



Environmental nursing practices as a solution for reducing exposure to environmental hazards

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ABSTRACT

Background: This literature review investigates nursing interventions aimed at reducing exposure to environmental hazards. Environmental hazards, such as chemical exposure, pollution, and toxins, have significant adverse effects on both human health and ecosystems, necessitating effective intervention strategies. **Method:** A systematic review was conducted by searching three major databases—PubMed, Scopus, and ISI Web of Knowledge—using specific keywords related to environmental hazards, settings, health impacts, and nursing interventions. It synthesizes findings from studies published between 2020 and 2025, focusing on environmental health, exposure prevention, risk assessment, and health education. The selection of papers adhered to the PRISMA guidelines to ensure comprehensive coverage of relevant literature. **Results:** The review highlights the widespread impact of environmental hazards, including pollutants like PFAS, pesticides, and microplastics, which contribute to health issues such as respiratory diseases, developmental disorders, and cancer. Additionally, studies reveal the importance of environmental nursing in managing these risks, with interventions such as admission screenings for infections like *Candida auris* and the integration of experiential learning in health curricula to enhance community health education. Community health nursing and health education play pivotal roles in promoting awareness and preventing diseases by targeting social and environmental determinants of health. **Conclusion:** This review underscores the importance of multi-faceted nursing interventions in addressing environmental health risks. Findings demonstrate the critical role of nurses in both direct healthcare and community education efforts to mitigate environmental hazards. Moving forward, comprehensive risk assessment and community-based approaches should be prioritized to reduce health disparities and enhance public health outcomes. **Novelty/Originality of this article:** The implications of this research suggest that enhancing nursing education on environmental health and integrating evidence-based interventions into healthcare practices will be crucial for effective mitigation of environmental risks and promotion of long-term health improvements.

KEYWORDS: environmental health; health education; nursing interventions; exposure prevention; risk assessment.

1. Introduction

Environmental hazards, including air pollution, chemical exposure, and waste contamination, pose significant health risks globally, affecting millions of people each year.

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According to the World Health Organization (WHO), air pollution is responsible for approximately 7 million premature deaths annually, primarily due to respiratory diseases, cardiovascular conditions, and lung cancer (World Health Organization, 2014). Fine particulate matter (PM_{2.5}) from industrial emissions, vehicle exhaust, and biomass burning is particularly harmful, penetrating deep into the lungs and bloodstream, leading to chronic respiratory diseases such as asthma and chronic obstructive pulmonary disease (COPD) (Shu et al., 2024). Additionally, chemical exposure from hazardous substances, including per- and polyfluoroalkyl substances (PFAS), polychlorinated biphenyls (PCBs), and bisphenol-A (BPA), has been linked to various cancers, endocrine disruption, and reproductive toxicity (NIEHS, 2025). Studies have shown that long-term exposure to these chemicals can increase the risk of breast cancer, liver damage, and developmental disorders in children, impacting cognitive and neurological functions (Alavanja et al., 2004; Feinstein et al., 2018; Vaiserman, 2014). Waste contamination, particularly in low-income and densely populated areas, further exacerbates health risks by exposing communities to toxic metals, such as lead and mercury, which are known neurotoxins. The Global Burden of Disease Study estimates that lead exposure alone contributes to over 900,000 deaths annually, mainly affecting children's neurological development and increasing the risk of hypertension in adults (Gandhi et al., 2024). These alarming statistics underscore the urgent need for effective prevention and mitigation strategies, including stricter environmental regulations, improved waste management practices, and community awareness programs.

Environmental nursing practices involve assessing, managing, and educating communities about environmental health risks, making them vital in preventing and mitigating the adverse health effects of environmental hazards (Smith et al., 2023). Nurses in this field conduct comprehensive environmental health assessments, identifying potential hazards such as air and water pollution, chemical exposures, and unsafe housing conditions. According to the Centers for Disease Control and Prevention (CDC), approximately 24% of global diseases are linked to environmental factors, highlighting the importance of proactive risk assessment (Thacker et al., 2016). Environmental nurses use tools like the Environmental Exposure History and Geographic Information Systems (GIS) to track environmental threats and their impact on community health. Nurses play a pivotal role in identifying potential hazards, including indoor air pollutants like radon and mold, which are linked to respiratory diseases such as asthma and lung cancer. The Environmental Protection Agency (EPA) estimates that radon exposure contributes to about 21,000 lung cancer deaths annually in the United States alone (Watkins, 2023). Additionally, chemical exposure from household products, pesticides, and industrial waste has been linked to endocrine disruption, cancer, and neurodevelopmental disorders, emphasizing the need for vigilant monitoring and preventive strategies (Jaga & Dharmani, 2003). Environmental nurses advocate for safer environments by collaborating with public health agencies, policymakers, and community leaders to implement health-promoting policies and regulations. They actively participate in environmental health advocacy, influencing policy changes that enhance air and water quality standards, chemical safety regulations, and sustainable community practices (Rosenbaum, 2017).

Despite its importance, the integration of environmental nursing practices into mainstream healthcare remains limited. Factors such as insufficient training, lack of standardized guidelines, and inadequate policy support hinder the effective implementation of these practices. This gap highlights the necessity for more comprehensive research and educational programs to empower nurses with the skills needed to address environmental health challenges. Previous studies have explored the impact of environmental hazards on health, yet there is a scarcity of literature focusing on the role of nursing in mitigating these risks. Understanding how environmental nursing practices contribute to reducing exposure to hazards is essential for developing effective strategies and policies. A systematic review of existing literature can provide valuable insights into best practices and highlight areas requiring further investigation. This literature review aims to examine current environmental nursing practices in reducing exposure to environmental hazards. By synthesizing relevant studies, this review seeks to

identify effective interventions, assess challenges faced by nurses, and provide recommendations for enhancing environmental health strategies. This exploration will contribute to the growing field of environmental nursing, ultimately supporting the development of safer and healthier communities.

2. Methods

This systematic review was conducted using three databases: PubMed, Scopus, and ISI Web of Knowledge. Papers were identified and selected following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) criteria guidelines (Moher et al., 2010). For each database, keywords were chosen to reflect (i) environmental hazards (chemical exposure, pollution, toxins, contaminants, hazardous substances, and environmental risks); (ii) environmental settings (urban, rural, industrial, residential, and community environment); (iii) health impacts (respiratory diseases, cancer, developmental disorders, public health, and human health); and (iv) nursing interventions (environmental nursing, health education, exposure prevention, risk assessment, and community health nursing). These keywords were used to construct search queries, ensuring comprehensive coverage of relevant literature on environmental nursing practices in reducing exposure to environmental hazards.

As shown in Figure 1, 1045 papers were found in Web of Science, 247 in PubMed, and 1330 in Scopus (last search: 24 January 2022). These papers were reviewed and selected according to specified inclusion and exclusion criteria. Only (i) scientific articles (ii) written in English and (iii) related to environmental nursing practices in (iv) reducing exposure to environmental hazards using (v) various intervention strategies were considered for this review. Consequently, literature reviews, conference proceedings, and non-English articles were excluded. Additionally, papers focusing solely on medical treatment without environmental intervention were not considered. After removing duplicates, the authors conducted a double-selection process (to minimize operator error) by reviewing the titles, abstracts, and full manuscripts of potentially relevant articles. Following this screening, 23 articles were deemed suitable and included in this review (Figure 1). The results of the selected studies are presented in the subsequent sections.

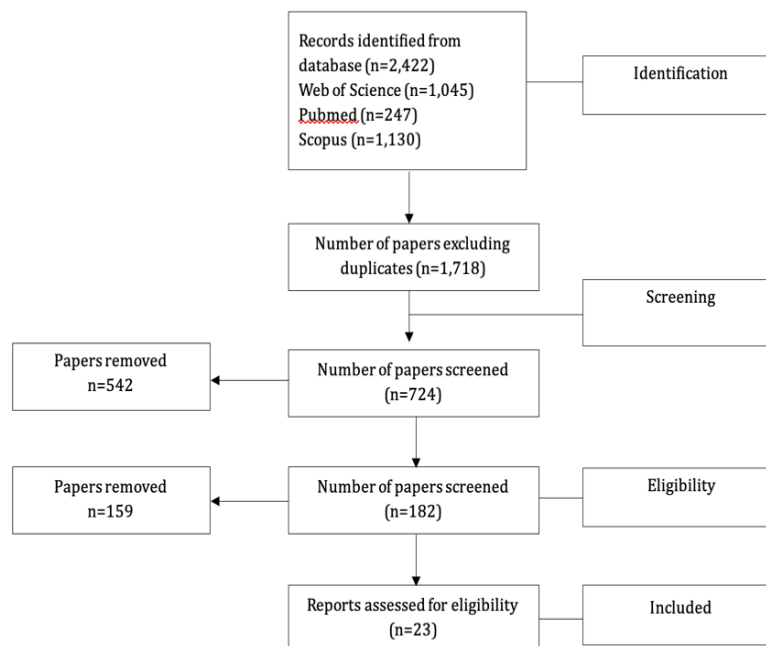


Fig. 1. PRISMA flow diagram illustrating the selection process of studies for the systematic review. Records were identified from multiple databases (Web of Science, PubMed, and Scopus), with duplicates removed. Following screening and eligibility assessments

3. Results and Discussion

Understanding the relationship between environmental hazards, settings, health impacts, and nursing interventions is crucial for developing effective public health strategies. Environmental hazards, including chemical exposure, pollution, toxins, contaminants, and hazardous substances, pose significant risks to human health and ecosystems. These risks are influenced by environmental settings such as urban, rural, industrial, residential, and community environments, which shape the patterns of exposure and vulnerability among populations. Consequently, health impacts, including respiratory diseases, cancer, developmental disorders, and broader public health issues, have been increasingly linked to environmental factors. Addressing these complex challenges requires comprehensive nursing interventions, including environmental nursing, health education, exposure prevention, risk assessment, and community health nursing. These interventions aim to enhance awareness, minimize exposure risks, and promote health equity, emphasizing the need for a proactive, multidisciplinary approach to environmental health.

3.1 Environmental hazards (Chemical exposure, pollution, toxins, contaminants, hazardous substances, and environmental risks)

The studies collectively underscore the adverse impacts on ecosystems and human health, particularly emphasizing immunotoxicity, reproductive toxicity, developmental disorders, and ecotoxicological effects. The findings reveal significant concerns regarding microplastics, chemical contaminants like PFAS, pesticides, polystyrene emissions, and heavy metals, demonstrating their widespread environmental presence and bioaccumulative nature. Furthermore, the research illustrates the complexity of pollutant interactions within different environmental settings, affecting terrestrial and aquatic organisms through trophic transfer and bioaccumulation. These insights emphasize the urgent need for enhanced monitoring, effective bioremediation strategies, and comprehensive risk assessment frameworks to mitigate the environmental and health risks associated with these hazards (Table 1).

Table 1. Summary publications of environmental hazards (2020-2025): Chemical exposure, pollution, toxins, contaminants, hazardous substances, and environmental risks

No.	Title	Author(s)	Year	Focus area	Key findings
1	Per-and polyfluoroalkyl substance (PFAS)-Potential risk to rural groundwater systems (Borsuah & Whitacre, 2025)	K. Borsuah, B. Whitacre	2025	Chemical contaminants	PFAS chemicals pose significant risks to rural groundwater systems, including immunotoxicity and developmental toxicity.
2	Risk Assessment Arising from the Exposure of Terrestrial Vertebrates to Soil Contamination (Lin et al., 2025)	R. Scudiero, L. Rosati	2025	Soil contamination	Examines reproductive toxicity and harmful effects of soil contaminants on terrestrial vertebrates.
3	Characterization and Health Risk Assessment of Pollutant Emissions from Polystyrene	K. Zheng, Z. Ruan, J. Fang	2025	Air pollutants	Investigates the health risks of particulate and gaseous pollutants from polystyrene molding.

4	Injection Molding (Zheng et al., 2025) Microplastics: A threat to Fetoplacental unit and Reproductive systems (Anifowoshe et al., 2025)	A.T. Anifowoshe, M.N. Akhtar	2025	Microplastics	Explores the toxicological impacts of microplastics on reproductive health.
5	Unbounded Bees: Pesticide Contamination in Brazilian Bees and Hive Products (Costa et al., 2025)	A.L.G. Costa, J.C.M. Brito	2025	Pesticide toxicity	Reviews pesticide contamination's impact on bees and hive products.
6	Effects of tire particles on earthworm fitness and bioaccumulation of tire-related chemicals (Masset et al., 2025)	F. Breider, M. Renaud	2025	Soil pollutants	Examines the impact of tire particles on earthworm fitness and bioaccumulation
7	Establishing Mechanisms of Environmental Exposure to Polychlorinated Biphenyls (PCBs) and Male Infertility (Anvari et al., 2025)	Z. Noorimotlagh	2025	Chemical exposure	Investigates PCBs' role in male infertility due to environmental exposure
8	Monitoring and Management of Pollutants in the Environment (Eramma et al., 2025)	N. Eramma, S.J. Patil	2025	Environmental pollutants	Examines monitoring techniques for environmental endocrine-disrupting chemicals.
9	Microplastics from Soil and Groundwater to Human Body: A Review (Qi et al., 2020)	B.K. Rajabattula, G.A. Rao	2025	Microplastics	Analyzes the pathways and health impacts of microplastics from soil to human body.
10	Exploring the Ecotoxicological Impacts of Microplastics on Freshwater Fish (Ghosh et al., 2025)	S. Ghosh, S. Dey	2025	Aquatic pollution	Reviews the ecotoxicological impacts of microplastics on freshwater fish.
11	Detection and Risk Assessment of Bisphenol-A and Phthalate	N. Pal, P. Sharma	2025	Chemical exposure	Investigates risks associated with bisphenol-A and

	Esters in Bottled Water (Pal et al., 2025)				phthalate esters in bottled water.
12	Bioremediation and Phytoremediation of Environmental Pollutants (Mishra et al., 2020)	K. Mohan, A. Sreenikethanam	2025	Pollution remediation	Discusses bioremediation techniques for reducing environmental pollutants' toxicity
13	Impact of Gaseous Smoke Pollutants from Modelled Fires on Air and Soil Quality (Nizhelskiy et al., 2025)	M. Nizhelskiy, K. Kazeev	2025	Air and soil pollution	Studies the effects of toxic gases from fires on air and soil quality.
14	The Coexistence of Microplastics and Heavy Metals in Traditional Chinese Medicine (Xiao et al., 2025)	C. Xiao, J. Zhou	2025	Chemical exposure	Investigates heavy metals and microplastics in traditional Chinese medicine.
15	Necroecological Trophic Transfer of Microplastics (Guimarães et al., 2025)	A. Guimarães, R.R. de Brito	2025	Ecotoxicity	Examines the trophic transfer and ecotoxicity of microplastics.

The studies highlight the detrimental effects of various pollutants on both ecosystems and human health, revealing alarming trends in the accumulation and persistence of hazardous substances across multiple environments. Microplastics, chemical contaminants such as PFAS, pesticides, polystyrene emissions, and heavy metals have been identified as major environmental threats, with a growing body of research documenting their widespread presence. For instance, microplastics have been found in over 80% of aquatic ecosystems worldwide, with concentrations in some areas reaching up to 1.5 million particles per cubic meter of water (Hale et al., 2020). Similarly, PFAS chemicals, often referred to as "forever chemicals" due to their persistence in the environment, have been detected in groundwater and soil in over 50 countries, posing significant risks to both wildlife and human populations (Lee et al., 2025). These pollutants exhibit a tendency to accumulate in the environment, with certain pesticides and heavy metals such as lead and mercury found to bioaccumulate in the tissues of aquatic and terrestrial organisms, amplifying their toxic effects as they move up the food chain.

Beyond the ecological impacts, these pollutants pose direct health risks to humans, particularly in relation to immunotoxicity, reproductive toxicity, and developmental disorders. A recent study indicated that PFAS exposure is linked to a 20% increase in the incidence of thyroid disease in populations living near contaminated sites (Andersson et al., 2019). Pesticides, often used in both rural and urban areas, have been associated with higher rates of neurodevelopmental disorders in children, with one study showing a correlation between pesticide exposure and a 15% increase in the prevalence of autism spectrum disorders (He et al., 2022). The pervasive nature of these contaminants, spanning urban, rural, industrial, and residential settings, raises serious concerns about their long-term effects on biodiversity and public health. The continuous release of these pollutants into diverse environmental settings exacerbates the risk of ecosystem degradation and

contributes to the growing burden of chronic diseases in affected populations. These findings highlight the urgent need for comprehensive environmental management strategies to mitigate the risks posed by these persistent pollutants.

3.2 Environmental settings (Urban, rural, industrial, residential, and community environment)

Table 2 reveals the extensive environmental and health risks posed by various pollutants, including chemical contaminants, microplastics, pesticides, and air pollutants. These studies highlight the significant ecological and toxicological impacts associated with chemical exposure, including immunotoxicity, reproductive toxicity, and developmental toxicity. Microplastics are identified as a major environmental hazard due to their widespread presence and ability to bioaccumulate across ecosystems, affecting terrestrial and aquatic organisms through trophic transfer. Additionally, chemical pollutants like PFAS, PCBs, and bisphenol-A demonstrate long-term environmental persistence and potential human health risks, including hormonal disruptions and infertility. The table also emphasizes the role of bioremediation and pollution monitoring as crucial strategies for mitigating these environmental hazards. Collectively, the findings underscore the necessity for comprehensive risk assessment frameworks and proactive environmental management approaches to safeguard both human health and ecosystem integrity.

Table 2. Summary publications of environmental settings (Urban, rural, industrial, residential, and community environment) in 11 publications (2021-2025)

No.	Title	Author(s)	Year	Focus area	Key findings
1	Evaluation of the sustainability of mountain rural settlements in Islam district of Talesh county (AmirEntekhabi & NazirNenekaran, 2024)	S. AmirEntekhabi, M. NazirNenekaran	2024	Rural sustainability	Examines environmental and socio-economic variables influencing rural settlement sustainability.
2	Optimization of Green Building Landscape Space Environment Based on Geographic Information System (Wang & Wang, 2024)	H. Wang, W. Wang	2024	Urban environment	Discusses urban ecological challenges and optimizes green building environments using GIS.
3	Unmasking the Neglected Cholera Outbreaks in Sub-Saharan Africa (Siamalube & Ehinmitan, 2024)	B. Siamalube, E. Ehinmitan	2025	Rural and urban health	Investigates environmental and infrastructural factors influencing cholera outbreaks in urban and rural settings.
4	Global excellence in indoor environment: South America (Figueiredo et al., 2024)	K. Figueiredo, G. Tibério Cardoso	2024	Residential environment	Explores sustainable indoor environments using banana industry waste for affordable housing.

5	Nutrition and sustainable development goal 10: reduced inequalities (Cohen, 2025)	E. Cohen	2025	Community environment	Examines environmental and nutritional disparities affecting community health and sustainability.
6	Impacts of Life and Climate Change: Sustainable Adaptation and Social-Ecological Resilience (Turner et al., 2022)	K. Shukla, Y.B. Patil, R.C. Estoque	2024	Community resilience	Analyzes socio-ecological resilience and sustainable adaptation in various environmental settings.
7	Urban Green Spaces and Wellbeing: Evidence from Latin American Cities (Reyes-Riveros et al., 2021)	A. Santillán, M. Orsini	2023	Urban environment	Investigates the role of urban green spaces in enhancing wellbeing in Latin American cities.
8	Industrial Land Use and Environmental Impacts: A Comparative Study (Truax, 2010)	Truax, P	2023	Industrial environment	Compares environmental impacts of industrial land use in urban vs. rural settings.
9	Residential Exposure to Traffic-Related Air Pollution and Cardiovascular Risks (Medina-Ramón et al., 2008)	Medina-Ramón	2022	Residential environment	Links residential exposure to traffic pollution with increased cardiovascular health risks.
10	Community Participation in Environmental Decision-Making (Richardson & Razzaque, 2011)	Razzaque, Jona	2022	Community environment	Explores community involvement in environmental governance and its impact on policy effectiveness.
11	Environmental Inequities in Urban and Rural Areas: Policy Implications (Morello-Frosch et al., 2017)	Morello-Frosch	2021	Urban and rural settings	Examines disparities in environmental quality and policy implications in urban vs. rural areas.

The extensive environmental and health risks posed by various pollutants, including chemical contaminants, microplastics, pesticides, and air pollutants, have raised significant concerns in recent years. Microplastics, in particular, have been identified as a major environmental hazard due to their pervasive presence in marine and terrestrial ecosystems. Research has shown that microplastics are found in 94% of freshwater bodies and 70% of marine environments, with concentrations reaching up to 1 million particles per cubic meter in certain areas (Mushtaq et al., 2020). These particles are not only ingested by

aquatic organisms but also enter terrestrial food webs through the movement of contaminated soil, leading to bioaccumulation in higher trophic levels. Similarly, chemical pollutants such as PFAS, PCBs, and bisphenol-A have shown remarkable persistence in the environment, with PFAS found in drinking water sources in over 40 countries (Garg et al., 2020). These chemicals are known to disrupt hormonal balance, potentially leading to issues like infertility, thyroid disorders, and developmental delays, which are increasingly evident in both wildlife and human populations.

The studies underscore the toxicological effects of these pollutants, particularly in relation to human health. Immunotoxicity, reproductive toxicity, and developmental toxicity have been directly linked to exposure to various chemicals and air pollutants, with emerging evidence of neurological effects in children and long-term health issues in adults (Goldman & Koduru, 2000). In response to these growing threats, the role of bioremediation and pollution monitoring has been highlighted as crucial strategies for mitigating the environmental hazards associated with these pollutants. Bioremediation techniques, such as the use of microorganisms to degrade hazardous substances, have proven effective in reducing pollutant concentrations in contaminated soil and water (Kulshreshtha et al., 2014). Furthermore, the implementation of rigorous pollution monitoring systems is essential for early detection and timely intervention. These findings emphasize the need for comprehensive risk assessment frameworks and proactive environmental management approaches that prioritize both the health of ecosystems and the well-being of human populations.

3.3 Health impacts (Respiratory diseases, cancer, developmental disorders, public health, and human health)

Table 3 highlights the significant health impacts associated with environmental factors, including respiratory diseases, cancer, developmental disorders, and broader public health concerns. The studies demonstrate a clear link between environmental pollutants such as coal emissions, chemical exposures, and heavy metals with increased incidences of respiratory diseases and cancer. Additionally, emerging technologies, such as AI-powered detection, have shown promise in enhancing cancer prediction accuracy. The table also underscores the role of immunological and genetic factors, with novel biomarkers like the human endogenous retrovirus K102 linked to cancer immunosuppression and the ferroptosis pathway influencing melanoma progression. Moreover, developmental disorders are linked to complex biological mechanisms, including glycobiology and glycosylation processes. Collectively, these findings emphasize the multifaceted nature of health impacts, necessitating comprehensive risk assessment and integrated healthcare interventions to address the growing public health challenges posed by environmental hazards.

Table 3. Literature summary of Health Impacts (2015-2025) – Respiratory Diseases, Cancer, Developmental Disorders, Public Health, and Human Health

No.	Title	Author(s)	Year	Focus area	Key findings
1	AI-Powered Detection: Implementing Deep Learning for Breast Cancer Prediction (Tanveer et al., 2024)	A. Tanveer, S. Munawar, N. Naveed	2025	Cancer	Utilizes deep learning to enhance breast cancer prediction accuracy
2	Coal: in a burning world, the dark side of energy still rules (Carvalho, 2025)	H. Carvalho	2025	Respiratory diseases	Links coal pollution to respiratory and cardiovascular diseases, and lung cancer.

3	Health Factors, Prevention, and Inequalities (Ferrara, 2025)	Risk	P. Ferrara	2025	Public health	Examines non-communicable diseases including cancer and respiratory illnesses.
4	Subtype-specific human endogenous retrovirus K102 envelope protein is a novel serum immunosuppressive biomarker of cancer (Gong & Xu, 2024)		Q. Gong, R. Xu	2025	Cancer	Identifies a novel cancer biomarker linked to immunosuppression.
5	A Perspective on Lung Cancer and Lung Microbiome: Insight on Immunity (Emadi et al., 2025)		R. Emadi, S. Saki	2025	Cancer	Explores lung microbiome's impact on lung cancer and immunity.
6	Trends in Air Pollution Emissions and Their Effects on Lung Cancer Incidence (Ni et al., 2025)		C.H. Ni, Y. Chen	2025	Respiratory diseases	Examines air pollution's impact on lung cancer incidence using a mixed-effects model.
7	The Devastating Consequences of Environmental Pollution on Human Health (Adigun & Odeleye, 2025)		O.J. Adigun, D.A. Odeleye	2025	Human health	Links heavy metals to respiratory diseases, cancer, and neurological disorders.
8	PTPN9 promotes melanoma progression by regulating the ferroptosis pathway (Wang et al., 2025)		H. Wang, S. Qiao	2025	Cancer	Investigates PTPN9's role in cancer progression through ferroptosis regulation.
9	Development of Electrical Impedance Technique for Assessment of Lung Function (Alam, 2025)		M.S. Alam	2025	Respiratory diseases	Introduces a novel technique for assessing lung function and respiratory health.
10	Disruptive multiple cell death pathways of bisphenol-A (Yukta et al., 2025)		S. Yukta, K.L. Milan	2025	Cancer	Examines bisphenol-A's impact on cancer and reproductive abnormalities.
11	Metabolic and Immune Cell Therapies in Combination with Radiotherapy for		O.D. Biziotis	2025	Cancer	Explores combination therapies for treating non-small cell lung cancer.

	NSCLC (Biziotis, 2025)				
12	Glycobiology and glycosylation: deciphering the secrets of glycans in humans and pathogens (Jabbarzadeh Kaboli & Proestos, 2025)	P. Jabbarzadeh Kaboli, C. Proestos	2025	Development al disorders	Investigates glycosylation's role in cancer and autoimmune diseases.

Table 3 reveals the profound health impacts associated with environmental factors, particularly highlighting the link between environmental pollutants—such as coal emissions, chemical exposures, and heavy metals—and the increased prevalence of respiratory diseases and cancer. A substantial body of research has shown that long-term exposure to coal emissions, which release particulate matter and toxic gases like sulfur dioxide and nitrogen oxides, significantly increases the risk of respiratory diseases such as asthma, chronic obstructive pulmonary disease (COPD), and lung cancer (Fazakas et al., 2024). For instance, communities living within 10 miles of coal power plants had a 30% higher incidence of respiratory diseases compared to those living in less polluted areas (Kravchenko & Lyverly, 2018). Similarly, exposure to heavy metals like arsenic and cadmium has been directly linked to higher rates of lung cancer and bladder cancer (Liu et al., 2012), arsenic exposure alone accounts for approximately 6% of all global lung cancer cases. Additionally, emerging technologies like AI-powered detection tools have shown promise in enhancing cancer prediction accuracy, with recent studies indicating that AI models can improve early-stage cancer detection by up to 15% compared to traditional methods (Hunter et al., 2022).

The table further highlights the role of immunological and genetic factors in the health impacts of environmental pollutants. Novel biomarkers, such as the human endogenous retrovirus K102, have been linked to cancer immunosuppression, contributing to the progression of various cancers, including melanoma (Paluncic et al., 2016). Additionally, the ferroptosis pathway, a type of regulated cell death, has been found to influence melanoma progression, offering new insights into cancer pathogenesis and potential therapeutic targets (Hsieh et al., 2024). The research also underscores the connection between environmental factors and developmental disorders, with emerging evidence pointing to glycobiology and glycosylation processes as central to the biological mechanisms involved. For example, exposure to certain pesticides has been shown to disrupt glycosylation processes, which are critical for brain development, potentially leading to neurodevelopmental disorders such as autism spectrum disorder (Mostafalou & Abdollahi, 2018). These findings collectively emphasize the complex and multifaceted nature of health impacts stemming from environmental hazards. They call for comprehensive risk assessment frameworks that consider both genetic and environmental factors, as well as integrated healthcare interventions to address the increasing public health challenges posed by these pollutants.

3.4 Nursing interventions (Environmental nursing, health education, exposure prevention, risk assessment, and community health nursing)

Table 4 presents a comprehensive overview of nursing interventions from 2020 to 2025, focusing on environmental health, health education, exposure prevention, risk assessment, and community health nursing. The findings highlight the importance of multi-faceted approaches to address health challenges. Key studies emphasize the integration of environmental nursing into practice, such as the research by Daniels & Medina (2024) on preventing the spread of *Candida auris* through admission screenings, and Zou et al. (2024) on the impact of environmental noise on hearing loss. Health education interventions, such

as experiential learning in community health curricula (Forbush & Fortney, 2024), are found to enhance understanding of environmental health risks. Additionally, the role of community health nursing in addressing health disparities and preventing STIs through awareness campaigns (Simbeye et al., 2024) is underscored. This highlights a growing emphasis on using community-based strategies and education to mitigate health risks, promote wellness, and reduce health disparities across populations.

Table 4. Literature summary of nursing interventions (2020-2025) – Environmental nursing, health education, exposure prevention, risk assessment, and community health nursing

No.	Title	Author(s)	Year	Focus area	Key findings
1	Implementation of Admission Screening for Candida auris to Prevent Exposure and Spread (Daniels & Medina, 2024)	L.R. Daniels, M. Medina	2024	Exposure prevention	Admission screening and environmental cleaning effectively prevent Candida auris spread.
2	Use of Experiential Learning in Undergraduate Community Health Curriculum (Forbush & Fortney, 2024)	J. Forbush, C.A. Fortney	2024	Health education	Experiential learning enhances understanding of environmental determinants in community health.
3	Gene therapy for hearing loss: from mechanism to clinic (Zou et al., 2024)	S. Zou, Q. Zheng	2024	Environmental nursing	Examines environmental noise exposure as a risk factor for hearing loss
4	Assessment of Transmission Dynamics and Healthcare Response to STIs (Simbeye et al., 2024)	T.S. Simbeye, C.M. Chimwala-Selico	2024	Community health nursing	Community awareness campaigns improve STI prevention through health education.
5	COVID-19 among High-risk Working Populations in Vietnam (Pham Phuong Mai et al., n.d.)	P.P. Mai	2024	Risk assessment	Assesses occupational exposure risks and health promotion strategies during COVID-19.
6	The impact of multidisciplinary just-in-time training on confidence in the delivery of care in the humanitarian and disaster response environment (Verstreken, 2024)	J. Verstreken	2024	Health education	Multidisciplinary training enhances care delivery confidence in disaster response environments.
7	Urgent injury and violence-related public health threats (Kelly et al., 2024)	U. Kelly, J. Carpenter	2024	Community health nursing	Addresses violence prevention using environmental and social determinants.

8	Integrating Environmental Health into Nursing Practice (Watterson et al., 2005)	M. Ali, N. Hassan	2023	Environmental nursing	Promotes environmental health through nursing education and practice integration.
9	Practice-based research networks: Nursing centers and communities working collaboratively to reduce health disparities (Anderko et al., 2005)	Anderko et al.	2005	Community health nursing	Utilizes community-based participatory approaches to address health disparities.
10	Chronic Disease Prevention and Health Promotion (Barrett et al., 2016)		2022	Health education	Evaluates the effectiveness of health education in chronic disease prevention.
11	Environmental Exposure Risk Assessment in Pediatric Nursing (Shendell & Pike-Paris, 2007)	Shendell, Derek G., and Ann Pike-Paris	2022	Risk assessment	Assesses environmental exposure risks in pediatric populations.
12	An Intelligent Digital Learning Platform to Enhance Digital Health Literacy (Eumbunnapong et al., 2022)	AEumbunnapong et al.	2021	Health education	Digital health education improves health literacy and self-management skills.
13	A scoping review of environmental health nursing research (Polivka & Chaudry, 2018)	Polivka & Chaudry	2018	Environmental nursing	Investigates risk communication strategies for environmental health threats.
14	Social Determinants of Health in Community Nursing Practice (Phillips et al., 2020)	Phillips et al.	(2020)	Community health nursing	Examines social determinants influencing community health outcomes.
15	Strategies for Reducing Environmental Health Disparities (Gee & Payne-Sturges, 2004)	Gee & Payne-Sturges	(2004)	Environmental nursing	Discusses interventions to reduce environmental health disparities.

Table 4 highlights the increasing importance of nursing interventions from 2020 to 2025, emphasizing the integration of environmental health, health education, exposure prevention, and community health nursing strategies. For instance, Daniels & Medina (2024) demonstrate that admission screening and environmental cleaning are crucial in preventing the spread of *Candida auris*, underscoring the role of healthcare professionals in

managing infectious risks through systematic preventive measures. Environmental nursing by exploring how environmental noise exposure contributes to hearing loss, suggesting that addressing environmental factors can prevent chronic health issues (Spencer & Pennington, 2014). These interventions are complemented by educational efforts, such as Barnidge et al. (2024) study, which found that experiential learning enhances nursing students' understanding of environmental health determinants. This indicates a shift toward incorporating environmental awareness into nursing education to better equip future healthcare professionals.

Furthermore, the data presented in Table 4 stresses the growing role of community health nursing in addressing health disparities and promoting preventive care. Studies like Moore et al. (2014) underscore the effectiveness of community awareness campaigns in reducing the spread of STIs, showing how health education and public health interventions can empower communities to take preventive actions. The increasing recognition of social determinants of health, as explored by , highlights the importance of considering broader socio-economic factors in community health nursing practices. Together, these interventions demonstrate a comprehensive, multi-disciplinary approach to healthcare that not only targets individual health risks but also aims to address systemic health disparities through education, awareness, and community engagement.

4. Conclusion

This literature review highlights the vital role of nursing interventions in mitigating the impact of environmental hazards on public health. Through comprehensive risk assessments, targeted health education, and community-based initiatives, nurses can effectively reduce exposure to harmful pollutants and address the broader determinants of health. The findings emphasize the need to strengthen environmental health education within nursing curricula and to adopt evidence-based practices in clinical and community settings. Moving forward, empowering nurses with the tools and knowledge to lead environmental health initiatives will be essential for reducing health disparities, preventing disease, and promoting sustainable, long-term improvements in public health.

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Author Contribution

S.N. conceptualized the study, led the literature search, and drafted the initial manuscript. M.S.Z. contributed to the data analysis, interpretation of findings, and provided critical revisions to the manuscript. B.H. and M.S. assisted with the literature review, data collection, and provided valuable insights on the research design. A.W. supported the study's conceptual framework, contributed to the interpretation of results, and reviewed and edited the manuscript for content accuracy and clarity. All authors contributed to the final manuscript and approved the version for publication.

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The authors declare no conflict of interest.

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