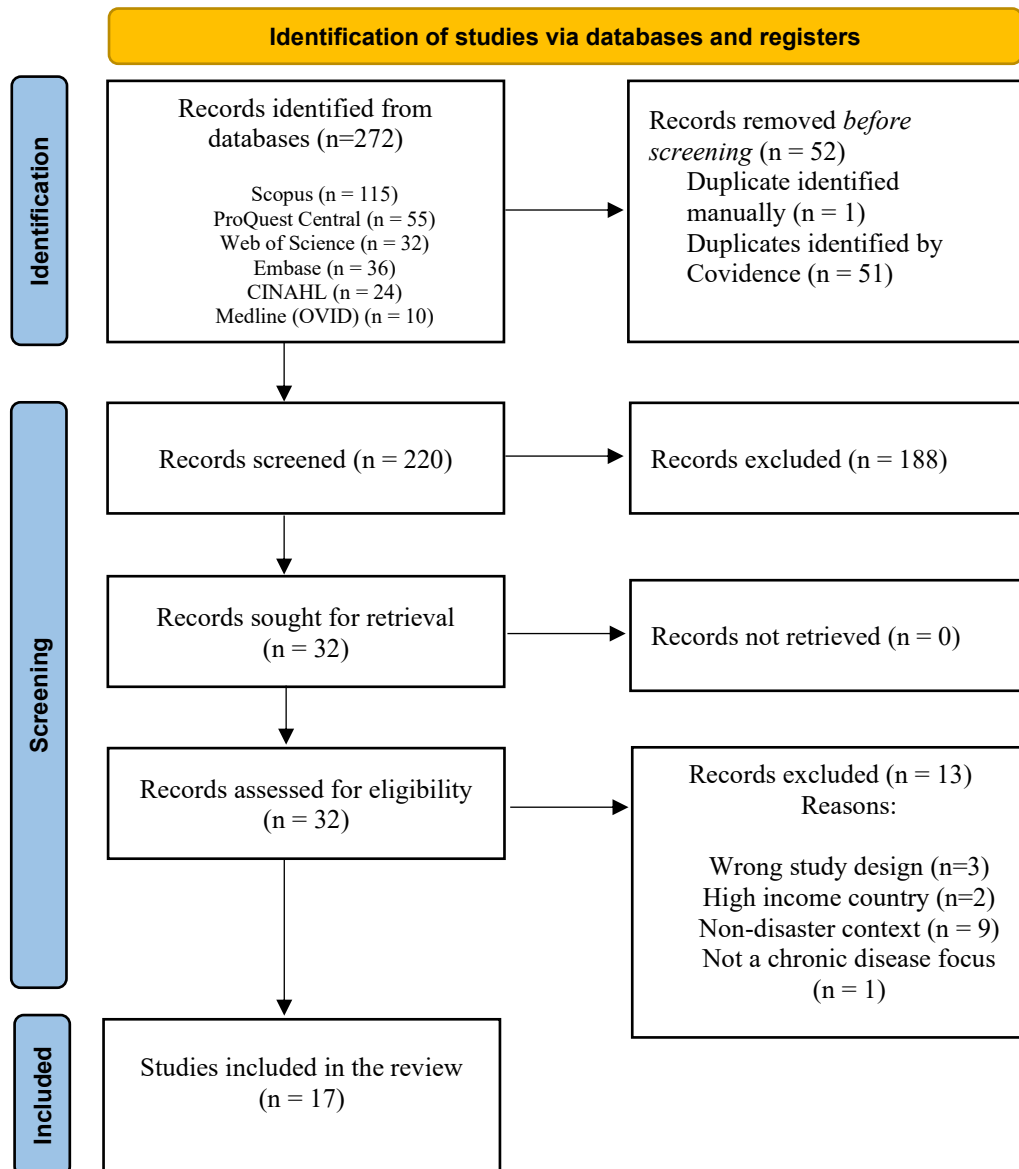


Figure 1: PRISMA flowchart of article selection process

3.1 Description of studies

Across the 17 studies screened, Cross-sectional studies accounted for the most significant proportion (n=9, 47.4%), reflecting the field's reliance on structured assessments to draw broad insights. This was followed by case studies (n=3, 15.8%), retrospective studies (n=2, 10.5%), mixed method studies (n=2, 10.5%), comparative studies (n=1, 5.3%), quantitative studies (n=1, 5.3%), and qualitative studies (n=1, 5.3%), which are further tabulated in Table 3.

Table 3. Descriptive characteristics of included studies (n=17)

Article No.	Author	Year	Article Title	Country/Region	Study Type	Population/Sub-population	Sample, Sampling, Sample size	Data Collection Tool	Data Analysis	Key Findings
1	Chan, E. Y. Y., & PIH, S. ³⁵	2009	Why are older people's health needs forgotten post-natural disaster relief in developing countries?	Pakistan	Cross-sectional	Healthcare providers about older adult needs	210 providers, convenience sample	Questionnaire	Descriptive statistics	Older adults' needs overlooked post-disaster; lack of chronic illness planning in relief.
2	Wagle, S., Amnatsatsue, K., Adhikari, B., Kerdmongkol, P., Van der Putten, M., & Silpasuwan, P. ⁴³	2021	Health-Related Quality of Life After the 2015 Gorkha Earthquakes, Among Older Adults Living in Lalitpur District of Central Nepal	Nepal (Lalitpur District)	Cross-sectional	Older adults, post-earthquake	489, stratified random sample	WHOQOL-BREF questionnaire	Descriptive	Older adults had poor quality of life, especially those with chronic conditions post-earthquake.
3	Cárdenas, M. K., Pérez-León, S., Singh, S. B., Madede, T., Munguambe, S., Govo, V., & Beran, D. ³³	2021	Forty years after Alma-Ata: primary health-care preparedness for chronic diseases in Mozambique, Nepal and Peru.	Mozambique, Nepal, Peru	Mixed methods	PHC workers and chronic patients	45 key informant interviews, doc review	Interview, doc review	Qualitative	PHC often underprepared for NCDs in disasters; integration needed.
4	Dehghani Tafti, A., Fatehpanah, A., Salmani, I., Bahrami, M. A., Tavangar, H., Fallahzadeh, H., & Tehrani, G. A. ³⁰	2023	COVID-19 pandemic has disrupted the continuity of care for chronic patients: evidence from a cross-sectional retrospective study in a developing country.	Iran	Retrospective	Chronic patients (hospital records)	1200 patient records, convenience	Health records	Descriptive statistics	Major disruptions to chronic care and increased complications during COVID-19 pandemic.
5	Aidoo, H., Essuman, A., Aidoo, P., Yawson, A. O., & Yawson, A. E. ⁴¹	2015	Health of the corporate worker: Health risk assessment among staff of a corporate organization in Ghana	Ghana	Cross-sectional	Corporate staff	200, simple random sample	Health risk assessment	Descriptive statistics	High prevalence of NCD risk factors among corporate workers; calls for workplace health interventions.
6	Chan, E. Y., & Griffiths, S. ³⁵	2009	Comparison of health needs of older people between affected rural and urban areas after the 2005 Kashmir, Pakistan earthquake	Pakistan	Comparative	Older adults, urban vs rural	242 (121 urban, 121 rural), stratified	Questionnaire	Chi-square	Rural elderly had less access to healthcare, worse outcomes post-disaster than urban peers.
7	Amin, L., Shah, B. R., Bierman, A. S., Lipscombe, L. L., Wu, C. F., Feig, D. S., & Booth, G. L. ³⁷	2014	Gender differences in the impact of poverty on health: Disparities in risk of diabetes-related amputation	Bangladesh (inferred)	Retrospective	Adults with diabetes	602, hospital records	Medical record review	Logistic regression	Women and poorer individuals at higher risk for amputation; poverty amplifies disparities.
8	Chan, E. Y., & Kim, J. J. ²⁸	2010	Characteristics and health outcomes of internally displaced population in unofficial rural self-settled camps after the 2005 Kashmir, Pakistan earthquake	Pakistan	Cross-sectional	Internally displaced persons (IDPs)	235, cluster sampling	Field survey	Descriptive statistics	IDPs had high burden of chronic illness, low access to primary care services.
9	Brinda, E. M., Rajkumar, A. P., Enemark, U., Prince, M., & Jacob, K. S. ³⁶	2012	Nature and determinants of out-of-pocket health expenditure among older people in a rural Indian community	India	Quantitative	Rural older adults	928, multistage cluster sample	Household survey	Multiple regression	Out-of-pocket costs high for chronic illness care; catastrophic expenditure common.
10	Baru, A., Sultan, M., & Beza, L. ³⁴	2022	The status of prehospital care delivery for COVID-19 patients in Addis Ababa, Ethiopia: The study emphasizing	Ethiopia	Cross-sectional	COVID-19 patients in EMS	360 cases, consecutive sample	EMS transport records	Descriptive statistics	Adverse events frequent in prehospital COVID-19 transport; need system strengthening.

			adverse events occurring in prehospital transport and associated factors							
11	Frontera-Escudero, I., Bartolomei, J. A., Rodríguez-Putnam, A., & Claudio, L. ³⁹	2023	Sociodemographic and health risk factors associated with health-related quality of life among adults living in Puerto Rico in 2019: a cross-sectional study	Puerto Rico	Cross-sectional	Adults, general population	1500, stratified random sample	Standardized survey	Regression, descriptive	Low SES, chronic disease and older age associated with poorer quality of life.
12	Mobula, L. M., Fisher, M. L., Lau, N., Estelle, A., Wood, T., & Plyler, W. ²⁹	2016	Prevalence of hypertension among patients attending mobile medical clinics in the Philippines after Typhoon Haiyan	Philippines	Cross-sectional	Adults using mobile clinics post-disaster	3000+, convenience sample	BP measurement, survey	Descriptive statistics	45% hypertension prevalence post-disaster; many undiagnosed before disaster.
13	Bateman, E., Feldman, C., Mash, R., Fairall, L., English, R., & Jithoo, A. ³¹	2009	Systems for the management of respiratory disease in primary care - An international series: South Africa	South Africa	Case study	PHC, respiratory disease patients	[Not stated, review]	Program documentation	Qualitative	Gaps in PHC respiratory care; models for scalable chronic care in disasters proposed.
14	HabibiSaravi, R., Seyedin, H., Rad, A. M., & Gouya, M. M. ³²	2019	Communicable diseases management in disasters: An analysis of improvement measures since 2005, Islamic Republic of Iran	Iran	Case study	Disaster-affected populations	[Not applicable]	Document review	Qualitative	Improvements since 2005 in communicable disease response, but chronic disease planning remains weak.
15	Haris, S., Poovathumparambil, V., Anaswara, N., Noll, S., Ghatak-Roy, A., Dreyer, N., & Davey, K. ⁴²	2020	Operation Navajeevan: A Public-Private Partnership Model for Disaster Relief in Kozhikode, India	India	Case study	Disaster-affected population	[Not stated, program data]	Program reports, records	Descriptive statistics	PPP improved access to health services for vulnerable, including those with chronic illness.
16	Rudner, N. ³⁸	2019	Disaster Care and Socioeconomic Vulnerability in Puerto Rico	Puerto Rico	Mixed methods	Socioeconomically vulnerable populations	60 households, purposive sample	Interviews, case records	Mixed (thematic + descriptive)	High vulnerability, poor disaster preparedness, high chronic illness burden among poor.
17	Chan, E. Y., Kim, J. H., Lin, C., Cheung, E. Y., & Lee, P. P. ⁴⁰	2014	Is Previous Disaster Experience a Good Predictor for Disaster Preparedness in Extreme Poverty Households in Remote Muslim Minority Based Community in China?	China	Cross-sectional	Poor, minority households	120, cluster sampling	Survey	Regression	Prior disaster experience did not reliably increase preparedness in poorest households.

Among the 19 included studies, the most common primary data analysis approach was descriptive statistical analysis (7 studies; 36.8%), followed by inferential or regression analysis (6 studies; 31.6%), and case studies (3 studies; 15.8%). Thematic or qualitative analysis was used as the primary method in 3 studies (15.8%). Each study was categorised by its single, primary analysis type to ensure mutually exclusive reporting, highlighting the methodological diversity present in the DRR and chronic illness evidence base.

Geographically, the studies included in this review strongly emphasise country-specific contexts and multi-country analyses relevant to developing countries. Of the 17 studies, the most common setting was Pakistan (4 studies; 21%), highlighting both urban and rural DRR challenges in South Asia. Multi-country or cross-regional analyses spanning Mozambique, Nepal, and Peru represented 1 study (5%), demonstrating the value of comparative perspectives for global DRR learning. The USA contributed two studies (11%), which provided relevant insights into chronic illness management post-disaster while based in a high-income context. Other countries with individual, country-specific studies included Nepal (1; 5%), Iran (2; 11%), India (2; 11%), Ghana (1; 5%), Bangladesh (1; 5%), Ethiopia (1; 5%), Puerto Rico (2; 11%), Philippines (1; 5%), South Africa (1; 5%), and China (1; 5%). These settings reflect a diverse representation of disaster risk profiles across Asia, Africa, and the Americas, with particular attention to low- and middle-income country (LMIC) contexts.

When mapped by DRR component, studies with a primary focus on the response phase comprised the largest share, representing 32% (6/19) of included articles. These studies primarily addressed immediate health needs, continuity of care, and access challenges for ICIs in the aftermath of disasters. Studies addressing combined response and recovery phases accounted for 26% (5/19), reflecting the overlapping nature of health needs and system challenges beyond initial emergency periods, such as ongoing medication access and rehabilitation. A smaller group (16%, 3/19) addressed multiple phases or were classified as “all-phase” studies (response, recovery, mitigation and preparedness), exploring integrated system approaches or public-private partnerships across the DRR cycle. A total of 16% (3/19) of studies focused specifically on preparedness, often highlighting gaps in chronic disease planning and the critical role of PHC in DRR. Finally, only 11% (2/19) of studies mapped to mitigation focusing on underlying determinants, risk factors, and structural inequities predisposing certain populations to worse outcomes in disaster contexts. This distribution demonstrated that most research continues to emphasise short-term management of chronic illness in disasters, rather than proactive or structural approaches to risk reduction, highlighting a critical gap and underscoring the need for greater focus on preparedness and long-term resilience in DRR for ICIs.

3.2 IDRR for ICIs in Developing Countries

Concerning Inclusive Disaster Risk Reduction (IDRR) for individuals with chronic illnesses (ICIs), five key themes emerged from the 19 reviewed articles. These include (1) Disruption and Continuity of Care for Chronic Illnesses, (2) Gaps/Weaknesses in PHC and Disaster Preparedness, (3) Social Vulnerability, Inequity, and Marginalisation, (4) Barriers to Access and Community Preparedness, and (5) The Role of Policy, Partnerships, and System Innovation. The following sections will describe each of these themes in more detail, providing evidence from the reviewed studies.

Firstly, the disruption and continuity of care for chronic illnesses emerged as a central concern, with disasters consistently interrupting medication access, healthcare visits, and the ongoing management of noncommunicable diseases, as highlighted in studies from both high- and low-resource settings [28,29,30]. Second, persistent gaps and weaknesses in PHC preparedness and integration with disaster response were documented, with research pointing to underprepared health systems and a lack of integrated planning for chronic illness management within DRR frameworks [31,32,33,34].

Third, the theme of social vulnerability, inequity, and marginalisation was evident across regions, as socioeconomically disadvantaged groups such as the rural poor, elderly, women, and displaced persons were disproportionately affected by disasters, facing higher morbidity, poorer health outcomes, and neglect in disaster relief efforts [35,36,37,38,39]. Fourth, multiple studies identified barriers to access and weaknesses in community and household preparedness, including financial hardship, lack of awareness, and inadequate outreach and screening barriers, which collectively restricted the ability of ICIs to prepare for and recover from disasters [36,40,41,29,34].

Finally, the pivotal role of policy, partnerships, and system innovation was underscored, with studies emphasising the need for multi-sectoral collaboration, innovative service models such as public-private partnerships, and policy reforms that explicitly integrate chronic illness care into all phases of DRR [32,33,42]. Collectively, these themes point to the imperative of advancing holistic, people-centred, and equity-driven approaches to disaster preparedness and response for ICIs in developing countries.

3.3 Role of PHC in IDRR for ICIs

Concerning the role of PHC in IDRR for ICIs, four key themes have emerged from the included 19 articles that were reviewed, which are (1) PHC as the Cornerstone of Continuity and Access to Chronic Care, (2) Gaps in PHC preparedness and integration with disaster systems,

(3) Social Vulnerability and Advancing Health Equity, and (4) Partnerships and Community Engagement in PHC for Resilience.

PHC plays a pivotal role in maintaining continuity of care for ICIs during disasters. Evidence from multiple studies illustrates that disruptions to PHC services, whether from natural disasters, pandemics, or health system shocks, can lead to medication interruptions, missed clinical follow-ups, and deteriorating health outcomes for vulnerable populations [28,29,30]. The frontline presence of PHC is particularly vital in ensuring sustained access to essential medicines and routine disease management, which are frequently jeopardised during crises. When PHC remains functional and accessible, it serves as a buffer against the compounding risks of unmanaged chronic conditions in the aftermath of disasters.

Despite its critical role, studies reveal persistent gaps in PHC preparedness for DRR. PHC systems in many developing contexts remain underprepared to meet the complex needs of people with NCDs and other chronic conditions during emergencies [31,32,33,34]. This is compounded by a lack of integration between routine chronic disease management and disaster planning, resulting in fragmented or reactive service delivery. System-level weaknesses, such as insufficient training, supply chain interruptions, and the absence of clear referral pathways for chronic patients, further undermine PHC effectiveness in disaster situations.

PHC is uniquely positioned to address the social determinants of health and reduce inequities exacerbated by disasters. The studies reviewed highlight that socioeconomically disadvantaged groups including the rural poor, elderly, women, displaced populations, and those with low health literacy face disproportionate barriers in accessing PHC before, during, and after disasters [28,35,36,37,38]. Equity-oriented PHC approaches are therefore essential for reaching marginalised communities, prioritising continuity of care for the most vulnerable, and reducing the risk of exclusion from disaster response mechanisms. Proactive PHC involvement can help ensure that those most at risk are not left behind in DRR strategies.

Emerging models and innovations in PHC demonstrate promising strategies to overcome traditional barriers in disaster contexts. Public-private partnerships, mobile clinics, workplace health interventions, and community risk assessment initiatives illustrate how PHC can expand its reach and effectiveness during emergencies [29,41,42]. Effective PHC also contributes to community preparedness through risk communication, health education, and the development of local resilience capacities [34,40]. Furthermore, policy reforms that foster collaboration between PHC, emergency services, and local organisations are vital to building integrated and DRR systems for ICIs.

3.4 Extent of participation, barriers and facilitators to participation

Concerning the extent of participation, barriers and facilitators to participation, several key themes have emerged from this review, which are tabulated in Table 4 below.

Table 4. Extent of participation, barriers and facilitators to participation from the included studies (n=17)

Component	Themes	Key Supporting Authors
Extent of Participation	- Participation is often passive or minimal - Limited consultation in planning - Proactive engagement is rare	Chan & PIH (2009); Cárdenas et al. (2021); Chan et al. (2014); Rudner (2019); Mobula et al. (2016); Dehghani Tafti et al. (2023); Chan & Kim (2010); HabibiSaravi et al. (2019)
Barriers	- Lack of awareness, poverty, age, and displacement - Healthcare system/service gaps - Financial and physical barriers - Stigma/cultural issues	Chan et al. (2014); Rudner (2019); Amin et al. (2014); Brinda et al. (2012); Chan (2010); Cárdenas et al. (2021); Bateman et al. (2009); Dehghani Tafti et al. (2023); Chan & Griffiths (2009); Baru et al. (2022)
Facilitators	- Social support - Outreach/mobile clinics - Partnerships and innovation - Inclusive policy - Health education	Mobula et al. (2016); Haris et al. (2020); Cárdenas et al. (2021); Aidoo et al. (2015); Chan et al. (2014); Bateman et al. (2009); Rudner (2019)

The collective evidence from 17 studies underscores that the participation of ICIs in DRR remains limited and often passive across diverse developing country contexts. While some post-disaster engagement is observed through health service utilisation or mobile outreach, such as participation in hypertension screening following typhoon events [29], the broader involvement of ICIs in proactive preparedness activities, community planning, and decision-making processes is generally minimal. Studies indicate that the most marginalised, including the rural poor, elderly, and displaced populations, are rarely consulted in DRR planning, and household or community preparedness levels among these groups are notably low [33,35,38,40].

Multiple barriers hinder the active participation of ICIs in DRR. Chief among these are limited awareness and knowledge about disaster risks and preparedness strategies, and a lack of targeted communication and education efforts [38,40]. Social and economic vulnerability, including poverty, advanced age, displacement, gender inequities, and rural residence, exacerbates marginalisation and further restricts opportunities for engagement [28,36,37,39].

Systemic gaps, such as weak integration of chronic illness management into DRR frameworks, disruptions in health services, and a lack of chronic illness planning in disaster relief, are common obstacles [30,31,33]. Financial barriers—most notably catastrophic out-of-pocket health expenditures and physical obstacles, such as damaged infrastructure and long distances to health facilities, significantly hinder access to services and participation [35,36,43]. Additionally, social stigma and cultural barriers contribute to the isolation and exclusion of ICIs in disaster contexts [35].

Despite these challenges, several facilitators have been identified that enhance the participation of ICIs in DRR. Strong social support networks comprising family, neighbours, and peer groups play a pivotal role in helping ICIs access care and information, especially in times of crisis. Community outreach, particularly through mobile clinics and proactive health services, increases health service utilisation and brings care closer to vulnerable populations [29,42]. Effective partnerships between public, private, and non-governmental actors, along with innovative service delivery models, have been shown to expand access and tailor responses to the unique needs of ICIs [42]. Inclusive DRR policies that deliberately integrate the perspectives and requirements of ICIs, and that embed chronic care within emergency and disaster systems, also serve as key enablers of participation [33]. Lastly, health education and risk communication initiatives that build awareness and empower ICIs to participate in preparedness activities are essential for reducing vulnerability and promoting equitable DRR [40,41].

4. Discussion

This review critically examined the extent to which developing countries have advanced the inclusion of individuals with chronic illnesses (ICIs) within DRR strategies, highlighting the evolving role of PHC and the multifaceted barriers and facilitators shaping participation. The findings demonstrate that, while developing countries have made incremental progress in recognising and addressing the health needs of ICIs within DRR strategies, significant challenges remain in translating recognition into inclusion in DRR policies and practice.

The studies reviewed reveal that, over the past decade, there has been a gradual but significant shift towards acknowledging the needs of ICIs in DRR discourse, especially in the context of rising NCD burdens in developing countries. Several countries have made strides in integrating chronic disease management into emergency response frameworks and public health policies [32,33]. However, the evidence consistently demonstrates that inclusion is often

more rhetorical than operational. Most DRR efforts continue prioritising acute, communicable threats, leaving gaps in preparedness and response for those with ongoing, complex health needs [30,31]. Notably, the participation of ICIs in DRR planning and decision-making remains limited; their voices and lived experiences are rarely central to the design of preparedness, mitigation, and recovery interventions [35,38]. This limited engagement results in DRR strategies that may overlook or inadequately address the realities faced by people living with chronic illness. Similar findings by Aitsi-Selmi et al. (2015), Tatsuki (2018), and Burns et al. (2020) highlighted the persistent disconnect between policy commitments and operational practices. However, a few contexts, such as Japan’s disability-inclusive community drills and New Zealand’s chronic-care preparedness initiatives, demonstrated more substantive integration of ICIs into DRR planning [44,45,46].

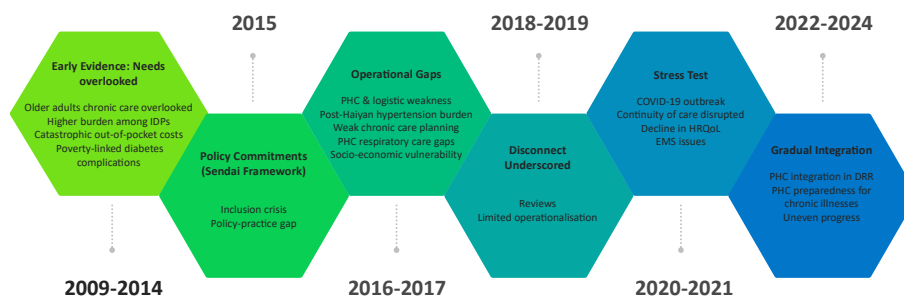


Figure : Evolving inclusion of ICIs in DRR

A key insight from this review is the foundational role of PHC as the frontline system for addressing the health needs of ICIs before, during, and after disasters. PHC facilities are often the first point of contact for ICIs, serving as hubs for medication access, continuity of care, risk communication, and health education [29]. In contexts where PHC systems are resilient and well-integrated with DRR mechanisms, disruptions to chronic care can be minimised, as evidenced by innovative models such as public-private partnerships and mobile outreach clinics [29,42]. Nevertheless, significant gaps persist in the preparedness of PHC

systems to respond to disasters. Many facilities lack disaster-specific planning for chronic disease management, face recurrent stockouts of essential medicines, and operate with limited guidance on how to adapt services for vulnerable populations during emergencies [31,33]. Similar observations have been reported with studies by Subramaniam & Villeneuve (2020), Wilson et al. (2021), and Kabir et al. (2022), confirming that PHC disaster readiness for chronic illness is often inconsistent, though some high-performing systems demonstrate that proactive, well-resourced PHC can substantially reduce disaster-related health disruptions for ICIs [13,47,48]

Multiple, intersecting barriers inhibit the meaningful participation of ICIs in DRR processes. Social determinants such as poverty, advanced age, gender, displacement, and rural residency consistently emerge as sources of heightened vulnerability, restricting both access to services and opportunities for engagement [36,37,39]. Health system constraints, including weak integration of chronic care with DRR, disruptions to PHC services, and lack of inclusive policy frameworks, further marginalise ICIs [31,33]. Financial barriers, notably catastrophic out-of-pocket health expenditures, and physical obstacles such as long distances to health facilities and damaged infrastructure impede participation [35,36]. Compounding these challenges are limited community awareness, social stigma, and, in some cases, cultural norms that deprioritise chronic illness in the context of disaster response [28]. The findings are consistent with Eyre et al. (2017), Kelman & Harris (2021), and Sunarto et al. (2024), echoing these intersecting barriers demonstrate that proactive, participatory approaches can overcome many of these constraints [49,50,51]

Despite these challenges, the review identifies several facilitators who can advance inclusive DRR for ICIs. Robust social support networks, familial, community-based, or peer-led, are critical in helping individuals access care and information, particularly in crisis settings. Community outreach, mobile clinics, and integrated service delivery models are shown to increase the reach and effectiveness of PHC, especially among marginalised populations [29,42]. Policy innovation, including deliberate integration of chronic disease management within DRR strategies and fostering partnerships across sectors, has been pivotal in contexts where progress has been made [33,42]. Health education and risk communication interventions that empower ICIs with knowledge and resources to participate in preparedness activities are fundamental for reducing vulnerability and promoting resilience [40,41]. Similar findings have been elaborated by Grimm et al. (2021) and Forsgren et al. (2022), highlighting that sustained investment in community health networks, culturally tailored preparedness campaigns, and

cross-sectoral coordination can significantly improve inclusion and health outcomes for ICIs during disasters [52,53]

The review highlighted that, despite increased recognition of the needs of ICIs in DRR, true operational inclusion remains limited in developing countries. While some policy advances have been made, practical gaps persist, particularly in integrating chronic care into PHC and DRR systems. The participation of ICIs in disaster planning is often passive, hindered by socioeconomic vulnerabilities, health system weaknesses, and barriers such as financial hardship, lack of information, and inadequate community outreach. These challenges are compounded for marginalised populations, reinforcing cycles of exclusion. However, the review also points to facilitators such as resilient PHC, mobile services, community support, and innovative partnerships that can enhance inclusion. Overall, bridging the gap between policy rhetoric and real-world practice is essential for achieving truly inclusive, people-centred DRR that addresses the health needs and participation of ICIs.

5. Implications for policy and practice

The review highlights the urgent need for developing countries to move beyond rhetorical commitments and embed the needs and participation of ICIs into the core of DRR strategy and practice. Strengthening PHC systems focusing on disaster preparedness, ensuring the continuous availability of essential medicines, and developing inclusive policies that explicitly address the social determinants of health are crucial steps. Efforts should be directed towards mitigating physical and financial barriers and fostering environments in which ICIs are empowered to actively participate in all stages of the disaster cycle, from risk assessment and planning to response and recovery.

6. Limitations of the study

This systematic review has a few limitations. First, the included studies were highly heterogeneous in design, population focus, disaster type, and setting, which limited opportunities for direct comparison and quantitative synthesis; most findings were descriptive or qualitative. Second, restricting the review to peer-reviewed literature may have introduced publication bias, potentially overlooking relevant studies published in other grey literature. Third, all forms of review papers were excluded from the study. At the same time, this ensured a focus on original research. However, it may have led to omitting important synthesised insights or broader perspectives available in existing review literature.

7. Conclusion

This systematic review demonstrated that while there is increasing recognition of the needs of ICIs in DRR across developing countries, progress remains fragmented. Most research and interventions still centre on post-disaster response, with insufficient emphasis on preparedness, mitigation, or integration of chronic care within disaster systems. Limited PHC readiness and the lack of proactive involvement of ICIs in DRR planning are key challenges.

Nevertheless, the review highlighted promising practices such as strong social support, outreach initiatives, and policy innovations that can facilitate more inclusive disaster preparedness. DRR efforts must prioritise integrated, community-based approaches that strengthen PHC and address social vulnerabilities. This will be vital to ensure that ICIs are not left behind and that PHC systems in developing countries become truly resilient and equitable in the face of disasters.

Acknowledgements

The authors wish to acknowledge the Griffith University Librarian, Amanda Pearson, for her support and guidance towards conducting a literature search for the study.

Author Contributions

MN: Conceptualisation, Methodology, Data curation, Analysis, Writing original draft, reviewing and editing and visualisation. JR: Supervision, Conceptualisation, Methodology. MM: Supervision, Writing- Review and editing, FD: Supervision, Conceptualisation, Methodology.

Competing Interests Statements

The authors declare that there are no competing or potential conflicts of interest. The views presented here are of the authors and do not necessarily represent those of the organisations they work for.

Data Availability

The comprehensive data extraction sheet will be made available on request.

Funding

This research received no specific grant from funding agencies in the public, commercial or not-for-profit sectors. This research is supported by Griffith University Postgraduate Research Scholarship (GUPRS) and the Australian Government Research Training Program (RTP) Scholarship for Meenal Nand.

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Supplementary Table 1.

Author (Year)	Year	Design Category (MMAT)	S1: Clear research questions?	S2: Data allow addressing RQ?	C1	C2	C3	C4	C5	Notes / Justification
Chan, E. Y. Y., & PIH, S.	2009	Quantitative descriptive	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Precise aim, appropriate sampling, relevant measurement, complete data, appropriate analysis.
Wagle, S., et al.	2021	Quantitative descriptive	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Clear aim, probability sampling, valid measurement tools, high data completeness, and appropriate descriptive statistics.
Cárdenas, M. K., et al.	2021	Mixed methods	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Integration of qualitative and quantitative, clear rationale, relevant sampling for both components, appropriate analysis and coherence.
Dehghani Tafti, A., et al.	2023	Quantitative descriptive	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Clear aim, relevant sampling, valid measures, high completeness, and appropriate descriptive analysis.
Aidoo, H., et al.	2015	Quantitative descriptive	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Random sampling, valid measurements, and appropriate descriptive statistics.
Chan, E. Y., & Griffiths, S.	2009	Quantitative descriptive	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Comparative design, stratified sampling, valid measurement tools, complete data, and appropriate analysis.
Amin, L., et al.	2014	Quantitative non-randomized	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Hospital records, appropriate logistic regression, and addressed confounding.
Chan, E. Y., & Kim, J. J.	2010	Quantitative descriptive	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Cluster sampling, field survey, relevant measures, and appropriate descriptive statistics.
Brinda, E. M., et al.	2012	Quantitative non-randomized	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Multistage cluster sampling, valid household survey, and regression analysis.
Baru, A., et al.	2022	Quantitative descriptive	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Consecutive sampling, EMS records, and appropriate descriptive statistics.
Frontera-Escudero, I., et al.	2023	Quantitative non-randomized	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Stratified random sample, standardised survey, regression analysis.
Mobula, L. M., et al.	2016	Quantitative descriptive	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Large convenience sample, appropriate BP measurement, descriptive statistics.
Bateman, E., et al.	2009	Qualitative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Program documentation, relevant qualitative approach, coherent findings.

HabibiSaravi, R., et al.	2019	Qualitative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Document review, qualitative synthesis, coherent with the aim.
Haris, S., et al.	2020	Qualitative	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Program evaluation, qualitative approach, relevant data collection and analysis.
Rudner, N.	2019	Mixed methods	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Clear integration of methods, relevant sampling, and coherence between quantitative and qualitative.
Chan, E. Y., et al.	2014	Quantitative non-randomized	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Cluster sampling, a valid survey, and regression analysis.

MMAT Criteria Definitions:

1. Qualitative Studies:

C1: Is the qualitative approach appropriate to answer the research question?

C2: Are the qualitative data collection methods adequate to address the research question?

C3: Are the findings adequately derived from the data?

C4: Is the interpretation of results sufficiently substantiated by data?

C5: Is there coherence between qualitative data sources, collection, analysis, and interpretation?

2. Quantitative Descriptive Studies:

C1: Is the sampling strategy relevant to address the research question?

C2: Is the sample representative of the target population?

C3: Are the measurements appropriate?

C4: Is the risk of nonresponse bias low?

C5: Is the statistical analysis appropriate to answer the research question?

3. Quantitative Non-Randomised Studies:

C1: Are participants representative of the target population?

C2: Are measurements appropriate regarding both the outcome and exposure/intervention?

C3: Are there complete outcome data?

C4: Are confounders accounted for in the design and analysis?

C5: Is the statistical analysis appropriate to answer the research question?

4. Mixed-Methods Studies:

C1: Is there an adequate rationale for using a mixed-methods design to address the research question?

C2: Are the different components of the study effectively integrated to answer the research question?

C3: Are the outputs of the integration of qualitative and quantitative components adequately interpreted?

C4: Are divergences and inconsistencies between quantitative and qualitative results adequately addressed?

C5: Do the different components of the study adhere to the quality criteria of each tradition of the methods involved?

Supplementary Table 2. PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Pages 5-6
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Pages 4-5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Pages 4-5
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 6
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 6
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 6
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	N/A
Synthesis	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating	Page 6

Section and Topic	Item #	Checklist item	Location where item is reported
methods		the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 6
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 6
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 6
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 6
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Page 6
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Pages 6-7
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 7
Study characteristics	17	Cite each included study and present its characteristics.	Pages 8-9
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Supplementary Table 1
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	N/A
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Pages 10-14
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Pages 10-14
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized	Pages 10-14

Section and Topic	Item #	Checklist item	Location where item is reported
		results.	
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Supplementary Table 1
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pages 14-16
	23b	Discuss any limitations of the evidence included in the review.	Page 17
	23c	Discuss any limitations of the review processes used.	Page 17
	23d	Discuss implications of the results for practice, policy, and future research.	Pages 16-17
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	PROSPERO, Reg No. CRD42025627512
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	https://www.crd.york.ac.uk/PROSPERO/view/CRD42025627512
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Nil
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 18
Competing interests	26	Declare any competing interests of review authors.	Page 18
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 18

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. This work is licensed under CC BY 4.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by/4.0/>