

# A review of nurse educators' knowledge and perceptions of climate change and its implications for nursing care

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## ABSTRACT

### Introduction

Climate change is rapidly becoming a global challenge, posing increased risks to human health. The United Nations has set a target to take urgent action to combat climate change and to strengthen educational institutions by incorporating climate change education into their curricula by 2030. This initiative is supported by the Intergovernmental Panel on Climate Change. Although nurses are at the forefront of managing health impacts related to climate change, little is known about the extent to which climate change is incorporated into their training on environmental education.

### Purpose

This review aimed to explore the knowledge and perceptions of nurse educators regarding climate change and its implications for nursing care.

### Methods

A systematic search strategy was applied to identify articles focusing on nurse educators' understanding of climate change and its effects on nursing care. Databases searched included ProQuest Central, PubMed, ClinicalKey, EBSCOhost, Scopus, Web of Science, Sage Journals, and Google Scholar. The search yielded 431 articles published between 2014 and 2024. Of these, 14 articles met the inclusion criteria and were analysed using content analysis.

### Results

The review of 14 studies revealed that 87% of nurse educators acknowledged climate change as a global concern, but only 42% reported confidence in teaching its health impacts. Five major themes emerged: (1) acknowledgment of climate change as a global phenomenon, (2) scientific knowledge and understanding of climate change education, (3) integration of content into curricula, (4) perceptions of climate change and its impact on health among nurse educators, and (5) barriers to incorporating climate change education into nursing curricula. Nurse educators' global health experience and interest enhanced their perception of the relevance of climate change to nursing education.

### Conclusion

Climate change poses significant challenges in terms of resource availability, curriculum integration, and educator readiness. There is an urgent need for competency building, curriculum reform, and resource development to prepare nurses for climate-related health challenges. Interdisciplinary collaborations, standardized guidelines, and frameworks that support the integration of climate change content into nursing education are recommended.

## INTRODUCTION

The Intergovernmental Panel on Climate Change (IPCC) posits that the earth's climate is changing at a fast rate, posing increased risks to human health because of both natural temperature variations and global warming directly caused by human activity (Engelbrecht & Monteiro, 2021). The effects of these changes demonstrate a close connection between planetary health and public health. Although climate change has been occurring continuously for the past 100 years, the speed of this variation has accelerated dramatically during that period, leading to significant disruptions in the earth's ecosystems (Arora, 2019).

Statistics from the United Nations (UN) indicate that 2010 to 2019 was the warmest decade on record, marked by increased frequencies of heatwaves, floods, wildfires, droughts, and hurricanes, all of which negatively impacted human health (Álvarez-Nieto et al., 2022). Such phenomena contribute to disruptions in mental, physical, and psychological health due to the spread of infectious diseases (Mazzoglio et al., 2023). Additional consequences include rising sea levels, food and water insecurity, mass migration, political unrest, and financial losses for both individuals and governments (Mazzoglio et al., 2023). Therefore, climate change is widely regarded as a global challenge with visible impacts on human health. The occurrence of extreme weather events and the increase in global surface temperatures are developing at an alarming pace, with significant global repercussions that threaten human well-being (Sukla et al., 2019).

The Emergency Event Database (EM-DAT) recorded 387 natural catastrophes worldwide in 2022, which resulted in 30,704 deaths and affected 185 million individuals – three times higher than in 2021 (EM-DAT, 2022). Moreover, climate-related illnesses, premature deaths, malnutrition in its various forms, and threats to mental health and well-being are all rising (EM-DAT, 2022). For example, droughts affected 88.9 million people in Africa, heatwaves in Europe caused nearly 16,000 additional deaths, and hurricanes caused approximately \$100 billion in damages across the Americas (EM-DAT, 2022). Asia experienced some of the most devastating disasters in 2022, though the scale of impact was relatively lower compared with other continents (Mishra et al., 2021). In South Africa, the effects of climate change have also been profound, with a surface

temperature increase of 2°C per century – making climate change a matter of urgent national significance and reframing it as a global public health phenomenon (Mikulewicz, 2020).

The United Nations' Sustainable Development Goal (SDG) 13 aims to urgently combat climate change and its impacts on all communities, particularly vulnerable populations, by 2030 (Hickel, 2019). To ensure effective climate change adaptation, mitigation strategies, and impact reduction, health policies should integrate these dimensions, educational institutions should incorporate climate change content into their curricula, and public awareness should be strengthened (United Nations, 2022). However, concerns regarding the feasibility of SDG 13 persist due to rising carbon emissions, ineffective mitigation strategies, and communities' limited knowledge – especially among marginalised and vulnerable groups (Ngcamu, 2023). Protecting public health therefore requires a healthcare workforce equipped to advocate for policy reform in response to rapid environmental degradation linked to climate change (McKimm & McLean, 2020). To enhance awareness and preparedness, sustainable healthcare should be integrated into health professional curricula (Tun et al., 2020).

Nursing represents a significant proportion of the healthcare sector (Dal'Bosco et al., 2020). Nurses are at the frontline of primary healthcare delivery, with roles that include addressing health impacts of climate change through direct patient care, education, advocacy, and community support to mitigate, adapt, and build resilience in the face of a changing climate (Martel-Morin & Lachapelle, 2022). Their active engagement provides opportunities to minimise the environmental impact of healthcare practice, including involvement in public health initiatives to mitigate climate change (Cook & Vizy, 2019). Therefore, it is essential for nurses to be knowledgeable about climate change, its implications, and strategies to manage climate-related health risks, while also preparing health facilities and communities to address its impacts (Leffers et al., 2017).

There is growing recognition of the importance of education in addressing climate change, but two major barriers impede the successful implementation of climate

change education in South African tertiary institutions: (a) fragmentation of information and instruction across policy levels and (b) the failure to align new scientific findings with educational content (Ardoin et al., 2020; Polit & Beck, 2021). In contrast, the Flemish Association for Development Cooperation and Technical Assistance established a coherent policy framework to ensure that climate change education is integrated across all educational levels, thereby fostering climate resilience (Asha et al., 2020). The IPCC has also produced comprehensive reports on the causes, impacts, and response options for climate change, highlighting the importance of climate change education within the health sector (Engelbrecht & Monteiro, 2021). Supporting this view, Breunig et al. (2019) argued that climate change education focusing on health and sustainable consumption should be incorporated into lifelong learning at all stages.

The psychological state of students regarding climate change may be linked to their knowledge and attitudes about the subject. Early introduction of climate change content in undergraduate nursing programmes fosters positive perceptions among students regarding the importance of climate change in nursing (Ali et al., 2024). The UN also emphasises higher education institutions as critical actors in expanding climate education across diverse topics to support community development (Reid, 2019). However, a literature gap persists: while many studies examine climate change broadly, relatively few explore how healthcare professionals might benefit from climate change education when integrated into curricula.

Despite the existence of projects in institutions focusing on the SDGs, knowledge gaps remain (Chankseliani et al., 2021). Many educators, from novices to seasoned professionals, are not required to undergo professional development related to climate change education (Reid, 2019). Martel-Morin and Lachapelle (2022) noted reluctance to integrate climate change into nursing curricula, largely due to the lack of nurse leaders' involvement in policy-making and limited expertise in the field. Consequently, this paper seeks to explore nurse educators' knowledge and perceptions of climate change and its implications for nursing care. Given the limited studies addressing this specific phenomenon, this review aims to fill the gap by assessing educators' knowledge, perceptions, and

perspectives on the integration of climate change into nursing curricula (Kotcher et al., 2021).

## METHODS

This integrative review is grounded in Rogers' Diffusion of Innovation theory, cited in Yu (2022), which provides a framework for understanding how new ideas spread within social systems. The theory highlights four key elements: innovation (climate change education in nursing curricula), communication channels (academic networks and professional forums), time (stages of adoption from knowledge to implementation), and the social system (nursing education institutions and stakeholders). In this context, Rogers' framework guided our understanding of how knowledge and practices of climate change education diffuse within nursing education and informed strategies to facilitate successful curriculum integration.

The review method applied was guided by the four stages of integrative review outlined by Whitemore et al. (2016). These stages include: (1) identifying the problem, (2) conducting a literature search, (3) synthesising data, and (4) evaluating, analysing, and interpreting results. An integrative literature review was chosen because it enabled the researchers to combine both qualitative and quantitative investigations, thereby providing a comprehensive understanding of the topic (Toronto & Remington, 2020). This approach was particularly appropriate given the complex relationship between nursing education and climate change (Aveyard & Bradbury-Jones, 2019).

### Search Strategy

A comprehensive search was conducted across eight databases—ProQuest Central, PubMed, ClinicalKey, EBSCOhost, Scopus, Web of Science, Sage Journals, and Google Scholar—to identify publications on nurse educators' knowledge and perceptions of climate change and its implications for nursing care. Keywords included *knowledge*, *perception*, *climate change*, *nurse educators*, *planetary education*, and *environmental education*.

The search yielded 431 articles, with an additional five retrieved through citation searching, for a total of 436. After removing 46 duplicates, 390 articles were screened by title and abstract. Of these, 281 were excluded for not meeting

inclusion criteria. The inclusion and exclusion criteria applied were:

#### Inclusion criteria:

- Peer-reviewed articles (qualitative, quantitative, or mixed-methods) published between 2014–2024.
- Focus on nurse educators' knowledge and/or perceptions of climate change and its implications for nursing care.
- Publications in English.

#### Exclusion criteria:

- Articles not addressing nurse educators' perspectives.
- Non-English publications.

Following screening, 109 articles were assessed for eligibility. Of these, 95 were excluded (72 out of scope, 23 unavailable), leaving 14 articles for the final review. Data from the selected studies were documented using the Rayyan software platform for sorting. The PRISMA flowchart in [Figure 1](#) illustrates the selection process ([Page et al., 2021](#)).

#### Quality Appraisal

[Whittemore and Knafl \(2005\)](#) note that there is no universally accepted tool for assessing the quality of integrative literature reviews. Given the varied methodologies of the 14 selected studies—qualitative, quantitative, mixed-methods, systematic reviews, and case reports—appropriate design-specific appraisal checklists were applied.

- **Qualitative studies** were assessed for methodological congruence, reflexivity, and participant representation using the *Joanna Briggs Institute Qualitative Assessment and Review Instrument (JBI-QARI)*, which includes 10 criteria questions. A minimum score of 5/10 was required ([Anderson et al., 2021](#); [Davis et al., 2022](#); [Munn et al., 2014](#); [Palaiologou & Brown, 2023](#)).
- **Quantitative studies** were evaluated for research focus, methodology, bias reduction, and analytical rigour using the *Pearson Critical Appraisal Checklist* ([Pearson et al., 2018](#); [Tod et al., 2022](#)).
- **Systematic reviews** were assessed using the *JBI Critical Appraisal Tool for Systematic Reviews*, with

attention to search strategies, critical appraisal processes, and evidence-based recommendations ([Aromataris et al., 2015](#); [Hilton, 2024](#)).

- **Mixed-methods studies** were evaluated using the *Mixed Methods Appraisal Tool (MMAT)*, which examines both qualitative and quantitative components as well as their integration ([Hong et al., 2018](#)).
- **Case reports** were assessed using the *JBI Critical Appraisal Checklist for Case Reports*, with emphasis on case descriptions, methodological appropriateness, and clinical relevance ([Moola et al., 2017](#)).

#### Data Extraction

Data extraction followed a systematic process guided by the PRISMA recommendations. A search across the eight databases yielded 431 records, supplemented by five from citation searching, totalling 436. After removing 49 duplicates, 385 articles remained for screening. Title and abstract screening excluded 281 records that did not meet inclusion criteria.

The remaining 104 full-text articles were assessed for eligibility. Of these, 95 were excluded (72 out of scope, 23 unavailable), leaving 14 studies for the final integrative review. Data were extracted into a structured table, capturing author/year, study setting, sample size, study design, and key findings on nurse educators' knowledge and perceptions.

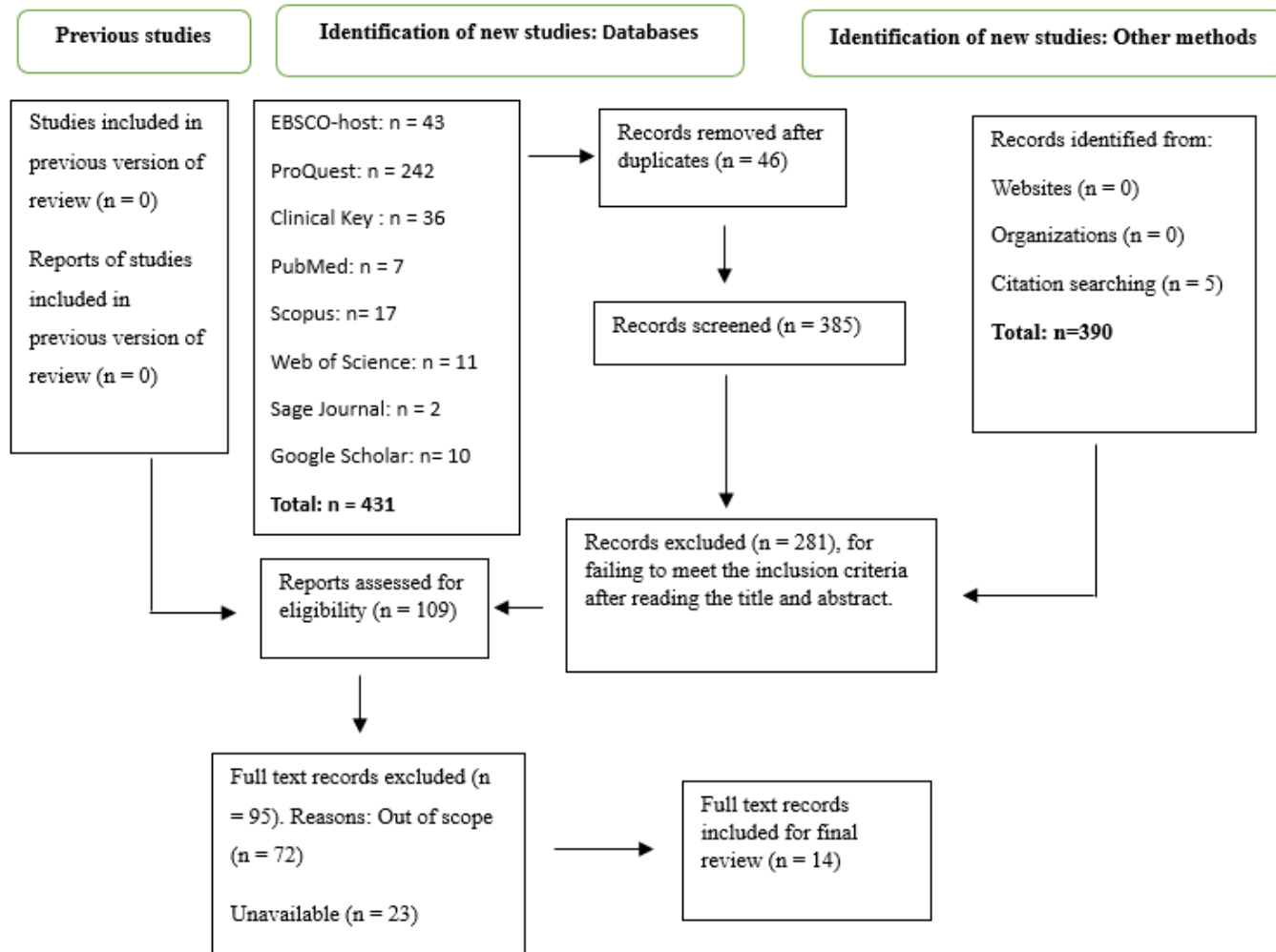
#### Data Analysis

The analysis of integrative literature reviews is still developing ([Whittemore & Knafl, 2005](#)). Nonetheless, qualitative content analysis is widely recognised as the most appropriate method for synthesising integrative reviews ([Aromataris et al., 2015](#)). Accordingly, qualitative content analysis was employed in this review ([Toronto & Remington, 2020](#)).

Each of the 14 included studies was read multiple times. Patterns were identified and coded, and these codes were then collated and compared to produce sub-themes. Data were organised using a matrix to identify trends and facilitate comparisons across studies. The four researchers collaborated to deliberate on the final themes and sub-

themes, establish credibility, and reach consensus on the findings.

Figure 1:  
PRISMA Flow Chart Indicating the selection Process and the Final Articles selected Page et al., 2021



## RESULTS

### Article Characteristics

A total of 14 articles published between 2015 and 2024 met the inclusion criteria for this review. Studies were conducted internationally, reflecting the relatively new phenomenon of climate change education in nursing. One study (7.14%) was published in 2015 (Adlong & Dietsch, 2015), one (7.14%) in 2016 (Jones et al., 2016), one (7.14%) in 2017 (Leffers et al., 2017), two (14.29%) in 2019 (Kerr et al., 2019; Walpole et al., 2019), one (7.14%) in 2021, six (49.86%) in 2022 (Aronsson et al., 2022; Cadet, 2022; Eilam, 2022; Griffin et al., 2022; Katzman et al., 2022; Nichols et al., 2022),

and two (14.29%) in 2023–2024 (Flaten et al., 2023; Ward et al., 2023).

Regarding methodological approaches, seven studies (50.0%) employed qualitative designs, three (21.43%) used mixed methods, three (21.43%) were systematic literature reviews, and one (7.14%) employed a quantitative design. Many of the included studies were conducted in urban academic settings across different countries.

Across the 14 studies, 87% of nurse educators acknowledged climate change as a global concern, but only 42% felt confident teaching its health impacts.

**Table 1:**  
Summary of Articles Included in the Review

Author(s), Year	Setting	Sample	Design	Summary of Findings
Katzman et al. (2022)	New Mexico, USA	625 participants	Mixed methods	Climate change education is scarce within health curricula. Clinicians must gain knowledge and skills to address its impacts. Although efforts exist to close this gap, more work is required.
Adlong & Dietsch (2015)	New South Wales, Australia	Journals and policies	Secondary qualitative	Nurse educators play a central role in teaching climate-health effects (e.g., extreme weather, disease transmission, food insecurity) and advocating for emission reduction strategies locally and nationally.
Flaten et al. (2023)	University of Minnesota, USA	66 universities	Case study	Advocates for including planetary health as the ninth concept in nursing curricula. Perceptions were shaped by educators' exposure to climate change impacts.
Walpole et al. (2019)	University of Plymouth, England	Nurses & physicians	Systematic review (phase 1); Case study (phase 2)	The Sustainable Healthcare Education Network successfully influenced UK curricula by integrating sustainable healthcare objectives. Similar adoption occurred in the USA and Europe.
Kerr et al. (2019)	Minnesota, USA	7 participants (nurses, nurse educators, physicians, veterinarian)	Mixed methods	Broader groups benefit more than individuals from environmental education integration, highlighting the importance of curricular adoption.
Aronsson et al. (2022)	University of Plymouth	Literature from mixed methods	Systematic integrative review	Climate change and sustainability remain underrepresented in news and curricula. The review recommends including these topics to prepare future nurses.
Morin et al. (2022)	University of Manitoba, Canada	13 nurse educators	Descriptive qualitative	Most participants viewed eco-literacy as essential in undergraduate nursing education, with only one exception.
Ward et al. (2023)	Australian College of Nursing	Multidisciplinary group	Exploratory case study	Younger nurse educators perceived climate change as more relevant to nursing practice than older educators. Students favoured including climate science in curricula.
Leffers et al. (2017)	Canada	12 nurse educators	Qualitative	Barriers included faculty resistance and curriculum overload, yet low faculty engagement with climate issues persists.
Jones et al. (2016)	England	20 nurses and midwives	Qualitative exploratory	Younger educators perceived climate change as having greater influence on nursing practice than older counterparts. Emphasised the need for preparedness in nursing education.
Eilam (2022)	Melbourne, Australia	8 databases	Systematic review	Identified curricular resistance; proposed drawing on cognitive psychology, curriculum theory, and philosophy of science to justify climate change as a disciplinary subject.
Cadet (2022)	Northeastern USA	20 family nurse practitioners	Quantitative, non-experiential	Emphasised incorporating climate concepts into curricula to address health impacts. Barriers include overloaded curricula and institutional reluctance.
Nichols et al. (2022)	University of Plymouth, England	Nursing curriculum program	Explorative descriptive review	Nurse educators with global health experience saw climate change as highly relevant. However, clinical integration of sustainability concepts remains limited.
Griffin et al. (2022)	USA	4 students	Case study	Demonstrated the importance of integrating climate change into the Doctor of Nursing Practice (DNP) curriculum. Advocated for competency development to prepare nurses as leaders in climate-health responses.

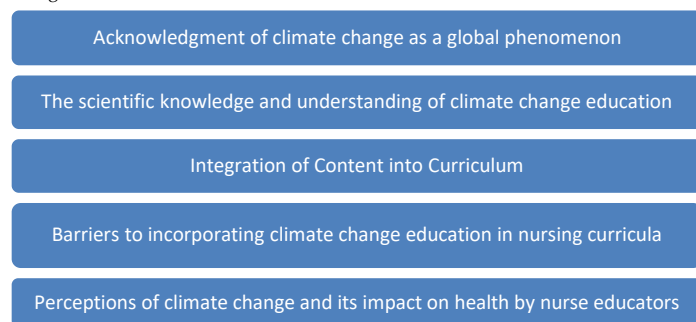
### Summary Themes

Five main themes related to the knowledge and perceptions of nurse educators about climate change education emerged, namely: (1) acknowledgment of climate change as a global phenomenon, (2) scientific knowledge and understanding of climate change education, (3) integration of content into the curriculum, (4) perceptions of climate change and its impact on health by nurse educators, and (5)

barriers to incorporating climate change education in nursing curricula.

**Figure 2:**

Themes and Sub-themes: Knowledge and perceptions of nurse educators on climate change inclusion



### *Theme 1: Acknowledgment of climate change as a global phenomenon*

Theme one indicates that there is awareness among nurse educators of the existence of climate change, its impact on health, and its importance in the health sector. Prasad (2021) reflected that although many nurse educators acknowledged climate change as a major worldwide concern, there was an apparent distinction in their understanding of its specific effects on health. This discrepancy between broad awareness and in-depth understanding emphasizes the need to provide nurse educators with more comprehensive instruction and training on climate change and its health impacts.

### *Theme 2: Scientific knowledge and understanding of climate change education*

This theme highlights that although most nurse educators recognize climate change as a global phenomenon, they did not always demonstrate the competencies necessary to teach the subject effectively. Differences in knowledge regarding the precise effects of climate change on health were reported. Scientific knowledge gaps were identified in 6 of the 14 (42.8%) studies, where educators believed they did not have the comprehensive understanding required to teach the subject (Abdallah & Wagdy Farag, 2022). Limited knowledge also exists regarding World Health Organization frameworks and established guidelines on climate change, mitigation, and adaptation strategies. These findings are consistent with Prasad (2021), who demonstrated that nurse educators had low levels of competency in facilitating classes covering climate change content within the curriculum. These knowledge gaps have influenced nurse educators' perceptions of the importance

of including climate change in an already congested curriculum.

### *Theme 3: Integration of content into the curriculum*

This theme reflects the growing concern that climate change education must be included in the nursing curriculum to address this pressing public health issue. Eight of the 14 (57.1%) reviewed studies emphasized the need for integrating climate change content into curricula. The concern is that climate change education in nursing programs varies widely and is often insufficient, creating ambiguity in facilitation and limiting the teaching of important and relevant content to nursing students. Both nursing students and faculty generally support the inclusion of climate change and sustainability in nursing education. Ongoing research continues to explore best practices for effective integration of climate change education into nursing curricula (Cadet, 2022; Griffin et al., 2022; Nichols et al., 2022).

### *Theme 4: Perceptions of climate change and its impact on health by nurse educators*

The importance of climate change education in nursing and its related health impacts was highlighted in 4 of the 14 (28.6%) reviewed studies. Álvarez-Nieto et al. (2022), Aronsson et al. (2022), and Morin et al. (2022) found that nurse educators' perspectives vary greatly, even as a general trend emerges toward recognizing its relevance. These perceptions can be grouped into three categories: (1) nurse educators who view climate change as integral, (2) those who acknowledge its relevance only to some extent, and (3) those who perceive climate change as outside the scope of nursing. Perceptions were influenced by the educators' stance and direct or indirect involvement with climate change impacts. For instance, nurse educators in public health and community health reported greater exposure to climate change issues than those in acute care fields. This disparity highlights the need for broader integration of climate change education across all areas of nursing (Flaten et al., 2023).

### *Theme 5: Barriers to incorporating climate change education in nursing curricula*

Eight of the 14 (57.1%) reviewed studies reflected barriers to integrating climate change education into nursing curricula. Theme five suggests that barriers are linked to nurse educators' perceptions of climate change as an

environmental issue rather than an interdisciplinary health concern. This limited perspective hinders theoretical understanding and practical implementation within nursing education. Efforts to adapt and include eco-literacy within nursing programs have tended to emphasize environmental issues more than health impacts, which limits healthcare providers' preparedness (Prasad, 2021).

## DISCUSSION

This integrative review reveals critical insights into nurse educators' readiness to address climate change in nursing education when viewed through Rogers' Diffusion of Innovation theoretical framework. Three overarching findings emerged, highlighting the current state of climate change education in nursing programs.

First, there were significant differences in nurse educators' knowledge and comprehension of climate change. Although climate change is widely acknowledged, many nurse educators lack the specialized skills needed to promote climate-informed health behaviors or successfully incorporate climate-related topics into nursing curricula. In some cases, awareness of climate change did not translate into scientific knowledge of the phenomenon, its health impacts, or nurse educators' roles in addressing it.

Rogers' theory explains this finding through the innovation characteristic of *complexity*: when an innovation is perceived as difficult to understand and implement, adoption rates decrease significantly (Rogers, 2003). Nurse educators may not be adequately prepared to train future nurses for the reality of a changing climate if they lack a solid understanding of the scientific foundations of climate change and its complex effects on vulnerable populations. While most educators (87%) acknowledged climate change as a global threat (Anwar et al., n.d.), only 42% felt equipped to teach its health impacts. This disparity aligns with Rogers' framework, where slow adoption of new content stems from low self-efficacy (competency gaps) and the perceived complexity of climate science.

The *knowledge stage* of Rogers' innovation-decision process is clearly evident in these findings. Many educators remain at this initial stage, having awareness but lacking the comprehensive understanding necessary to progress to subsequent stages. For example, da Silva et al. (2019) found that knowledge gaps among Brazilian health educators

necessitated policy reviews to strengthen climate change education for nurses. Similarly, Leffers et al. (2017) emphasized that health professionals, including nurses, must be formally educated on climate-related health threats to ensure preparedness for mitigation strategies and patient care delivery.

Second, curriculum integration barriers were noted in 8 of the 14 (57.1%) studies. The inclusion of climate change in nursing curricula is essential given the growing need for nurses to care for communities impacted by climate change. Nursing students require resources and instructional strategies that effectively address the health effects of climate change. This requires institutional support to strengthen nurse educators' competencies in climate change literacy. Rogers' framework suggests that these barriers reflect *social system characteristics* that influence innovation adoption. In particular, the compatibility of climate change education with existing curricula is a critical factor affecting adoption.

Torres et al. (2023) found that although formal integration of climate change content into nursing curricula is increasingly acknowledged, significant obstacles remain due to already overcrowded curricula and competing priorities. Similarly, White et al. (2022) reported that nurse educators struggled with time constraints and broad content requirements, hindering their ability to incorporate climate change into courses. The lack of commonly utilized resources or standardized guidelines for medical and nursing education also complicates curriculum development. Furthermore, educators reported difficulty in evaluating students' learning in climate change subjects, particularly in relation to nursing competencies, due to the absence of established assessment criteria. This underscores the need for interdisciplinary collaboration and standardized frameworks to support climate change integration.

Third, an emerging challenge concerns nurse educators' competence and confidence in teaching and assessing climate change content. Many expressed a need for additional training and felt unprepared to teach the topic, particularly regarding climate science (Prasad, 2021). Interestingly, educators with experience or interest in global health issues were more likely to perceive climate

change education as integral to nursing practice. Younger educators also tended to view climate change as having greater relevance to nursing practice compared to their older counterparts (Jones et al., 2016; Morin et al., 2022; Ward et al., 2023). This suggests that perceptions of relevance and generational differences may influence adoption. Nurse educators must therefore advocate for the inclusion of climate change within nursing curricula, but this can only be realized if they possess the knowledge, competence, and conviction regarding its importance (Flaten et al., 2023; Griffin et al., 2022).

Finally, numerous studies emphasized the need for institutional resources and support for climate change education in nursing. Abdallah and Wagdy Farag (2022) found that the implementation of awareness programs significantly improved nursing students' knowledge, perceptions, and daily practices related to climate change. This is critical, as climate change poses profound risks to human health (Frankovic, 2017; World Health Organization [WHO], 2018). Studies linking climate change to health impacts consistently show that extreme weather events, droughts, wildfires, and floods are among the most serious threats to human well-being (WHO, 2018). Moreover, Álvarez-Nieto et al. (2022), Aronsson et al. (2022), and Morin et al. (2022) found wide variation in nurse educators' perspectives, despite a general shift toward acknowledging the imperative of climate change education.

#### *Limitations of the Study*

Researchers found that no prior study of this nature has been documented for publication, which is concerning given the current reports of climatic challenges that nurses face daily. The following limitations were identified:

- Nurse educators' knowledge and perceptions of climate change is a relatively new area of inquiry, limiting the availability of existing studies.
- The review included only seven databases, restricting the breadth of the article search.
- Some publications were excluded due to language restrictions.
- The study relied exclusively on secondary data rather than original research.

## CONCLUSIONS

This review highlights the complex and evolving domain of climate change education in nursing programs. Although the significance of integrating climate content into nursing curricula is increasingly recognized, major challenges persist regarding resource availability, curriculum integration, and educator readiness.

To prepare future nurses for the health threats associated with climate change, future efforts should focus on:

- Enhancing educator competency through targeted professional development.
- Creating resources tailored to the nursing profession.
- Encouraging interdisciplinary collaborations to strengthen curriculum integration.

Based on the findings, nursing education leaders should promote institutional, national, and international policy changes while fostering interdisciplinary partnerships to ensure widespread adoption. Professional nursing associations are urged to develop standardized frameworks for climate health competencies, providing clear learning objectives, assessment criteria, and career pathways from entry-level to advanced practice.

Academic institutions can collaborate formally with medical schools, environmental science programs, and public health departments to design joint courses, research projects, and clinical rotations centered on climate health. Additionally, institutions must seek sustained funding for curriculum development, faculty training, and student scholarships in climate health specialization through government grants, foundation support, and industry partnerships.

However, this review is limited by the variability of study designs, geographic representation, and the depth of climate change content addressed across the included studies. Future research should adopt more consistent methodologies and expand to underrepresented regions to provide a comprehensive understanding of global trends and best practices in climate change education within nursing.

Closing the knowledge gap requires curriculum reform and targeted professional development to empower nurse

educators to take an active role in climate health education and advocacy. The following actionable steps are recommended:

- Develop national competency frameworks for climate education in nursing.
- Implement faculty training programs to build capacity for climate-related content delivery.
- Advocate for policy changes mandating the integration of climate change into nursing curricula.

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## REFERENCES

**Abdallah, Z. A., & Wagdy Farag, A. A.** (2022). Impact of awareness program regarding health consequences of climate change on knowledge, perception and daily life practices among nursing students. *Egyptian Journal of Nursing and Health Sciences*, 3(1), 367–390. <https://doi.org/10.21608/ejnhs.2022.227958>

**Adlong, W., & Dietsch, E.** (2015). *Nursing and climate change: An emerging connection*. *Collegian*, 22(1), 19–24. <https://doi.org/10.1016/j.colegn.2013.10.003>

**Ali, A., Shedayi, A. A., Khan, A., & Shafaqat, S.** (2024). How does climate change impact remote mountain communities? An empirical investigation in Gilgit-Baltistan. *GeoJournal*, 89(1), Article 41. <https://doi.org/10.1007/s10708-024-11043-4>

**Álvarez-Nieto, C., Richardson, J., Navarro-Perán, M. Á., Tutticci, N., Huss, N., Elf, M., Anåker, A., Aronsson, J., Baid, H., & López-Medina, I. M.** (2022). Nursing students' attitudes towards climate

change and sustainability: A cross-sectional multisite study. *Nurse Education Today*, 108, 105185. <https://doi.org/10.1016/j.nedt.2021.105185>

**Anderson, W., Taylor, C., McDermid, S., Ilboudo-Nébié, E., Seager, R., Schlenker, W., Cottier, F., De Sherbinin, A., Mendeloff, D., & Markey, K.** (2021). Violent conflict exacerbated drought-related food insecurity between 2009 and 2019 in sub-Saharan Africa. *Nature Food*, 2(8), 603–615. <https://doi.org/10.1038/s43016-021-00327-4>

**Anwar, C., Khalid, A. Y., & Sultan, A.** (n.d.). *The impact of perceived health competencies on the academic performance of nursing students*. *Journal of Nursing*, 70(8).

**Ardoin, N. M., Bowers, A. W., & Gaillard, E.** (2020). Environmental education outcomes for conservation: A systematic review. *Biological Conservation*, 241, 108224. <https://doi.org/10.1016/j.biocon.2019.108224>

**Aromataris, E., Fernandez, R., Godfrey, C. M., Holly, C., Khalil, H., & Tungpunkom, P.** (2015). Summarizing systematic reviews: methodological development, conduct and reporting of an umbrella review approach. *JBI Evidence Implementation*, 13(3), 132–140. <https://doi.org/10.1097/XEB.0000000000000055>

**Aronsson, J., Nichols, A., Warwick, P., & Elf, M.** (2022). Awareness and attitudes towards sustainability and climate change amongst students and educators in nursing: A systematic integrative review protocol. *Nursing Open*, 9(1), 839–844. <https://doi.org/10.1002/nop2.1134>

**Asha, J., Rishidas, S., SanthoshKumar, S., & Reena, P.** (2020). *Analysis of temperature prediction using random forest and Facebook Prophet algorithms*. In *Innovative Data Communication Technologies and Application: ICIDCA 2019* (pp. 432–439). [https://doi.org/10.1007/978-3-030-38040-3\\_49](https://doi.org/10.1007/978-3-030-38040-3_49)

**Aveyard, H., & Bradbury-Jones, C.** (2019). An analysis of current practices in undertaking literature reviews in nursing: findings from a focused mapping review and synthesis. *BMC Medical Research Methodology*, 19, Article 51. <https://doi.org/10.1186/s12874-019-0751-7>

**Breunig, H. M., Amirebrahimi, J., Smith, S., & Scown, C. D.** (2019). Role of digestate and biochar in carbon-negative bioenergy. *Environmental Science &*

- Technology*, 53(22), 12989–12998. <https://doi.org/10.1021/acs.est.9b03763>
- Cadet**, M. J. (2022). Integrating climate change concepts into advanced practice registered nurses curricula with the application of the National Organization of Nurse Practitioner Faculties competencies. *Journal of Professional Nursing*, 41, 157–165. <https://doi.org/10.1016/j.profnurs.2022.05.006>
- Chankseliani**, M., Qoraboyev, I., & Gimranova, D. (2021). Higher education contributing to local, national, and global development: New empirical and conceptual insights. *Higher Education*, 81(1), 109–127. <https://doi.org/10.1007/s10734-020-00565-8>
- Cook**, K. H., & Vizy, E. K. (2019). Contemporary climate change of the African monsoon systems. *Current Climate Change Reports*, 5, 145–159. <https://doi.org/10.1007/s40641-019-00130-1>
- da Silva**, J. M. C., Rapini, A., Barbosa, L. C. F., & Torres, R. R. (2019). Extinction risk of narrowly distributed species of seed plants in Brazil due to habitat loss and climate change. *PeerJ*, 7, e7333. <https://doi.org/10.7717/peerj.7333>
- Dal’Bosco**, E. B., Floriano, L. S. M., Skupien, S. V., Arcaro, G., Martins, A. R., & Anselmo, A. C. C. (2020). Mental health of nursing in coping with COVID-19 at a regional university hospital. *Revista Brasileira de Enfermagem*, 73, e20200434. <https://doi.org/10.1590/0034-7167-2020-0434>
- Davis**, P., Zarowiecki, M., Arnaboldi, V., Becerra, A., Cain, S., Chan, J., Chen, W. J., Cho, J., da Veiga Beltrame, E., & Diamantakis, S. (2022). WormBase in 2022 – data, processes, and tools for analyzing *Caenorhabditis elegans*. *Genetics*, 220(4), iyac003. <https://doi.org/10.1093/genetics/iyac003>
- Eilam**, E. (2022). Climate change education: the problem with walking away from disciplines. *Studies in Science Education*, 58(2), 231–264. <https://doi.org/10.1080/03057267.2021.2011589>
- Engelbrecht**, F. A., & Monteiro, P. (2021). The IPCC Assessment Report Six Working Group 1 report and southern Africa: Reasons to take action. *South African Journal of Science*, 117(11–12), 1–7. <https://doi.org/10.17159/sajs.2021/12679>
- Flaten**, C. B., Pechacek, J. M., Potter, T. M., & Mueller, C. (2023). Planetary health in nursing curricula: How one school transformed nursing curricula as they integrated planetary health concepts with the 2021 AACN essentials. *Journal of Professional Nursing*, 49, 52–56. <https://doi.org/10.1016/j.profnurs.2023.08.010>
- Frankovic**, I. (2017). *The impact of climate change on health expenditures*. ECON WPS. <https://hdl.handle.net/10419/149991>
- Griffin**, M. T. Q., Alfes, C. M., Chavez, F., Ea, E. E., Lynn, K. A., Rafferty, M. A., & Fitzpatrick, J. J. (2022). Incorporating climate change into Doctor of Nursing Practice curricula. *Journal of Professional Nursing*, 42, 156–161. <https://doi.org/10.1016/j.profnurs.2022.06.008>
- Hickel**, J. (2019). Is it possible to achieve a good life for all within planetary boundaries? *Third World Quarterly*, 40(1), 18–35. <https://doi.org/10.1080/01436597.2018.1535895>
- Hilton**, M. (2024). JBI critical appraisal checklist for systematic reviews and research syntheses (product review). *Journal of the Canadian Health Libraries Association / Journal de l'Association Des Bibliothèques de La Santé Du Canada*, 45(3). <https://doi.org/10.29173/JCHLA29801>
- Hong**, Q. N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., Gagnon, M.-P., Griffiths, F., Nicolau, B., & O’Cathain, A. (2018). The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. *Education for Information*, 34(4), 285–291. <http://mixedmethodsappraisaltoolpublic.pbworks.com/>
- Jones**, C. D., Ciais, P., Davis, S. J., Friedlingstein, P., Gasser, T., Peters, G. P., Rogelj, J., van Vuuren, D. P., Canadell, J. G., & Cowie, A. (2016). Simulating the Earth system response to negative emissions. *Environmental Research Letters*, 11(9), 095012. <https://doi.org/10.1088/1748-9326/11/9/095012>
- Katzman**, J. G., Tomedi, L. E., Herring, D., Jones, H., Groves, R., Norsworthy, K., Martin, C., Liu, J., Kazhe-Dominguez, B., & Arora, S. (2022). Educating community health professionals about the health-related effects of climate change through ECHO telementoring. *Journal of Primary Care and Community Health*, 13. <https://doi.org/10.1177/21501319221102033>
- Kerr**, R., Nerbonne, J. F., & Potter, T. (2019). Sparking a movement for a healthy climate through leadership development. *Creative Nursing*, 25(3), 216–221. <https://doi.org/10.1891/1078-4535.25.3.216>

- Kotcher, J., Maibach, E., Miller, J., Campbell, E., Alqodmani, L., Maiero, M., & Wyns, A.** (2021). Views of health professionals on climate change and health: A multinational survey study. *The Lancet Planetary Health*, 5(5), e316–e323.
- Leffers, J., Levy, R. M., Nicholas, P. K., & Sweeney, C. F.** (2017). Mandate for the nursing profession to address climate change through nursing education. *Journal of Nursing Scholarship*, 49(6), 679–687. <https://doi.org/10.1111/jnu.12331>
- Martel-Morin, M., & Lachapelle, E.** (2022). The Five Canadas of Climate Change: Using audience segmentation to inform communication on climate policy. *PLoS ONE*, 17(11), e0273977. <https://doi.org/10.1371/journal.pone.0273977>
- Mazzoglio, P., Butera, I., & Claps, P.** (2023). A local regression approach to analyze the orographic effect on the spatial variability of sub-daily rainfall annual maxima. *Geomatics, Natural Hazards and Risk*, 14(1), Article 2205000. <https://doi.org/10.1080/19475705.2023.2205000>
- McKimm, J., & McLean, M.** (2020). Rethinking health professions' education leadership: Developing 'eco-ethical' leaders for a more sustainable world and future. *Medical Teacher*, 42(8), 855–860. <https://doi.org/10.1080/0142159X.2020.1748877>
- Mishra, A., Bruno, E., & Zilberman, D.** (2021). Compound natural and human disasters: Managing drought and COVID-19 to sustain global agriculture and food sectors. *Science of the Total Environment*, 754, Article 142210. <https://doi.org/10.1016/j.scitotenv.2020.142210>
- Moola, S., Munn, Z., Tufanaru, C., Aromataris, E., Sears, K., Sfetcu, R., Currie, M., Qureshi, R., Mattis, P., Lisy, K., & P.-F. Mu.** (2017). Checklist for case reports. *Joanna Briggs Institute Critical Appraisal Tools*, 1–4.
- Morin, J. L., Cohen, B., Harder, N., & Thompson, S.** (2022). Nurse educators' perceptions of ecoliteracy in undergraduate nursing education. *Quality Advancement in Nursing Education*, 8(1). <https://doi.org/10.17483/2368-6669.1287>
- Munn, Z., Porritt, K., Lockwood, C., Aromataris, E., & Pearson, A.** (2014). Establishing confidence in the output of qualitative research synthesis: The ConQual approach. *BMC Medical Research Methodology*, 14, Article 108. <https://doi.org/10.1186/1471-2288-14-108>
- Ngcamu, B. S.** (2023). Climate change effects on vulnerable populations in the Global South: A systematic review. *Natural Hazards*, 118(2), 977–991. <https://doi.org/10.1007/s11069-023-06070-2>
- Nichols, A., Howes, S., Thompson, A., Byrt, L., Sarah, C., & Rees, F.** (2022). Embedding sustainability into nursing and midwifery university education. *Nursing Times*, 118(8).
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... Moher, D.** (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *The BMJ*, 372. <https://doi.org/10.1136/bmj.n71>
- Palaiologou, I., & Brown, A.** (2023). Ethical considerations and dilemmas for the researcher and for families in home-based research: A case for situated ethics. *Research Ethics*, 19(4), 519–535. <https://doi.org/10.1177/17470161231181860>
- Pearson, N. A., Packham, J. C., Parsons, H., & Haywood, K. L.** (2018). Quality and acceptability of patient-reported outcome measures used to assess fatigue in axial spondyloarthritis (axSpA): a systematic review (protocol). *Systematic Reviews*, 7, Article 52. <https://doi.org/10.1186/s13643-018-0777-7>
- Polit, D., & Beck, C.** (2021). *Nursing research: Generating and assessing evidence for nursing practice* (11th ed.). Wolters Kluwer.
- Prasad, V.** (2021). *Examining climate change education within the VCE curriculum and its implementation at a Victorian secondary school*. Victoria University. <https://vuir.vu.edu.au/id/eprint/42802>
- Reid, A.** (2019). Climate change education and research: Possibilities and potentials versus problems and perils? *Environmental Education Research*, 25(6), 767–790. <https://doi.org/10.1080/13504622.2019.1664075>
- Tod, D., Booth, A., & Smith, B.** (2022). Critical appraisal. *International Review of Sport and Exercise Psychology*, 15(1), 52–72. <https://doi.org/10.1080/1750984X.2021.1952471>
- Toronto, C. E., & Remington, R.** (2020). *A step-by-step guide to conducting an integrative review*.
- Torres, M. J., Bienvenido-Huertas, D., Tzuc, O. M., Bassam, A., Castellanos, L. J. R., & Flota-Bañuelos, M.** (2023). Assessment of climate change's impact on energy demand in Mexican buildings: Projection in single-family houses based on Representative Concentration Pathways. *Energy for Sustainable*

- Development, 72, 185–201.  
<https://doi.org/10.1016/j.esd.2022.12.012>
- Tun, S., Wellbery, C., & Teherani, A.** (2020). Faculty development and partnership with students to integrate sustainable healthcare into health professions education. *Medical Teacher*, 42(10), 1112–1118.  
<https://doi.org/10.1080/0142159X.2020.1796950>
- Walpole, S. C., Barna, S., Richardson, J., & Rother, H.-A.** (2019). Sustainable healthcare education: integrating planetary health into clinical education. *The Lancet Planetary Health*, 3(1), e6–e7.  
[https://doi.org/10.1016/S2542-5196\(19\)30010-0](https://doi.org/10.1016/S2542-5196(19)30010-0)
- Ward, A., Carson, G., & Lokmic-Tomkins, Z.** (2023). Educators must step up to prepare nursing and midwifery students for work in a climate emergency. *Australian Nursing and Midwifery Journal*, 373(11), 28–30.  
<https://doi.org/10.1136/bmj.n1049>
- White, P. T., Wolf, K. J., & Johnson-Maynard, J.** (2022). Changes in teacher attitudes relating to climate science. *Natural Sciences Education*, 51(2), e20086.  
<https://doi.org/10.1002/nse2.20086>
- Whittemore, D. O., Butler Jr, J. J., & Wilson, B. B.** (2016). Assessing the major drivers of water-level declines: New insights into the future of heavily stressed aquifers. *Hydrological Sciences Journal*, 61(1), 134–145.  
<https://doi.org/10.1080/02626667.2014.959958>
- Whittemore, R., & Knafl, K.** (2005). The integrative review: Updated methodology. *Journal of Advanced Nursing*, 52(5), 546–553. <https://doi.org/10.1111/j.1365-2648.2005.03621.x>
- World Health Organization.** (2018). The state of food security and nutrition in the world 2018: Building climate resilience for food security and nutrition. Food & Agriculture Organization.
- Yu, P.** (2022). *Diffusion of Innovation theory*. In *Implementation Science: The Key Concepts* (pp. 59–61).  
<https://doi.org/10.4324/9781003109945-16/DIFFUSION-INNOVATION-THEORY-PING-YU>