Eco-nursing competencies for nurses: A scoping review

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ABSTRACT

Background: Nurses are tasked with addressing the health impacts of climate change. Eco-nursing competencies, covering knowledge, attitudes, and skills related to climate change, equip nurses to actively mitigate and adapt to its effects on health and the environment.

Objective: To synthesize existing literature on eco-nursing roles and competencies for nurses.

Methods: A scoping review of published papers examined nurses' roles and eco-nursing competencies. Databases searched included Academic Search Complete, CINAHL Plus, MEDLINE (PubMed), and Google Scholar. Search terms encompassed climate change and nursing synonyms, limited to English articles up to April 15, 2023. Thematic analysis was used to synthesize findings, delineating roles, and eco-nursing competencies. Results were tabulated.

Results: Out of 445 papers identified, 31 underwent data analysis. These papers highlighted nurses' roles in climate change (42%), along with climate change knowledge and skills (64.5%), and attitudes (13%). Roles encompassed research, education, advocacy, leadership, and clinical practice, with corresponding competencies embedded within existing core competencies for general nurses, nurse specialists, and nurse managers.

Conclusion: The review demonstrates that nurses' roles in climate change necessitate relevant knowledge, attitudes, and skills. Future research should contextualize these roles and eco-nursing competencies based on geographical locations, considering the distinct disease burden in each area.

Registration: The study protocol was registered in the Open Science Framework on 5 March 2023 before conducting the full study https://doi.org/10.17605/OSF.IO/9GC4N

Tweetable abstract: Amidst growing concerns about climate change, nurses are increasingly tasked with preparing to mitigate its health impacts through the delineation of eco-nursing competencies. These competencies will equip nurses to effectively tackle the health and environmental ramifications of climate change, building upon existing core competencies tailored to various geographic contexts.

What is already known

- Nurses are currently ill-prepared for active participation in climate change initiatives due to insufficient training and preparation.
- Knowledge deficiencies remain prevalent among nurses, primarily stemming from ongoing debates and limited integration of sustainability topics into nursing education.

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What this paper adds

- Clarifying the roles of nurses in addressing the health impacts of climate change, alongside their associated eco-nursing competencies.
- Acknowledging the interplay between climate change and health, empowering nurses to actively engage in both mitigation and adaptation efforts.

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1. Introduction and background

Climate change contributes to various illnesses (Chase et al., 2022; McDermott-Levy et al., 2019). Predictions suggest that from 2030 to 2050, climate change could lead to around 250,000 extra deaths annually from malnutrition, diarrhoea, heat stress, and vector-borne diseases (Opoku et al., 2021). Health systems face challenges in attaining Sustainable Development Goal (SDG) 3 for universal health coverage (World Health Organisation, 2015) with climate-sensitive diseases further complicating this goal.

The need to redefine eco-nursing, specifically focusing on climate change, arises from its potential impact on health and nursing care. Nurses, being at the forefront of patient care, are uniquely positioned to address and mitigate these effects. (Corvalan et al., 2020; LeClair & Potter, 2022). The concept of eco-nursing emerged in the late 1980s, aiming at health promotion interventions for individuals and social environments (McLeroy et al., 1988). This redefined perspective on eco-nursing or ecological nursing now encompasses the provision of nursing care considering climate variations and their impacts on human health, utilizing an ecological framework to deliver healthcare across the lifespan within different environmental contexts (Fouladbakhsh & Szczesny, 2014; LeClair & Potter, 2022; Rafferty et al., 2015; Watts et al., 2015).

As the largest group of health professionals, nurses are ideally positioned to champion eco-nursing due to their proximity to patients and esteemed professional status (Butterfield et al., 2021; World Health Organisation, 2020). Incorporating eco-nursing competencies in the nursing curriculum is vital due to the growing impact of environmental issues on health. Educating nurses on these issues equips them to address and mitigate health risks (Opoku et al., 2021). Eco-nursing promotes sustainable healthcare practices, reducing the ecological footprint of health facilities. It also fosters advocacy skills, enabling nurses to influence policies for healthier environments. Ultimately, eco-nursing competencies could ensure that future nurses are prepared to provide comprehensive, sustainable, and proactive healthcare in an increasingly eco-conscious world.

Competencies serve as guides for fulfilling professional roles. Internationally, there has been some development of interprofessional climate change-related competencies (Clark et al., 2016; Jagals & Ebi, 2021; Kreslake et al., 2018; McKinnon et al., 2022). Competency, as defined by the International Confederation of Nurses and the World Health Organization (2019), refers to an individual's practical skills, knowledge, attitudes, and behaviours required to fulfil a specific role. Eco-nursing competencies entail proficiency in practical skills, knowledge, and attitudes necessary for achieving eco-nursing objectives. While some competencies, such as environmental analysis and health promotion, have been integrated into existing nursing curricula (Wit et al., 2023), it is essential to delineate specific eco-nursing competencies tailored for climate change. To address this scoping review aims to answer the following questions: (i) What are the roles of nurses related to eco-nursing? And (ii) What competencies (attitudes, knowledge, and skills) are required by nurses related to eco-nursing?

2. Methods

2.1. Design

This scoping review aimed to synthesize the best available evidence concerning the role of nurses in climate change and current eco-nursing competencies relevant to nurses. Scoping reviews are valuable tools for summarizing existing knowledge, identifying research gaps, and informing future research and decision-making processes (Aromataris & Munn, 2020). The review followed the Johanna Briggs Institute (JBI) methodology for scoping reviews and used the PRISMA-ScR checklist (Aromataris & Munn, 2020). A preliminary search on CINAHL Plus, MEDLINE (PubMed), and Google Scholar found no ongoing reviews mapping eco-nursing competencies for nurses. A protocol was developed and registered with the Open Science Framework on March 5, 2023, before conducting the full study (https://doi.org/10.17605/OSF.IO/9GC4N).

2.2. Search strategy

Searches were conducted in the following databases using synonyms of nursing and climate change: Academic Search Complete (Ebscohost), CINAHL Plus, MEDLINE (PubMed), and Google Scholar. After piloting search terms in the literature and web sources, we included the following search terms and synonyms: (RN OR nurse OR professional nurse OR nurse practitioner OR nursing student) AND (competencies OR skills OR roles OR knowledge OR attitudes) AND (climate change OR global warming OR planetary health OR climate health) AND English AND published in peer-reviewed journals between 2018-2023. The selection of 2018 as the starting year is significant because it marks the inception of the first conference dedicated to the nexus of climate change and health, the Global

Conference on Air Pollution and Health (WHO, 2018). This conference emphasized the need to equip national health workforces with skills and knowledge to address the direct effects of air pollution on health and to advise policymakers on proactive measures to reduce the burden of air pollution-related diseases (WHO, 2018). The last search was conducted on April 15, 2023. The full search strings for different databases can be found in Supplementary Material 1.

2.3. Study selection

Following the search, all relevant papers were collated and uploaded directly into Covidence (Covidence, 2022). Duplicates were removed, and two reviewers independently screened the titles and abstracts of selected papers against the inclusion and exclusion criteria. Given the diverse nature of scoping review literature (Aromataris & Munn, 2020) and the scarcity of research articles in the emerging field of climate change and health, the researchers broadened their scope to include relevant systematic reviews, narrative reviews, and papers on curriculum development. Included papers focused on professional nurses, nurse managers, nurse educators, or nursing students and explored or outlined eco-nursing roles and competencies, including relevant attitudes, knowledge, and skills.
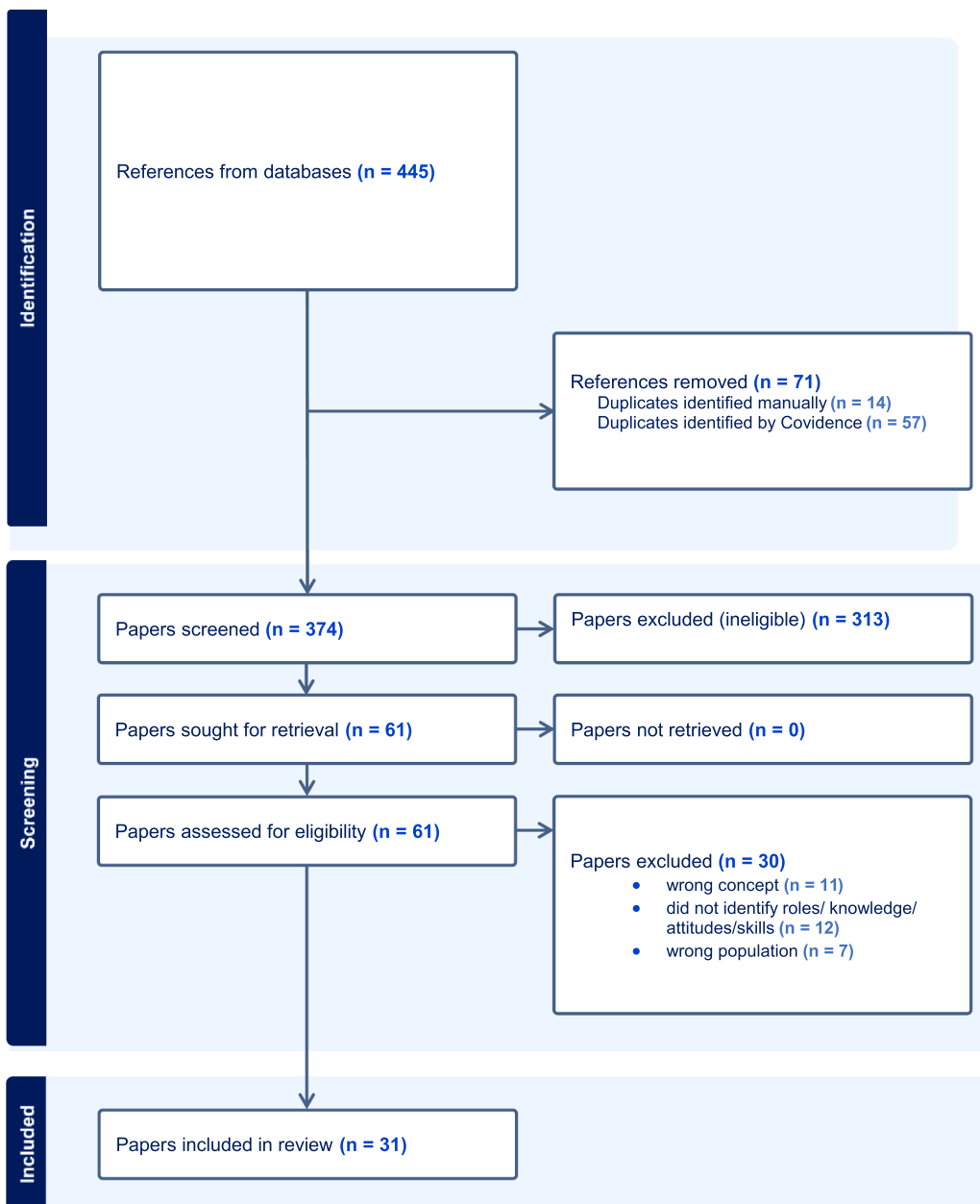

Fig. 1. PRISMA diagram showing the selection process of studies (Aromataris & Munn, 2020).

Table 1

Characteristics of included papers.

Study	Aim	Method	Participants	Roles identified	Related eco-nursing competencies identified
Literature reviews (n=7)					
1. Lopez-Medina (2019)	To identify environmental competencies and approaches used to embed sustainability in nursing education	Systematic review	Literature published in Dutch, English, German, and Spanish related to nurses and climate change	Nil	**Knowledge:** Impact of nursing activities on the environment; Climate change mitigation strategies **Skills:** Skills for nurse managers, educators, and researchers -Leadership, community engagement and advocacy
2. Parker (2019)	Synthesis of healthcare competencies, education, and training of relevance to issues of environmental sustainability and climate change in the health sector	Systematic review	English language articles on environmental competencies in healthcare related to nurses and climate change	Nil	**Skills:** Skills for advanced practice nurses – research and evidence-based practice; policy analysis; leadership, community engagement and advocacy
3. LeClair (2021)	To describe types of strategic actions that nurses take to promote environmental justice (EJ) through research, education, advocacy, and practice (REAP) re-ported in peer-reviewed literature	Scoping review	Primary research studies and non-research articles related to nurses and climate change	**Advocacy:** advocate for environmentally friendly practices **Research:** conduct research related to climate change **Education:** educates self, other nurses, health professionals and communities	**Skills:** (i) skills for advanced practice nurses-climate health assessment and resilient care planning (ii) skills for general nurses-leadership, community engagement and advocacy for environmental justice
4. Mat (2022)	Review of literature on the role of nurses in response to health emergencies related to climate change	Systematic review	Studies published between 2014 to 2021 and written in English or Turkish related to nurses and climate change	**Advocacy:** advocate for environmentally friendly practices **Leadership:** lead public health policy action	**Knowledge:** knowledge on climate change science and climate-related health risks **Skills:** skills for general nurses- independent practice; leadership, community engagement and advocacy
5. McKinnon (2022)	To assess roles of health professionals in addressing climate change in health professions education and interprofessional education	Scoping review	Peer-reviewed articles and grey literature related to nurses and climate change	**Advocacy:** advocate for environmentally friendly practices	**Knowledge:** Knowledge on climate change science and climate-related health risks; vulnerable populations; integration of eco-nursing into all levels of nursing; climate change mitigation strategies **Skills:** skills for advanced practice- independent practice
6. Mundie (2022)	To explore the policies of Canadian nursing regulatory bodies and associations on nursing practice specific to environmental health	Systematic review	Policy statements from nursing associations and competency documents from nursing regulators and national associations related to nurses and climate change	**Advocacy:** advocate for environmentally friendly practices **Research:** research evidence to change practice and promote mitigation strategies through integrating evidence-based strategies	**Education:** educates self, other nurses and health professionals and communities **Skills:** skills for general nurses- leadership, community engagement and advocacy research; research and evidence-based practice; patient education
7. Vandenberg (2023)	To map existing literature on nurses' perceptions, knowledge, attitudes, and experiences with vector-borne diseases, specifically	Scoping review	English language articles related to nurses and climate change	**Advocacy:** advocate for policies that promote and protect the health of vulnerable populations	**Knowledge** on climate sensitive diseases; vulnerable populations susceptible to the impacts of climate change;

Table 1 (*continued*)

Study	Aim	Method	Participants	Roles identified	Related eco-nursing competencies identified
	Lyme disease and West Nile virus			**Education:** educates self, other nurses and health professionals as well as communities on climate sensitive diseases	culturally sensitive advocacy strategies **Skills:** <u>skills for general nurses:</u> patient education; emergency preparedness and response
Quantitative studies (n=7)					
8. Buriro (2018)	To assess the knowledge, perception and information sources of nurses about climate change	Cross sectional study	Participants (n=105) consisted of professional nurses and nursing managers	Nil	**Knowledge:** knowledge on climate change science and climate-related health risks
9. Cruz (2018)	To assess attitudes of nursing students towards climate change and environmental sustainability	Descriptive comparative study	Convenience sample (n=1059) of university nursing students from four Arab countries was surveyed	Nil	**Attitudes:** concern for planetary health; commitment to act
10. Felicilda-Reynaldo (2018)	To explore knowledge of and attitudes toward climate change and its effect on health among student nurses	Cross-sectional study	Baccalaureate nursing students (n=1059) from four Arab countries	Nil	**Knowledge:** knowledge on climate change science and climate-related health risks **Attitudes:** concern for planetary health; eco-health advocacy and prevention; anti-anthropocentric perspective
11. Yang (2018)	To assess knowledge and perceptions of medical, public health, and nursing students about climate change and its impacts	Cross-sectional study	Senior university students (n=1387)	Nil	**Knowledge:** knowledge on climate change science and climate-related health risks
12. Aronsson (2020)	To provide sustainability education to undergraduate student nurses and midwives and to explore whether students were able to apply their sustainability knowledge and to challenge unsustainable nurse practice	Cross sectional study	University nursing students (n=385)	Nil	**Knowledge:** knowledge on impact of nursing activities on the environment; integration of eco-nursing into all levels of nursing practice
13. Linton (2020)	To elicit student attitudes related to sustainability in health care.	Cross sectional pilot study	Nursing students (n=89)	Nil	**Attitudes:** concern for planetary health; eco-health advocacy and prevention; commitment to act
14. Ryan (2020)	To assess knowledge and attitudes regarding climate change, pollution from the health care sector, and responsibility for resource conservation within professional practice	Online Qualtrics survey	Nursing students (n=280)	Nil	**Knowledge:** climate change science and climate-related health risks; impact of nursing activities on the environment
Mixed methods studies (n=2)					
15. Chen (2020)	To explore sustainability education in nursing students in two countries	Mixed methods study	First-year undergraduate nursing students from two countries (n=69 students from China and n=32 students from England) Quantitative study (n=71) Qualitative study (n=37)	Nil	**Attitudes:** concern for planetary health; eco-health advocacy and prevention
16. Ergin (2021)	To evaluate knowledge and awareness of nursing students about global	Mixed method study	Undergraduate senior nursing students	Nil	**Knowledge:** knowledge on climate change science and climate-related

Table 1 (*continued*)

Study	Aim	Method	Participants	Roles identified	Related eco-nursing competencies identified
	warming, climate change, the impact on health and the role of the public health nurse				health risks; vulnerable populations and those susceptible to the impacts of climate change; impact of nursing activities on the environment
			Quantitative questionnaire (n=154) Qualitative focus groups (n = 19)		**Skills:** skills for advanced practice nurses- policy analysis and development competency
Qualitative studies (n=3)					
17. Kalogirou (2020)	To explore Canadian nurses' perspectives on climate change, health, and nursing practice	Focused ethnography study	Professional nurses and nurse managers (n=22) from medicine units and emergency room	Nil	**Knowledge:** knowledge on climate change science and climate-related health risks
18. Lopez-Medina (2022)	To describe nursing students' perceptions of sustainable health education in the nursing curriculum and their concerns about sustainable healthcare and the impact of climate change on nursing	Qualitative study	Undergraduate nursing students (n=200)	Nil	**Knowledge:** knowledge on climate change mitigation strategies
19. Mahmoud (2023)	To explore the effect of climate change on health and critical care nurse's practice	Descriptive exploratory study	ICU and emergency care nurses (n= 84)	Nil	**Skills:** skills for advanced practice- leadership, community engagement and advocacy
Narrative studies (n=8)					
20. Cook (2019)	To outline the nurses' opportunities to lead national efforts of climate change mitigation strategies	Narrative study	Research articles and conference proceedings that dealt with climate change and health related to nurses	Nil	**Knowledge:** knowledge on climate change science and climate-related health risks **Skills:** Skills for advanced practice nurses- leadership, community engagement and advocacy
21. McDermott-Levy (2019)	To help nurses understand climate change and how that relates to the need for specific interventions to support climate adaptation for the older adult population	Opinion paper	Articles on nurses and climate change	**Advocacy:** advocate for policies that promote and protect the health of vulnerable populations **Research:** conduct research related to climate change	**Knowledge:** knowledge on vulnerable populations; climate change science and climate-related health risks **Skills:** skills for advanced practice nurses- independent practice eco-competency; leadership, community engagement and advocacy
22. Rosa (2019)	To propose a paradigm shift that is inclusive of new and broader possibilities for nursing to engage worldwide health initiatives related to planetary health	Narrative study	Articles and documents related to the scholarly dialogue on the advancement of planetary nursing	**Advocacy:** advocate for environmentally friendly practices; nursing education on climate change; multi-disciplinary teams that advance planetary health **Education:** educates self, other nurses, health professionals and communities **Leadership:** lead public health policy action	**Knowledge:** knowledge on integration of eco-nursing into all levels of nursing practice; climate change mitigation strategies eco-competency **Skills:** skills for general nurses- leadership, community engagement and advocacy; research and evidence-based practice; patient education; emergency preparedness and response

Table 1 (*continued*)

Study	Aim	Method	Participants	Roles identified	Related eco-nursing competencies identified
23. Nicholas (2020)	To identify health consequences of climate change impacts in older adults, with a specific focus on heat-related illness	Narrative study	Articles on nurse practitioners, older adults and climate change	Nil	**Skills:** skills for advanced practice nurses- climate health assessment and resilient care planning
24. Giudice (2021)	To advocate for global and national policies and practices that promote strategies to reduce the harmful effects of climate change on the health and wellbeing of women	Narrative study	Narration of several studies related to nurses and climate change	**Advocacy:** advocate for policies that protect vulnerable populations **Research:** research evidence to change practice and promote/ implement mitigation strategies **Education:** educates self, other nurses, health professionals and communities; **Clinical practice:** diagnose, manage and prevent climate related illnesses **Leadership:** lead public health policy action	**Knowledge:** knowledge on climate change science and climate-related health risks; vulnerable populations **Skills:** (i) skills for advanced practice nurses- research and evidence-based practice; climate health assessment and resilient care planning; emergency preparedness and response; ethical decision-making (ii) skills for general nurses-independent practice eco-competency
25. Rosa (2021)	Discussion to highlight ongoing and emergent roles of nurses and midwives in advancing the SDG targets by 2030 at the intersection of social and economic inequity, the climate crisis, interprofessional partnership building, and the rising status and visibility of the profession worldwide	Narrative study	Published articles, policies and nursing associations related to nurses and climate change	**Advocacy:** advocate for nursing education on climate change; multi-disciplinary teams that advance planetary health **Education:** educate themselves, other nurses, health professionals and communities on climate sensitive diseases **Clinical practice:** diagnose, manage and prevent climate related illnesses; team work to manage vulnerable populations needs **Leadership:** lead public health policy action	**Skills:** (i) skills for general nurses- leadership, community engagement and advocacy (ii) skills for nurse managers, educators and researchers-leadership, community engagement, and advocacy
26. Harris (2022)	To discuss the role of nursing at the intersection of public health, policy, climate change, and the SDGs	Discussion paper	Articles, policies and nursing curriculum documents	**Advocacy:** advocate for nursing education on climate change **Education:** educate themselves, other nurses, health professionals and communities on climate-sensitive diseases and how they can take preventative measures **Leadership:** lead public health policy action	**Knowledge:** knowledge on vulnerable populations; integration of eco-nursing into all levels of nursing practice **Skills:** (i) skills for advanced practice nurses- research and evidence-based practice; policy analysis and development (ii) Skills for nurse managers, educators, and researchers-leadership, community engagement, and advocacy
27. Reiner (2022)	Raising school nurse awareness, understanding, and agency regarding the	Narrative study	Articles on the school nurse and climate change	**Advocacy:** advocate for policies that promote and	**Knowledge:** knowledge of climate change science

Table 1 (*continued*)

Study	Aim	Method	Participants	Roles identified	Related eco-nursing competencies identified
	possible trajectories of environmental degradation and its implications to health and well-being			protect the health of vulnerable populations **Research:** use research evidence to change practice and promote/ implement mitigation strategies **Leadership:** lead through role modelling	and climate-related health risks **Skills:** (i) skills for advanced practice nurses- eco-competency in leadership, community engagement and advocacy
Other (n=4)					
28. Alvarez-Garcia (2018)	To develop and validate two new tools that assess the knowledge and skills respectively about children's environmental health	Instrument development	Nursing students (n=308)	Nil	**Skills:** (i) skills for advanced practice nurses- independent practice; research and evidence-based practice
29. Keating (2020)	Development of an innovative educational module that integrates climate change as a critical content area	Curriculum development	Doctor of Nursing Practice level of nurse training	**Education:** educate self, other nurses, health professionals, and communities on climate-sensitive diseases	**Skills:** (i) skills for advanced practice nurses- leadership, community engagement and advocacy (ii) skills for general nurses- independent practice
30. Cadet (2022)	To discuss integrating climate change concepts into advanced practice nurses' curricula	Curriculum development	Family nurse practitioner students (n=20)	Nil	**Knowledge:** knowledge of climate change science and climate-related health risks **Skills:** (i) skills for advanced practice- independent practitioner; research to create novel knowledge and provide evidence-based practice; climate health assessment and resilient care planning; emergency preparedness and response; ethical decision-making; technology and information literacy; policy analysis and development
31. Griffin (2022)	Development of advanced-level nursing competencies that are observable and measurable that address climate change while incorporating climate change throughout the Doctor of Nursing Practice (DNP) curricular programs	Consensus methods	Doctor of Nursing Practice level of nurse training students	**Advocacy:** advocate for environmentally friendly practices **Research:** use research evidence to change practice and promote/ implement mitigation strategies **Clinical practice:** diagnose, manage, and prevent climate-related illnesses	**Knowledge:** knowledge of vulnerable populations

Excluded papers comprised those focusing on health professionals other than nurses, those not addressing nurses' attitudes, knowledge, skills, or roles in eco-nursing, and those not peer-reviewed or protocols. All papers meeting the inclusion criteria underwent full-text review and were further screened by two independent reviewers. Excluded full-text papers were documented with reasons for exclusion, and conflicts were resolved by a third reviewer.

2.4. Data extraction

Two reviewers independently extracted data from four papers and compared results to ensure consistency (Aromataris & Munn, 2020). Subsequently, one reviewer completed full data extraction, with a second reviewer confirming the extracted data. A third

Table 2
Identified roles from the review.

Role	Component	Description	References
Advocacy	Advocate for environmentally friendly practices/actions	Nurses in all contexts should advocate for environmentally friendly practices	(Griffin et al., 2022; Keating et al., 2022; Mat, 2022; McKinnon et al., 2022; Mundie & Donelle, 2022; Rosa & Upvall, 2019)
	Advocate for policies that promote and protect the health of vulnerable populations	Nurses should advocate for climate change policies that address the concerns of vulnerable populations while also supporting infrastructure, policies, and programs in schools and communities	(Giudice, 2021; Lilienfeld et al., 2018; McDermott-Levy et al., 2019; Reiner & Haas-Howard, 2022; Vandenberg et al., 2023)
	Advocate for nursing education on climate change	Nurses ought to be educated in policy analysis, be part of multi-disciplinary teams that advance planetary health through sharing nursing knowledge as it relates to the social determinants of health, climate change, and sustainable healthcare	(Harris et al., 2022; Rosa et al., 2021; Rosa & Upvall, 2019)
Research	Conduct research related to climate change	Nurses must conduct and disseminate research on the effects of climate change	(McDermott-Levy et al., 2019; Rosa & Upvall, 2019)
	Use research evidence to change practice and promote/implement mitigation strategies	Nurses need to address climate change by integrating evidence-based strategies. This involves applying research-driven approaches to decrease greenhouse gas emissions, promoting healthy personal and environmental behaviours, and advocating for policy enhancements. By utilizing evidence-based policies and guidelines, nurses can effectively care for vulnerable populations and minimize the adverse effects of climate change within clinical practice	(Giudice, 2021; Griffin et al., 2022; Mundie & Donelle, 2022; Reiner & Haas-Howard, 2022)
Education	Educates self, other nurses and health professionals as well as communities on climate sensitive diseases	Nurses must educate themselves, other health professionals and communities about climate change, it's relationship with illness and how they can take preventative measures. They also need to be taught research methods and data analyses to inform evidence-based policy responses and public health initiatives	(Giudice, 2021; Harris et al., 2022; Keating et al., 2022; Mundie & Donelle, 2022; Rosa et al., 2021; Rosa & Upvall, 2019; Vandenberg et al., 2023)
Clinical practice	Diagnose, manage and prevent climate related illnesses	Nurses should diagnose actual and potential health problems and assess risks to develop plans of care. They ought to have knowledge on disease transmission modelling to make clinical decision and provide primary and secondary prevention of diseases	(Giudice, 2021; Griffin et al., 2022; Keating et al., 2022; Rosa et al., 2021; Vandenberg et al., 2023)
	Collaboration to monitor vulnerable populations	Nurses must team up with other health professionals to anticipate and monitor the health needs of vulnerable populations as it relates to environmental health and the structural determinants of health. Nurses should provide healthcare and vulnerability monitoring to anticipate patient and population needs related to climate change	(Rosa et al., 2021)
Leadership	Leading through role modelling	Nurses have to be planetary health role models through being good stewards of the environment through professional and personal actions to reduce greenhouse gas emissions. They can role model behaviours such as conserving energy, supporting healthy food systems, reduce waste through re-using, composting, recycling, and commuting sustainably	(Giudice, 2021; Reiner & Haas-Howard, 2022)
	Leading public health policy action	Nurses should lead public health policy by initiating planetary health promoting policies, build relationships with people of influence and thought leaders to fully engage and integrate nursing's contribution in policy and public health arenas	(Giudice, 2021; Harris et al., 2022; Mat, 2022; Rosa et al., 2021; Rosa & Upvall, 2019)

independent reviewer was available to resolve any disagreements. Data were extracted from papers meeting the inclusion criteria using a tool (Supplementary material 2) developed by the researchers guided by the research questions (Aromataris & Munn, 2020). The tool was piloted with one paper and revised accordingly, incorporating fields for paper characteristics and findings on eco-nursing roles and competencies. Critical appraisal of included articles was not required, following scoping review guidelines (Aromataris & Munn, 2020).

2.5. Data Analysis and Presentation

Data analysis in scoping reviews varies depending on the review's purpose and the author's discretion (Aromataris & Munn, 2020). For this scoping review, thematic analysis was chosen to identify and categorize nurses' eco-nursing roles and competencies (Naeem et al., 2023). Data on eco-nursing roles and competencies extracted from the articles were downloaded as an Excel file from Covidence. Reviewers created a coding framework with descriptions for each code after reviewing the data. Subsequently, one reviewer coded the data in Excel and grouped the codes into themes, which were then checked and confirmed by a second reviewer (Naeem et al., 2023).

3. Results

3.1. Search outcome

The search yielded 445 papers, with 71 duplicates removed. After screening 374 titles and abstracts, 61 papers underwent full-text review. Among these, 31 papers were included in the data extraction process (Fig. 1).

3.2. Characteristics of included papers

The included papers spanned from 2018 to 2023, with the majority (16, 52%) published between 2018 and 2020. Educational settings were the focus of most papers (15, 48%), followed by health settings (8, 26%). Participants primarily consisted of university students (12, 39%), followed by professional nurses (9, 29%). Narrative opinion papers predominated (8, 26%), with quantitative research and review studies comprising seven (7, 22%) each. Mixed methods were utilized in only two (2, 6%) papers. Among the 31 reviewed papers, 13 (42%) described nurses' roles in climate change, while 20 (64.5%) discussed climate change knowledge and related skills. Four (13%) papers addressed climate change-related attitudes. There was considerable overlap in information across papers regarding roles, knowledge, attitudes, and skills (Table 1).

3.3. Roles of nurses in climate change

The review identified five key roles for nurses in mitigating and adapting to the health impacts of climate change: advocacy, research, education, clinical practice, and leadership. Each role requires specific eco-nursing competencies (Table 2).

Advocacy role: The review emphasized the nurse's role as a climate advocate, as highlighted in 13 papers. This role includes promoting eco-friendly practices and planetary health (Griffin et al., 2022; Keating et al., 2022; Mat, 2022; McKinnon et al., 2022; Mundie & Donelle, 2022; Rosa & Upvall, 2019) and advocating for policies that protect vulnerable populations (Giudice, 2021; Lilienfeld et al., 2018; McDermott-Levy et al., 2019; Reiner & Haas-Howard, 2022; Vandenberg et al., 2023). Additionally, the importance of advocating for nursing education on climate change was highlighted (Harris et al., 2022; Rosa et al., 2021; Rosa & Upvall, 2019).

Education role: Seven papers described the nurse's role in climate change-related education. This includes self-education, formal and informal education of nurses and health professionals (Giudice, 2021; Harris et al., 2022; Keating et al., 2022; Rosa et al., 2021), and educating the community on climate-sensitive diseases (Mundie & Donelle, 2022; Rosa & Upvall, 2019; Vandenberg et al., 2023).

Leadership role: The leadership role, highlighted in six papers, focused on leading by example (Giudice, 2021; Reiner & Haas-Howard, 2022) and spearheading public health policy initiatives (Giudice, 2021; Harris et al., 2022; Mat, 2022; Rosa et al., 2021; Rosa & Upvall, 2019).

Research role: Six papers emphasized the nurse's role in climate change research. This role includes conducting climate-related research (McDermott-Levy et al., 2019; Rosa & Upvall, 2019) and using research evidence to change practices and implement mitigation strategies (Giudice, 2021; Griffin et al., 2022; Mundie & Donelle, 2022; Reiner & Haas-Howard, 2022).

Clinical role: The clinical practice role of nurses, highlighted in only five papers, involves diagnosing, managing, and preventing climate-related illnesses (Giudice, 2021; Griffin et al., 2022; Keating et al., 2022; Rosa et al., 2021; Vandenberg et al., 2023). This role also includes collaborating with teams to mitigate risks among vulnerable populations (Rosa et al., 2021).

3.4. Eco-nursing competencies

The review identified the specific knowledge, attitudes, and skills required for each eco-nursing role (Table 3).

Eco-nursing knowledge: Twenty papers delineated the knowledge areas essential for nurses in climate change and sustainability (Table 3). This knowledge encompasses climate change science, climate-related health risks (Buriro et al., 2018; Cadet, 2022; Cook et al., 2019; Ergin et al., 2021; Felicilda-Reynaldo et al., 2018; Giudice, 2021; Harris et al., 2022; Kalogirou et al., 2020; Mat, 2022; McKinnon et al., 2022; Reiner & Haas-Howard, 2022; Ryan et al., 2020; Vandenberg et al., 2023; Yang et al., 2018), climate-sensitive

diseases (Vandenberg et al., 2023), vulnerable populations (Ergin et al., 2021; Giudice, 2021; Griffin et al., 2022; Harris et al., 2022; McDermott-Levy et al., 2019; McKinnon et al., 2022; Vandenberg et al., 2023), and the environmental impact of nursing activities (Aronsson et al., 2020; Cook et al., 2019; Ergin et al., 2021; López-Medina et al., 2022; Ryan et al., 2020). Furthermore, nurses require an understanding of integrating eco-nursing into nursing practice at all levels (Aronsson et al., 2020; Harris et al., 2022; McKinnon et al., 2022; Rosa & Upvall, 2019), climate change mitigation strategies (McKinnon et al., 2022; Rosa & Upvall, 2019), and advocacy strategies (Vandenberg et al., 2023).

Eco-nursing skills: Twenty papers have delineated nurses' skills in climate change and sustainability (Table 3). These skills encompass practicing independently (Giudice, 2021; Keating et al., 2022; Mat, 2022), demonstrating leadership, community engagement, and effective advocacy (Aronsson et al., 2020; Cadet, 2022; Cook et al., 2019; Harris et al., 2022; LeClair et al., 2021; Lopez-Medina et al., 2019; Mahmoud and Mahmoud, 2023; Mat, 2022; McDermott-Levy et al., 2019; Mundie & Donelle, 2022; Reiner & Haas-Howard, 2022; Rosa et al., 2021; Rosa & Upvall, 2019). Additionally, proficiency in research and evidence-based practice (Mundie & Donelle, 2022; Rosa & Upvall, 2019), patient education (Mundie & Donelle, 2022; Rosa & Upvall, 2019; Vandenberg et al., 2023), and emergency preparedness and response (Rosa & Upvall, 2019; Vandenberg et al., 2023) is crucial for nurses during this climate change era. These competencies primarily apply to general nurses, while advanced practice nurses and nurse leaders are expected to demonstrate a more nuanced and in-depth proficiency in these skills. In addition to the skills required for general nurses, advanced practice nurses should be competent in policy analysis and development (Cadet, 2022; Ergin et al., 2021; Harris et al., 2022; McKinnon et al., 2022; Parker et al., 2019).

Eco-nursing attitudes: Only four papers briefly addressed attitudes towards climate change and sustainability. These included a concern for planetary health (Chen & Price, 2020; Cruz et al., 2018; Felicilda-Reynaldo et al., 2018; Linton et al., 2020), advocacy for eco-health, prevention (Chen & Price, 2020; Felicilda-Reynaldo et al., 2018; Linton et al., 2020), and a commitment to action (Cruz et al., 2018; Linton et al., 2020). Additionally, an anti-anthropocentric attitude was noted, challenging the human-centred worldview, and advocating for a more inclusive and respectful relationship with nature (Felicilda-Reynaldo et al., 2018). This perspective recognises the interconnectedness and value of all living beings and ecosystems.

4. Discussion

Integrating eco-nursing into the curriculum embodies a paradigm shift, linking healthcare and environmental stewardship (Corvalan et al., 2020; World Health Organisation, 2020). This holistic approach emphasizes the symbiotic relationship between planetary and human health, promoting ecological awareness and sustainable practices (Hampshire et al., 2022). It prepares nurses for systemic thinking, advocacy, and innovation, aligning with global health and sustainability goals (Opoku et al., 2021; World Health Organisation, 2015).

The scoping review addressed two primary research questions: (i) What are the roles of nurses in eco-nursing? and (ii) What competencies (attitudes, knowledge, and skills) are required by nurses for eco-nursing? The review included 31 articles that highlighted key nursing roles in advocacy, education, research, clinical practice, and leadership related to climate change and eco-nursing. These roles emphasize the necessity for nurses to possess tailored eco-competencies—knowledge, attitudes, and skills—to effectively mitigate and adapt to the health impacts of climate change.

Table 3
Synthesized roles, and related eco-nursing competencies.

Role	Related eco-nursing competencies		
	Knowledge	Attitudes	Skills
Advocacy	Advocacy strategies Integration of eco-nursing into all levels of nursing practice	Eco-health advocacy and prevention	Leadership, community engagement, and advocacy Policy analysis and development Ethical decision making
Research	Climate change science and climate-related health Climate change mitigation strategies Vulnerable populations Impact of nursing activities on the environment	Commitment to act Concern for planetary health	Research and evidence-based practice Policy analysis and development
Education	Climate change science and climate-related health risks Integration of eco-nursing into all levels of nursing practice	Anti-anthropocentric perspective	Patient education Technology and information literacy
Leadership	Climate change science and climate-related health risks Climate sensitive diseases Climate change mitigation strategies	Concern for planetary health	Leadership, community engagement, and advocacy Climate health assessment and resilient care planning
Clinician	Vulnerable populations Impact of nursing activities on the environment	Commitment to act	Independent practice competence Climate health assessment & resilient care planning Emergency preparedness and response Ethical decision making Technology and information literacy

4.1. The role of the nurse as a clinician and related competencies

The role of the nurse as a clinician, outlined in the nurses' competency framework (ICN & WHO, 2019; Wit et al., 2023), was identified in only five papers, highlighting a research gap in this evolving role. To fulfill the clinician role, nurses need eco-nursing competencies related to assessing health determinants and the susceptibility of patients and communities to climate change, enabling them to implement preventive measures. Recent studies emphasize the importance of holistic healthcare and managing climate-related risks (Giudice, 2021; Keating et al., 2022; Mat, 2022). Clinician competencies require nurses to evaluate climate change risks and establish links with disease disparities, addressing the root causes of climate change (Álvarez-Nieto et al., 2022; Cadet, 2022; Ergin et al., 2021; Harris et al., 2022).

4.2. The role of the nurse as an advocate and related competencies

This review confirmed that nurses play a crucial role in advocating for policies that protect the health of vulnerable populations in the context of climate change, with over half of the papers addressing this role. Traditionally revered as patient advocates, nurses in eco-nursing extend this advocacy to environmental concerns, recognizing the vital link between human health and a healthy environment (Corvalan et al., 2020). Nurses need key competencies, such as the ability to analyze environmental and health policies to assess their impact (LeClair et al., 2021; Nicholas et al., 2020; Parker et al., 2019). This competency ensures the safety and wellbeing of patients affected by climate change (Cadet, 2022). Additionally, nurses must advocate for their colleagues to be informed about climate change and prepared to mitigate its effects (Mundie & Donelle, 2022; Rosa & Upvall, 2019).

The role of an advocate can be challenging for individual nurses, underscoring the importance of collaboration within multidisciplinary teams (Parker et al., 2019). Advanced practice nurses, such as primary care nurse specialists in South Africa, may be particularly suited for this role (Nicholas et al., 2020).

4.3. The role of the nurse as an educator and related competencies

Nurses play a crucial role in addressing climate change through education, as outlined in their competency framework (ICN & WHO, 2019; Wit et al., 2023). To fulfill this role, nurses must possess a fundamental understanding of climate science (Buriro et al., 2018; Ryan et al., 2020). This knowledge enables them to educate communities about climate change and strategies to mitigate its effects (LeClair et al., 2021; Mat, 2022; Mundie & Donelle, 2022; Vandenberg et al., 2023).

The nurse's educational role in climate change includes both patient education and training nurses who are novices. To provide effective health education, nurses must understand climate-sensitive illnesses and vulnerable populations, enabling them to protect susceptible community members (Rosa et al., 2021; Vandenberg et al., 2023). This education should include guidance on how vulnerable populations and outdoor workers can protect themselves from extreme weather conditions like heat waves and extreme cold (McKinnon et al., 2022; Vandenberg et al., 2023). Additionally, nurses should use technology literacy aids to educate communities about flood risks, employing maps to alert populations near flood zones and develop action plans for extreme weather events (Cadet, 2022).

To facilitate nurse training, educators must prioritize equipping both nursing students and practicing nurses with eco-nursing competencies. Despite including some health promotion activities and environmental assessments, most nursing curricula lack fundamental climate change information (Cadet, 2022; Harris et al., 2022). While various organizations support integrating climate change topics into nursing curricula, actual implementation remains challenging (Cadet, 2022). Cadet (2022) highlights the scarcity of research on methods for integrating climate change concepts into already dense nursing curricula. Nonetheless, studies by Cadet (2022), Keating et al., (2022), and Parker et al., (2019) suggest strategies such as integrating these topics throughout the nursing training period and incorporating them into existing modules. Additionally, continuous professional development learning sessions can help equip practicing nurses with essential knowledge (Linton et al., 2020).

4.4. The role of the nurse in leadership and related competencies

In addition to nursing research's role in climate change, the nurse's leadership role is crucial in eco-nursing. While nurse leadership is described in competency frameworks (ICN & WHO, 2019; International Council of Nurses, 2018; Wit et al., 2023), its significance in eco-nursing cannot be overstated. Nurses play a vital role in climate change mitigation and adaptation efforts, promoting eco-friendly practices such as sustainable travel, adopting renewable energy sources, and implementing waste reduction strategies (Giudice, 2021; Reiner & Haas-Howard, 2022). According to the International Council of Nurses (2018), nurses advocate for healthcare waste reduction and ensure proper waste management. Additionally, nurses can lead sustainable healthcare initiatives by actively considering the carbon footprint of their activities and taking proactive steps to reduce it (Álvarez-Nieto et al., 2022; Cruz et al., 2018; Linton et al., 2020).

Another leadership role involves planning and offering health services, including digital health services. By providing healthcare services directly within communities or through telenursing services, nurses can reduce patient movements, minimizing the need for extensive travel to access healthcare services, a practice that can be adopted by other sectors (Keshvardoost et al., 2021; Randall et al., 2017; Rosa & Upvall, 2019).

4.5. The role of the nurse in climate change research and related competencies

Six papers identified the role of nurses in climate research. Nurses should engage in research to effectively contribute to addressing climate change, with advanced practice nurses particularly tasked with promoting evidence-based practice (Harris et al., 2022). Nursing research on climate change enables insights into climate-sensitive illnesses, understanding the environmental impacts of nursing activities, identifying vulnerable populations, and devising strategies to address associated challenges (Ergin et al., 2021; Ryan et al., 2020; Vandenberg et al., 2023). The outcomes of such research inform sustainable healthcare practices and policy adjustments (Mundie & Donelle, 2022; Rosa & Upvall, 2019).

5. Limitations of the study

This scoping review is the initial attempt to consolidate the roles and competencies of nurses in eco-nursing. Omissions of unpublished studies, grey literature, or non-English publications could introduce bias into the findings. Generalizing the results beyond the included studies may be limited, given potential influences from geographic, healthcare system, and cultural factors. Although the scoping review methodology permits broader literature inclusion, this approach entails treating studies of differing quality levels equally, potentially compromising the robustness of synthesized evidence.

6. Conclusion

Eco-nursing is crucial for the nursing curriculum and clinical practice as it emphasizes the relationship between environmental health and patient well-being. Climate change, pollution, and resource depletion significantly impact public health, necessitating an integrated approach to healthcare education. By incorporating eco-nursing, nurses can better understand and address these environmental determinants of health. Implementation involves updating curricula to include courses on sustainability, environmental health risks, and the impact of climate change on health. Practical training in eco-friendly practices, such as waste reduction, energy conservation, and advocating for green policies in healthcare settings will prepare nurses to promote and practice sustainable healthcare.

The urgency lies in implementing these competencies and seizing every opportunity to impart them to the nursing workforce, enhancing their confidence in patient care. While some competencies are already part of existing frameworks (ICN & WHO, 2019; Wit et al., 2023), their integration can be improved by identifying specific eco-nursing knowledge, attitudes, and skills. Therefore, nursing practice must evolve effectively, incorporating these competencies to address the unique health demands posed by changing climate conditions.

CRediT authorship contribution statement

Thandazile Sibindi: Writing – review & editing, Validation, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Jennifer-Anne Chipps:** Writing – review & editing, Validation, Supervision, Methodology, Conceptualization. **Talitha Crowley:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijnsa.2024.100221.

References

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.

Aromataris & Munn. (2020). JBI manual for evidence synthesis. In. https://doi.org/10.46658/JBIMES-20-01.

Aronsson, J., Clarke, D., Grose, J., Richardson, J., 2020. Student nurses exposed to sustainability education can challenge practice: A cohort study. Nurs Health Sci 22 (3), 803–811. https://doi.org/10.1111/nhs.12734.

Buriro, N.A., Mureed, S., Kumar, R., Ahmed, F., Hussain, K., Fatima, A., 2018. Nurses' Perception, Knowledge and Information Sources on Climate Change and Health at Dow University Hospital Karachi. Journal of Liaquat University of Medical & Health Sciences 17 (04), 265–271. https://doi.org/10.22442/jlumhs.181740590.

Butterfield, P., Leffers, J., Vásquez, M.D., 2021. Nursing's pivotal role in global climate action. Bmj. https://doi.org/10.1136/bmj.n1049.

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.

Chase, H., Hampshire, K., Tun, S., 2022. Improving the medical curriculum on planetary health and sustainable healthcare. Bmj 376 o209.

Chen, M.J., Price, A.M., 2020. Comparing undergraduate student nurses' understanding of sustainability in two countries: A mixed method study. Nurse Educ Today 88, 104363. https://doi.org/10.1016/j.nedt.2020.104363.

Clark, M., Raffray, M., Hendricks, K., Gagnon, A.J., 2016. Global and public health core competencies for nursing education: A systematic review of essential competencies. Nurse Education Today 40, 173–180. https://doi.org/10.1016/j.nedt.2016.02.026.

Cook, C., Demorest, S.L., Schenk, E., 2019. Nurses and Climate Action. AJN American Journal of Nursing 119 (4), 54–60. https://journals.lww.com/ajnonline/citation/2019/04000/nurses_and_climate_action.29.aspx.

Corvalan, C., Villalobos Prats, E., Sena, A., Campbell-Lendrum, D., Karliner, J., Risso, A., Wilburn, S., Slotterback, S., Rathi, M., Stringer, R., 2020. Towards climate resilient and environmentally sustainable health care facilities. Int J Environ Res Public Health 17 (23), 8849. https://doi.org/10.3390/ijerph17238849.

Covidence, 2022. Covidence getting started handout. Veritas Health Innovation. Retrieved 30/01/2023 from.

Cruz, J.P., Felicilda-Reynaldo, R.F.D., Alshammari, F., Alquwez, N., Alicante, J.G., Obaid, K.B., Rady, H., Qtait, M., Silang, J., 2018. Factors Influencing Arab Nursing Students' Attitudes toward Climate Change and Environmental Sustainability and their Inclusion in Nursing Curricula. Public Health Nurs 35 (6), 598–605. https://doi.org/10.1111/phn.12516.

Ergin, E., Altinel, B., Aktas, E., 2021. A mixed method study on global warming, climate change and the role of public health nurses from the perspective of nursing students. Nurse Education Today 107. https://doi.org/10.1016/j.nedt.2021.105144. N.PAG-N.PAG.

Felicilda-Reynaldo, R.F.D., Cruz, J.P., Alshammari, F., Obaid, K.B., Rady, H., Qtait, M., Alquwez, N., Colet, P.C., 2018. Knowledge of and attitudes toward climate change and its effects on health among nursing students: A multi-Arab country study. Nurs Forum 53 (2), 179–189. https://doi.org/10.1111/nuf.12240.

Fouladbakhsh, J., Szczesny, S.G., 2014. Integrative Nursing in the Community. Integrative Nursing 11, 344.

Giudice, L. C. (2021). Position statement: climate change, women's health and environmental justice.

Griffin, M., 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.

Hampshire, K., Islam, N., Kissel, B., Chase, H., Gundling, K., 2022. The Planetary Health Report Card: a student-led initiative to inspire planetary health in medical schools. The Lancet Planetary Health. https://doi.org/10.1016/S2542-5196(22)00045-6.

Harris, O.O., Bialous, S.A., Muench, U., Chapman, S., Dawson-Rose, C., 2022. Climate Change, Public Health, Health Policy, and Nurses Training. American Journal of Public Health 112 (Sup3), S321–S327. https://doi.org/10.2105/ajph.2022.306826.

ICN & WHO, 2019. Core Competencies In Disaster Nursing. I. WHO.

International Council of Nurses. (2018). ICN Position Statement: Nurses, climate change and health. In.

Jagals, P., Ebi, K., 2021. Core Competencies for Health Workers to Deal with Climate and Environmental Change. International Journal of Environmental Research and Public Health 18 (8), 3849. https://doi.org/10.3390/ijerph18083849.

Kalogirou, M.R., Dahlke, S., Davidson, S., Yamamoto, S., 2020. Nurses' perspectives on climate change, health and nursing practice. Journal of clinical nursing 29 (23-24), 4759–4768. https://doi.org/10.1111/jocn.15519.

Keating, S.A., Vetter, M.J., Klar, R.T., Wright, F., 2022. Integrating Climate Change in the Curriculum: Using Instructional Design Methods to Create an Educational Innovation for Nurse Practitioners in a Doctor of Nursing Practice Program. Journal for Nurse Practitioners 18 (4), 424–428. https://doi.org/10.1016/j.nurpra.2021.11.009.

Keshvardoost, S., Dehnavieh, R., Bahaadinibeigy, K., 2021. Climate Change and Telemedicine: A Prospective View. Int J Health Policy Manag 10 (1), 45–46. https://doi.org/10.15171/ijhpm.2020.08.

Kreslake, J. M., Sarfaty, M., Roser-Renouf, C., Leiserowitz, A. A., & Maibach, E. W. (2018). The critical roles of health professionals in climate change prevention and preparedness. In (Vol. 108, pp. S68-S69): American Public Health Association.

LeClair, J., Potter, T., 2022. Planetary Health Nursing. AJN, American Journal of Nursing 122 (4), 47–52.

LeClair, J., Watts, T., Zahner, S., 2021. Nursing strategies for environmental justice: A scoping review. Public Health Nurs 38 (2), 296–308. https://doi.org/10.1111/phn.12840.

Lilienfeld, E., Nicholas, P.K., Breakey, S., Corless, I.B., 2018. Addressing climate change through a nursing lens within the framework of the United Nations Sustainable Development Goals. Nurs Outlook 66 (5), 482–494. https://doi.org/10.1016/j.outlook.2018.06.010.

Linton, M.E., Wilson, K.J., Dabney, B.W., Johns, E.F., 2020. Integrating Environmental Sustainability Content Into an RN-to-BSN Program: A Pilot Study. J Nurs Educ 59 (11), 637–641. https://doi.org/10.3928/01484834-20201020-07.

López-Medina, I.M., Álvarez-García, C., Parra-Anguita, L., Sanz-Martos, S., Álvarez-Nieto, C., 2022. Perceptions and concerns about sustainable healthcare of nursing students trained in sustainability and health: A cohort study. Nurse Educ Pract 65, 103489. https://doi.org/10.1016/j.nepr.2022.103489.

Lopez-Medina, I.M., Álvarez-Nieto, C., Grose, J., Elsbernd, A., Huss, N., Huynen, M., Richardson, J., 2019. Competencies on environmental health and pedagogical approaches in the nursing curriculum: A systematic review of the literature. Nurse education in practice 37, 1–8. https://doi.org/10.1016/j.nepr.2019.04.004.

Mahmoud, F.H., Mahmoud, B.H., 2023. Effect of Climate Change on Health and Critical Care Nurses Practice. The Egyptian Journal of Hospital Medicine 90, 1149–1155. https://doi.org/10.21608/ejhm.2023.280272.

Mat, S.T.B., 2022. The Role of Nurses in Addressing Health Effects of Climate Change and Wildfires. Health Problems of Civilization 16 (1), 31–36. https://doi.org/10.5114/hpc.2021.111213.

McDermott-Levy, Kolanowski, A.M., Fick, D.M., Mann, M.E, 2019. Addressing the Health Risks of Climate Change in Older Adults. Journal of Gerontological Nursing 45 (11). https://doi.org/10.3928/00989134-20191011-04.

McKinnon, S., Breakey, S., Fanuele, J.R., Kelly, D.E., Eddy, E.Z., Tarbet, A., Nicholas, P.K., Ros, A.M.V., 2022. Roles of health professionals in addressing health consequences of climate change in interprofessional education: A scoping review. The journal of climate change and health 5, 100086. https://doi.org/10.1016/j.joclim.2021.100086.

McLeroy, K.R., Bibeau, D., Steckler, A., Glanz, K., 1988. An ecological perspective on health promotion programs. Health education quarterly 15 (4), 351–377. https://doi.org/10.1177/109019818801500401.

Mundie, C., Donelle, L., 2022. The Environment as a Patient: A Content Analysis of Canadian Nursing Organizations and Regulatory Bodies Policies on Environmental Health. Can J Nurs Res 54 (4), 464–473. https://doi.org/10.1177/08445621211035913.

Naeem, M., Ozuem, W., Howell, K., Ranfagni, S., 2023. A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research. International Journal of Qualitative Methods 22. https://doi.org/10.1177/16094069231205789.

Nicholas, P.K., Breakey, S., Blank, P., 2020. Roles of Nurse Practitioners: Health Consequences of Climate Change in Vulnerable Older Adults. Journal for Nurse Practitioners 16 (6), 433–437. https://doi.org/10.1016/j.nurpra.2020.03.011.

Opoku, S.K., Filho, W.L., Hubert, F., Adejumo, O., 2021. Climate Change and Health Preparedness in Africa: Analysing Trends in Six African Countries. International Journal of Environmental Research and Public Health 18 (9), 4672. https://doi.org/10.3390/ijerph18094672.

Parker, G., Berta, W., Shea, C., Miller, F., 2019. Environmental competencies for healthcare educators and trainees: A scoping review. Health Education Journal 79 (3), 327–345. https://doi.org/10.1177/0017896919886599.

Rafferty, A.M., Stott, R., Watts, N., 2015. An alliance for action on climate change. Nursing Standard (2014+) 30 (13), 17. https://doi.org/10.7748/ns.30.13.17.s21.

Randall, S., Crawford, T., Currie, J., River, J., Betihavas, V., 2017. Impact of community based nurse-led clinics on patient outcomes, patient satisfaction, patient access and cost effectiveness: A systematic review. Int J Nurs Stud 73, 24–33. https://doi.org/10.1016/j.ijnurstu.2017.05.008.

Reiner, K.L., Haas-Howard, C., 2022. Essential Strategies for School Nurses to Move Upstream in Support of Healthy Students and a Healthy Planet. NASN Sch Nurse 37 (4), 217–222. https://doi.org/10.1177/1942602X221078342.

Rosa, W.E., Catton, H., Davidson, P.M., Hannaway, C.J., Iro, E., Klopper, H.C., Madigan, E.A., McConville, F.E., Stilwell, B., Kurth, A.E., 2021. Nurses and Midwives as Global Partners to Achieve the Sustainable Development Goals in the Anthropocene. J Nurs Scholarsh 53 (5), 552–560. https://doi.org/10.1111/jnu.12672.

Rosa, W.E., Upvall, M.J., 2019. The case for a paradigm shift: from global to planetary nursing. Nursing Forum 54 (2), 165–170. https://doi.org/10.1111/nuf.12310.

Ryan, E.C., Dubrow, R., Sherman, J.D., 2020. Medical, nursing, and physician assistant student knowledge and attitudes toward climate change, pollution, and resource conservation in health care. BMC Med Educ 20 (1), 200. https://doi.org/10.1186/s12909-020-02099-0.

Vandenberg, S.Y., Chircop, A., Sedgwick, M., Scott, D., 2023. Nurses' perceptions of climate sensitive vector-borne diseases: A scoping review. Public Health Nurs 40 (3), 468–484. https://doi.org/10.1111/phn.13173.

Watts, N., Stott, R., Rafferty, A.M., 2015. Combating climate change. BMJ : British medical journal 351, h6178. https://doi.org/10.1136/bmj.h6178.

Wit, R.F., de Veer, A.J.E., Batenburg, R.S., Francke, A.L., 2023. International comparison of professional competency frameworks for nurses: a document analysis. BMC Nurs 22 (1), 343. https://doi.org/10.1186/s12912-023-01514-3.

World Health Organisation, 2015. Operational framework for building climate resilient health systems. World Health Organization. https://www.who.int/publications/i/item/9789241565073.

World Health Organisation. (2018). WHO First Global conference on air pollution and health.

World Health Organisation. (2020). Operational framework for primary health care: transforming vision into action. htt https://www.who.int/publications/i/item/97892400017832.

Yang, L., Liao, W., Liu, C., Zhang, N., Zhong, S., Huang, C., 2018. Associations between Knowledge of the Causes and Perceived Impacts of Climate Change: A Cross-Sectional Survey of Medical, Public Health and Nursing Students in Universities in China. Int J Environ Res Public Health 15 (12). https://doi.org/10.3390/ijerph15122650.