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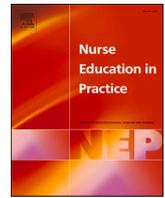
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Environmental sustainability in healthcare: A qualitative study of the perspectives of nursing, medical and public health students in Kazakhstan

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ABSTRACT

The aim was: This study explored the perspectives of nursing, medical and public health students on environmental sustainability in healthcare.

Background: The healthcare sector has increasingly recognized the importance of adopting environmental sustainability over the past few years. This growing awareness emphasizes the need to thoroughly assess the connection between health care and environmental responsibility.

Design: Qualitative descriptive-exploratory design.

Methods: This study explored the views on environmental sustainability in health care of 29 nursing, medical and public health students at three universities in Kazakhstan through focus group discussions. Thematic analysis was used in the data analysis. Data collection was carried out from June to August 2023.

Results: Using semantic thematic analysis, 209 initial codes were extracted, and then similar codes and meanings were grouped, leading to 21 categories until the development of the five significant themes. The five main themes are 'the impact of the environment on health', 'environmental sustainability practices in healthcare care', 'the importance of interdisciplinary collaboration in environmental sustainability in healthcare', 'intrinsic motivation to engage in environmental sustainability practices in healthcare' and 'challenges and barriers to practicing environmental sustainability in healthcare'.

Conclusions: The study findings suggest the critical aspect of addressing environmental sustainability through interprofessional collaboration and working on intrinsic motivation among health professionals. Furthermore, our study contributes in several ways to our understanding of environmental sustainability in healthcare. Provides a basis for clinicians, educators and policy makers to consider adding sustainability to their agenda to prepare future health professionals.

1. Introduction

Climate change is considered the most significant challenge for humanity in the 21st century, posing a considerable threat to people and health, the economy and the environment at the global, national and local levels (U.S. U.S. U.S. Global Change Research Program, 2016;

World Health Organization 2022). The consequences of climate change, including natural disasters, pollution and environmental degradation, negatively affect the health of many people around the world (Rocquet et al., 2021). Climate change endangers basic needs for optimal health, such as clean air, water, food and shelter (World Health Organization 2022). Around 250,000 additional annual mortality between 2030 and

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2050 is expected due to extreme temperatures, natural disasters and evolving infection patterns (World Health Organization 2020a).

The healthcare system can also contribute to environmental problems (Eckelman and Sherman, 2016; Lenzen et al., 2020). A global assessment revealed the harmful environmental effects of healthcare, including "scarce water use, air pollution, reactive nitrogen in the water and other factors, in addition to greenhouse gas (GHG) emissions" (Lenzen et al., 2020, p. e277). The healthcare sector is responsible for approximately 4.4% of global greenhouse gas emissions (Choi, 2022). These negative impacts represent 1–5% of global environmental impacts (Lenzen et al., 2020). Healthcare institutions are one of the most energy-intensive facilities worldwide, using energy in their operations all day and night. In addition, several medical devices and medications are manufactured in facilities that contribute to the emission of GHG (Lenzen et al., 2020). The US healthcare sector is estimated to be responsible for 8% of national GHG emitted from hospitals and direct purchases, while the UK contributes to 3–4% of national GHG levels (Eckelman and Sherman, 2016). These greenhouse gases are associated with increased air pollution-related diseases (World Health Organization 2020a). As the effects of medical treatments on the environment have become increasingly apparent, traditional approaches need to be reevaluated. This increased awareness underscores the need to carefully study the relationship between environmental accountability and healthcare.

The Central Asian region, with its unique geopolitical and socio-economic characteristics, is faced with challenges in resource shortages and climate-related problems (United Nations Development Program United Nations Development Programme (2017). The region's health-related environmental burdens increased the importance of sustainability in healthcare (United Nations Development Programme 2017). Kazakhstan can become a focal point for efforts to incorporate environmental sustainability practices into healthcare in this region (United Nations Development Programme 2019). The country has significant improvements in healthcare outcomes, serving a wide range of demographics, including those of urban, rural and ethnically diverse populations (World Health Organization 2020b). As the government works to ensure fair access to healthcare services, this diversity introduces both opportunities and problems (United Nations Development Programme 2021).

However, the country is experiencing a shortage of qualified healthcare professionals, which hinders the optimal functioning of the healthcare system (Official Information Source of the Prime Minister of the Republic of Kazakhstan, 2021). Recognizing these issues, Kazakhstan invested in innovating and advancing its healthcare, with the aim of enhancing the overall efficiency of services by embracing new technologies, building infrastructures and expanding healthcare workforce education (Official Information Source of the Prime Minister of the Republic of Kazakhstan, 2021). The country had intensified and modernized the training of health science students, as they are the future of the country's health system. These improvements in the education of health science students present critical opportunities for future changes that may occur in healthcare practice (The International Labour Organization 2019). Part of these efforts is to prepare these students to practice sustainability. The identities and values of health professionals are shaped by the training and education they receive and therefore attitudes toward various areas of healthcare care, such as environmental sustainability, can be shaped during this formative time (Forouzadeh et al., 2018).

The critical part of education in the development of sustainable healthcare is recognized worldwide by many health experts, healthcare institutions and universities and health organizations (Álvarez-Nieto et al., 2022; Schwerdtle et al., 2020). In various parts of the world, different fields related to health, such as medicine, public health, nursing and pharmacy, have started to implement educational programs that focus on environmental sustainability, either as a standalone course, integrated into related courses, or separate workshops and

training (Parker et al., 2020). Schwerdtle et al. (2020) emphasized that education should focus on actively implementing educational interventions and not just on recognizing the importance of incorporating "climate change and environmental sustainability" into healthcare-related curricula. Experts, healthcare workers and students have long agreed on the importance of integrating "climate change and environmental sustainability" into healthcare curricula. For example, previous studies among Arab nursing students revealed that student nurses had positive attitudes towards environmental sustainability and felt strongly about adding these topics to their program's curriculum (Cruz et al., 2018a; Cruz et al., 2018b; Felicilda-Reynaldo et al., 2018). Similar findings and recommendations were made by nursing students from the United Kingdom, Germany, Spain and Switzerland (Richardson et al., 2016). In another study conducted among medical students in the UK, most reported that they did not receive formal education on environmental sustainability in their program. Most medical students who reported having a course on environmentally sustainable healthcare were not convinced that their course was helpful (Gupta et al., 2022). Despite this, students demand the incorporation of sustainable healthcare into medical curricula. Nursing students from Spain made similar demands for more training on "low environmental impact healthcare and innovative educational practices" in their nursing education (López-Medina et al., 2022).

In Kazakhstan, a limited number of environmental sustainability studies had been conducted. For example, Oladejo et al. (2023) emphasized the negative effects of climate change on population health and environmental sustainability. Another study reported on challenges and strategies for sustainability education in the different institutions of the country (Yelubayeva et al., 2023). However, none of these studies specifically addressed the perspectives of health sciences students on environmental sustainability in the country's healthcare system and the scarcity of studies that focus on the experiences and perspectives of these students, especially in Kazakhstan, regarding environmental sustainability. Studies such as this are critical given that these students represent the future healthcare workforce of the country and understanding their perceptions is essential to shape effective educational strategies and interventions. An in-depth exploration of potential barriers and facilitators that medical and nursing students face in adopting sustainable practices is necessary to develop targeted educational initiatives. Moreover, the lack of research has left policymakers and educators with an incomplete understanding of this demographic's specific needs and viewpoints.

1.1. Aim

This study explored the perspectives of nursing, medical and public health students on environmental sustainability in healthcare.

2. Method

This exploratory-descriptive qualitative study was conducted in three universities in Kazakhstan. The study participants were recruited via email, which contained an invitation to participate. Study participants received written instructions detailing the investigation objectives and anticipated outcomes. A total of 30 students responded to the participation query; only 29 participated in the focus group discussions (FGD). Participants were six men and 23 women, ages 19–24. There were 12 nursing students, seven medical students and 10 public health students. The characteristics of the participants are summarized in Table 1. This study adhered to the 'Consolidated criteria for reporting qualitative research' (COREQ).

2.1. Instruments

A panel of experts for the validity of face and content evaluates five guide questions. The tool was piloted and no unforeseen complications

Table 1
Characteristics of the participants.

Participants	Age	Gender	Year level	Program
1	22	Female	3	Bachelor of Public Health
2	23	Female	3	Bachelor of Public Health
3	22	Female	2	Bachelor of Public Health
4	24	Female	3	Bachelor of Public Health
5	22	Female	2	Bachelor of Public Health
6	22	Female	2	Bachelor of Public Health
7	23	Female	3	Bachelor of Public Health
8	24	Female	4	Bachelor of Public Health
9	23	Female	4	Bachelor of Public Health
10	24	Female	4	Bachelor of Public Health
11	24	Female	2	Doctor of Medicine
12	21	Female	2	Bachelor of Science in Nursing
13	23	Female	1	Doctor of Medicine
14	22	Female	2	Bachelor of Science in Nursing
15	23	Female	2	Doctor of Medicine
16	20	Female	2	Bachelor of Science in Nursing
17	24	Male	2	Doctor of Medicine
18	24	Male	2	Doctor of Medicine
19	23	Male	1	Doctor of Medicine
20	23	Male	1	Doctor of Medicine
21	19	Female	2	Bachelor of Science in Nursing
22	19	Female	2	Bachelor of Science in Nursing
23	23	Male	2	Bachelor of Science in Nursing
24	20	Female	2	Bachelor of Science in Nursing
25	23	Female	4	Bachelor of Science in Nursing
26	22	Male	4	Bachelor of Science in Nursing
27	23	Female	4	Bachelor of Science in Nursing
28	21	Female	4	Bachelor of Science in Nursing
29	22	Female	4	Bachelor of Science in Nursing

or difficulties were observed throughout the pilot testing phase of data collection. The interpretation of the guide questions remains constant among the participants. The formulated guide question was suitable for participants to explore their perspectives on environmental sustainability in healthcare.

2.2. Data collection and ethics

This study was part of a research protocol approved by the Nazarbayev University Institutional Research Ethics Committee (IREC number: 636/31102022). Data collection was carried out from June to August 2023. After obtaining approval from the ethics committee, we sent a letter to the directors of medical schools. The letter contains the study's aims and intentions, requests for permission to conduct the study and inquiries about the requirement for institutional ethical approval. On receiving the approval of the department heads, researchers from each university emailed the student, requesting his consent to participate in the study. They also requested suggestions from the participant on possible interview dates and times, considering their preferences and availability. Among the cohort of students invited to participate in the study, only 30 actively responded to the invitation. A researcher from each institution organized logistics, including venue preparation and recording equipment, to establish a conducive environment. The participants gathered in a conference room provided by the collaborating institution. The researcher and the participants are the only ones allowed in the conference room. Before the FGDs, written informed consent was collected after a thorough description of the objective and the assurance of confidentiality. During this time, the students were also informed of the use of audio recordings and field notes during the FGDs. The moderators (four researchers with experience conducting FGDs) use a flexible discussion to encourage open communication. During the FGDs, participants expressed their perspectives on environmental sustainability in health. In this study four FGDs were performed. There were 10 students in the first FGD and 10, four and five in the second, third and fourth FGD, respectively. Two FGDs were organized in Astana City, while one FGD was organized in Shymkent and another one in Karaganda. On the fourth FGD, data saturation was reached, since no

further themes and codes were identified. In addition, data saturation within one focus group was obtained when participants had no additional ideas to contribute (Cron, 2020). FGDs lasted 60–90 minutes. After conducting the FGD, the researchers transcribed the data and the primary qualitative researchers manually coded and analyzed the gathered data. The participants validated the codes and themes. Pseudonyms were used to protect the identities of the participants. Some of the FGD was conducted in Russian and Kazakh; before conducting the data analysis, a forward and backward translation was performed.

2.3. Data analysis

Thematic analysis was used in the data analysis to describe recurring patterns of significance that emerge from the data of the participants with respect to their perception of environmental sustainability in healthcare. In this study, the semantic approach developed by Braun and Clarke (2022) was used to classify meanings into themes, but initially the patterns of meaning were crucially identified and examined. Thematic analysis was conducted in six stages. To gauge the participants' thorough understanding of the topic, the researchers initially conducted assessments to familiarize themselves with the transcribed information. The researchers constructed codes representing categories with meanings like those in their second step. The researchers thoroughly analyzed the data and assigned the accurate code to every recognized category. The codes created gave rise to the development of themes. The fourth phase involved a comprehensive examination and thorough analysis of these difficulties. During this stage, additional subthemes also emerged. The themes were assigned specific appellations that accurately conveyed their content and were delineated in a manner that offered concise and unambiguous explanations for their respective topics.

2.4. Rigor and trustworthiness

To establish reliability and credibility, two techniques were used to guarantee the integrity and dependability of the research: (a) the creation of memos (Morse, 2015); and (b) the use of analyst triangulation with coauthors (Flick, 2004). The researchers used memo writing to document the decision-making processes involved in the research project and to track the development of theories related to: (a) the formation of concepts, categories, properties and themes; (b) the reasoning used to define these analytical constructs; and (c) the connections between these analytical constructs (Birks et al., 2008). The study results were made more generalizable to ensure transferability by including comprehensive participant views in the results section. These statements described their experiences and opinions directly. The objective was achieved by including comprehensive explanations in the results section (Morse, 2015). External auditing involved the participation of a secondary researcher who scrutinized the research process and verified if the gathered data and the research technique are coherent (dependability). Six researchers (two women and four men with master's and Ph.D. degrees) conducted external audits during this investigation at different phases of the study process. Throughout the study, two researchers (the first and last author, with experience in conducting and publishing qualitative research) conducted confirmability auditing, which refers to a specific type of auditing that thoroughly examines research findings and evaluates their implications (Lincoln and Guba, 1985).

3. Results

Using semantic thematic analysis, 209 initial codes were extracted and then similar codes and meanings were grouped, leading to 21 categories up to the development of the five significant themes: "impact of the environment on health", "environmental sustainability practices in healthcare", "importance of interdisciplinary collaboration in environmental sustainability in healthcare", "intrinsic motivation to engage in environmental sustainability practices in healthcare" and "challenges

and barriers to practicing environmental sustainability in healthcare” (see Table 2).

3.1. Impact of the environment on health

Participants emphasized the substantial impact of the environment on the development of health conditions. The environment significantly influences health, as it profoundly affects the physical and mental well-being of individuals in residential, occupational and recreational settings. Environmental issues include various elements, including air and water quality, climate conditions, natural ecosystems and human-made infrastructure. These components can exert beneficial or detrimental impacts on human health:

“The relationship between the environment and health is closely related. All the things that happen in the environment and the factors can affect the human immune system and the health conditions of future generations. More broadly, things like natural disasters, such as floods and the decrease of minerals in the water constitution could have negative impacts in the future. Human health will worsen.” S-11.

3.1.1. Cardiovascular and respiratory disorders

Extended exposure to air pollution, a consequence of the environment, affects primarily health by increasing vulnerability to cardiovascular disorders, including heart attacks and strokes. Climate change is increasing the frequency and intensity of weather occurrences, increasing the probability of accidents and illnesses. Air pollution, predominantly from industrial emissions, automobile exhaust and other pollutants, can cause various respiratory disorders, such as asthma, bronchitis and other respiratory disorders:

“The important area of climate change is atmospheric air. It is more about air pollution because we have many different factories. It affects agricultural areas of activity. Atmospheric air is a direct way of transferring diseases because human beings breathe and cannot live without air. I think air is more important than water.” S-3

Table 2
Themes and sub-themes.

Sub-themes	Themes
Cardiovascular and respiratory disorders	Impact of the environment on health
Waterborne illness	
Heat-related diseases	
Cancer	
Adopting sustainable practices in healthcare facilities	Environmental sustainability practices in healthcare
Engagement in local environmental practices	
Holistic problem-solving approach	Importance of interdisciplinary collaboration in environmental sustainability in healthcare
Interdisciplinary teams involvement	
Cooperative research	
Quality improvement	
Cooperation with healthcare practitioners and environmental expert	
Personal values and ethics	Intrinsic motivation to engage in environmental sustainability practices in healthcare
Creativity and invention	
Education and advancement	
Proactive mindset	Challenges and barriers to practicing environmental sustainability in healthcare
Lack of awareness and education	
Lack of standardized data and metrics	
Lack of regulatory and policy frameworks	
Prioritization of immediate patient care	
Lack of textbooks and learning materials	

“There are also seasonal problems with the drainage system. For example, during the summer, there may be bad smells around you. In winter, you can notice black smog in the morning. It means that factories do not comply with regulations on emissions and pollute the air. Such things should be monitored. Also, there are problems with waste management; there should be more waste bins in the city.” S-15

3.1.2. Waterborne Illness

Access to contaminated drinking water is crucial to the development of waterborne diseases. Water contamination is due to inefficient waste management practices and unprotected water sources; It is feasible to cause water pollution and stop the transmission of dangerous diseases:

“For example, environmental problems such as contaminated water due to waste from factories, form pesticides and drainage can cause health problems such as diarrhea.” S-26

3.1.3. Heat-related diseases

Climate change precipitates severe weather phenomena, such as heatwaves, which can result in heat-related ailments, including heat-stroke. Environmental factors, such as rising temperatures and changes in ecosystems, can have an impact on the spread and behavior of disease-carrying vectors, such as mosquitoes and ticks, influencing vector-borne diseases:

“Climate change has a high impact on human health. For example, I live in the western part of the country, which is very hot in this region. However, when I come to the northern part of the country, it is colder. It takes time for me to adapt to climate change, a month or something like that. I have a bit of a high temperature, a sore throat and similar feelings. Therefore, climate change has a great impact on human health. It depends on adaptation.” S-16

3.1.4. Cancer

Contact with environmental toxins, such as pesticides, heavy metals, industrial chemicals and hospital waste, can harm an individual’s well-being, which can lead to cancer. This factor is due to exposure to hazardous chemicals and improper disposal, which increases human exposure:

“Climate change is due to farmers’ use of chemicals. In the hospital, it was also noted that we have a lot of waste, increasing environmental waste. Hospital waste is toxic and improper disposal can harm our health, such as cancer in the blood.” S-21

3.2. Environmental sustainability practices in healthcare

The participants recognized the worldwide scope of environmental sustainability concerns. They acknowledged that climate change, pollution and resource depletion substantially affect public health and healthcare systems. Participants showed a strong sense of responsibility in promoting environmental sustainability in the healthcare sector:

“Climate change has a global effect that we should address. Controlling environmental changes requires limiting waste emissions, recycling and controlling waste and environmental pollution. Measures through which we can help nature: we can start with ourselves and at the state level, maintaining ecosystem processes, balance in the ecosystem, replenishing these resources and collective and individual influence.” S-17

“As students, we should learn about environmental sustainability to influence the younger generation. The next generation should learn environmental sustainability, since their health is at risk if they are sensitive to climate change.” S-29

3.2.1. Adopting sustainable practices in healthcare facilities

Students advocate for the adoption of sustainable practices in healthcare facilities, including hospitals and clinics. They recognized the need to reduce waste, conserve resources and minimize the environmental impact of healthcare operations:

“Also, we have separate trash cans for plastic things and bottles today. Everyone is recycling. In our clinical exposure, we put our waste in a proper bin and do it at home. Recycling is important to prevent air, water and land pollution.” S-2

“When it comes to environmental sustainability, we must consider planting trees around. The atmosphere will be good and healthy when we have many green places.” S-7

3.2.2. Engagement in local environmental practices

Students regularly engage with local communities to promote environmental awareness and encourage the implementation of sustainable healthcare practices. They understand the importance of involving the community in addressing environmental and health problems:

“I participate in tree planting activities. But we are not sure if the plant will be watered. There should be someone in the community who will regularly check those planted trees.” S-12

3.3. Importance of interdisciplinary collaboration in environmental sustainability in healthcare

Interdisciplinary collaboration is critical to address the complexity and interconnection between the environment and healthcare, as it brings experts from different specialties together with the aim of promoting environmental sustainability in healthcare. A collaborative approach could have a greater impact in minimizing the healthcare’s negative environmental effects by fostering diverse innovative ideas on how to promote sustainable practices while achieving optimal health outcomes effectively.

3.3.1. Holistic problem solving approach

This interdisciplinary collaboration can include experts from different fields of healthcare care, environmental sciences, engineering, policy and education, adding field-based knowledge to the conversation. Environmental sustainability in healthcare has complex issues (that is, minimizing pollution, preserving resources and proper disposal of waste) that require a holistic problem-solving approach. The members of the interdisciplinary team contribute to solving complicated problems by focusing on the different areas of the problem that are within the scope of their specialization:

“When we talk about environmental sustainability, it is a joint effort of the government, the hospital staff and administration, the school and the people. Each should do their part to promote an environmentally friendly environment to maintain health and promote a healthy environment.” S-19

3.3.2. Interdisciplinary team participation

Involving interdisciplinary teams can improve educational programs and training designed to equip healthcare personnel with the essential knowledge and skills to adopt sustainable practices with success. Interdisciplinary teams possess the ability to develop groundbreaking, environmentally friendly technology, adopt sustainable healthcare practices and devise policies that efficiently address environmental issues while also improving patient care:

“A hospital team focusing on environmental sustainability is needed to ensure that we have sustainable healthcare practices. They will be responsible for conducting an educational program on environmental sustainability for medical professionals and patients.” S-23

“... in addition, there is a need to purchase eco-friendly equipment. Perhaps there is a need to look at the use of syringes. An innovation on how to reuse syringes should be studied since the one common hospital waste is syringes.” S-22

3.3.3. Cooperative research

Cooperative research efforts can accelerate the transformation of environmental sustainability ideas and findings into concrete healthcare applications, ensuring that research directly influences patient care and the environment:

“We will need to communicate our research on environmental sustainability to the greater community by disseminating it to the public for awareness and actions.” S-5

3.3.4. Quality improvement

Collaboration is essential for driving quality improvement projects, as it helps identify areas where the introduction of sustainable practices can improve patient care, reduce costs and mitigate environmental harm:

“We need to work with hospital administration and staff to discuss environmental sustainability projects to identify the role of each in environmental sustainability.” S-9

3.3.5. Cooperation with healthcare professionals and environmental experts

Collaboration also includes the active participation of neighboring communities. Public health specialists have the ability to cooperate with healthcare professionals and environmental experts to instruct and educate populations in sustainable healthcare projects:

“Environmental sustainability is not the work of an individual group, person, or institution. So, I think working with other cities or institutions is crucial to ensure that everyone does their part.” S-14

3.4. Intrinsic motivation to participate in environmental sustainability practices in healthcare

Intrinsic motivation refers to the inherent drive or personal tendency to engage in a particular activity because of its intrinsic satisfaction and feeling of accomplishment. Students identify intrinsic motivation as crucial in inspiring people, healthcare professionals and organizations to adopt and advocate for sustainable practices.

3.4.1. Personal values and ethics

The student identifies personal values and ethics as intrinsic motivation. Many people, particularly those in the healthcare field, naturally embrace environmental sustainability because it aligns with their values and ethical principles. They may have a strong sense of social responsibility to protect the environment and prioritize the well-being of future generations:

“Environmental sustainability for healthcare students might be related to personal values and training. So, we want to plant trees for future generations, not for us. Also, we must educate young people to be aware and responsible for protecting the environment.” S-8

3.4.2. Creativity and invention

Intrinsic motivation can drive and stimulate creativity and invention. The innate drive of students increases their capacity to think innovatively and generate original solutions to environmental challenges in healthcare settings:

“As students, we know the extent of the effect of environmental issues. We must investigate and develop the best solution to sustain

our environment. Also, we should develop educational campaigns on environmental sustainability for different age groups.” S-1

“For recycling, there should be more waste bins with specific indications of plastics, paper, etc. so that people could adapt to recycling waste.” S-6

3.4.3. Education and advancement

Intrinsic motivation cultivates an unwavering determination to pursue ongoing education and advancement. Students with innate motivations are motivated to actively seek opportunities for professional development and education related to environmental sustainability, leading to more effective and educated approaches:

“As students, we need to learn about environmental sustainability to increase our awareness and intervention to help maintain our environment.” S 15

“Environmental sustainability should be incorporated into the curriculum of medical courses or seminars and training, but this should be done regularly.” S-25

3.4.4. Proactive mindset

The students exhibited a proactive mindset in anticipating future challenges. They recognize the vital importance of environmental sustainability in the treatment of imminent health problems:

“When it comes to environmental sustainability, we must consider planting trees around. The atmosphere will be good and healthy when we have many green places.” S-8

“Every student should participate in environmental sustainability. Medical students should start practicing recycling and planting trees since the atmosphere will be good and healthy when we have many green places and eventually it will prevent health problems.” S-20

3.5. Challenges and barriers to the practice of environmental sustainability in healthcare

The effort to achieve environmental sustainability in healthcare has several challenges and barriers despite its significance in improving public health and reducing the ecological impact of the healthcare sector. The issues can vary according to the geographic location and the setting of healthcare.

3.5.1. Lack of awareness and education

One of the challenges and barriers to practicing sustainability is the need for more awareness and education. Many hospital workers and administrators may need a better understanding of the environmental impact of healthcare activities. Health-related programs require more education and training on sustainability:

“The common problem that we have now is the lack of campaign and awareness of most people, including health practitioners, since we do not have courses in environmental sustainability.” S-28

3.5.2. Lack of standardized data and metrics

A standardized approach to collecting data and metrics to assess the ecological impact of healthcare practices might help efforts to measure progress and identify areas that need improvement:

“Barriers may include the necessary facilities and equipment. If it relates to measurements, then we need measuring equipment.” S-10

“It is about the administrative and legislative parts. If we do not have certain permissions to carry out such measurements, hospitals will not allow us to research on their sites.” S-13

3.5.3. Lack of regulatory and policy frameworks

Current regulatory and policy frameworks may not adequately facilitate or incentivize sustainable healthcare practices in specific locations. At times, limitations can impede sustained initiatives:

“Another barrier might be certain regulations. The regulations and state standards are not updated. Regulation changes should take place annually. It includes normative regulations and state standards.” S-4

“We have textbooks written by authors from Russia, but we do not have textbooks written by Kazakhstani authors. It means that all normative regulations are considered within the textbooks written by authors from Russia. The legislative parts are also Russian.” S-8

3.5.4. Prioritization of immediate patient care

Healthcare facilities may prioritize immediate patient care to the detriment of long-term sustainability. Prioritizing short-term objectives might hinder efforts to reduce waste, save resources and alleviate environmental impacts:

“When I work in the clinical area, my priority is my patient; I do not focus on environmental sustainability.” S-27

3.5.5. Lack of textbooks and learning materials

The accessibility of textbooks and learning materials is culturally inappropriate, lack of resources and topics on ecology are limited in their courses, making it difficult for students to embrace eco-friendly options:

“We have plenty of resources that are described in the syllabuses. The syllabi provide additional readings, which are available on the Internet. We have some barriers in ‘Sanitary Regulations and Standards’ because they are provided in Russian rather than Kazakhstani textbooks.” S-20

“We were provided examples based on the normative regulations and legislation of Russia during the course. Regulation might not be very different, but it is hard to learn from such textbooks. We have some books written by Kazakh authors, but Russian authors write most of them. We have only a few books based on our specialization. This is a barrier.” S-18

4. Discussion

This study explored the perspectives of nursing, medical and public health students on environmental sustainability through qualitative research. Participants acknowledged that the environment, including climate conditions, human-made infrastructure and air and water quality, has a substantial impact on health. They emphasize the connections between environmental variables and health issues, including waterborne illnesses, respiratory diseases caused by air pollution and illnesses related to heat stress caused by climate change. Therefore, students know the profound correlations between health problems and climate change (Felicilda-Reynaldo et al., 2018). According to Watts et al. (2018) and Mousavi et al. (2020), climate change is consistently identified as the greatest global risk to human health. Consequently, new policy measures that consider human health a crucial element in climate change discussions must be implemented.

The researchers show environmental sustainability practices. Participants push for resource conservation, waste reduction and community involvement in environmental issues while advocating for sustainable practices in healthcare facilities. The students mentioned that sustainability is a collective obligation undertaken by multiple organizational stakeholders. Moreover, they asserted that present activities on environmental sustainability will benefit future generations. The rationales provided by the participants are consistent with the

ethical principle of patient care. According to Riedel (2015), when healthcare professionals provide patient care, they should not only focus on their current patients, but also think of their future patients, which means providing care while practicing sustainability. However, healthcare workers often face a dilemma in deciding whether to employ sustainable judgments and the long-term effects of present practices. Therefore, emphasis should be placed on enhancing students' competence in sustainable decision-making. Sustainability should be a central ethical idea and core value in every aspect of the students' practices. It should be deeply incorporated in health sciences curricula (Shaw et al., 2021). By integrating environmental sustainability into undergraduate education, health science students can better address environmental sustainability practices in their clinical practice (Aronsson et al., 2020).

Our findings also highlight the critical role of interdisciplinary collaboration in addressing the complexity and interconnection between environment and health problems. The study participants emphasized the need for the collaboration of experts in different fields to generate diverse innovative ideas, promote sustainable practices and improve health outcomes. Positive perceptions of students about interdisciplinary collaboration is encouraging for the global environmental movement. Since climate change is the main focus of different environmental advocacy groups, healthcare professionals have a moral duty to understand the interdependence of justice, equality and health and the concrete impacts of climate change on health (Nicholas and Breakey, 2017; Riedel, 2015).

Their intrinsic drive greatly aids the efforts of the participants to promote environmental sustainability. Personal ethics and values are strong motivators that foster a sense of obligation to protect the environment for future generations. It is also believed that intrinsic motivation stimulates creativity, innovation and a commitment to lifelong learning about environmental sustainability. Today, health sciences students comprehend environmental sustainability participation due to intrinsic factors, previous academic instruction, or active involvement in climate-focused networks or organizations. Consequently, this student's concept and motivation for environmental sustainability are crucial in helping educators incorporate sustainability concepts into education programs and facilitate progress (Reimers, 2020). They stressed the need for an environmentally friendly curriculum that incorporates frequent and regular lectures on environmental sustainability. Integrating environmental sustainability concepts into nursing education can help improve students' critical thinking and flexible healthcare delivery abilities, especially when resources are scarce (Cruz et al., 2018a, 2018b). Education plays a crucial role in supporting nursing and medical students in their efforts to address environmental sustainability issues by implementing environmental policies and sustainable practices. As Schwerdtle et al. (2019) mentioned, updating the current healthcare curriculum is crucial to meaningfully preserving human health and the environment.

Despite the significance of environmental sustainability, the study notes several challenges and barriers. Nursing, medical and public health students face significant challenges regarding the imperative for enhanced education and knowledge. The participants stated that more courses focused on environmental sustainability are currently needed for healthcare professionals. This result is in line with a study on nursing students, which found that to actively participate in and contribute to reducing the effects of climate change, they must acquire the knowledge required (Iira et al., 2020). However, since incorporating a new subject into a medical curriculum may be difficult, Richardson et al. (2016) and Tun (2019) have noted the need for pedagogical knowledge and approaches. Students recognized that the inherent focus on patient care in hospitals is a challenge in implementing environmentally sustainable practices. Healthcare professionals often prioritize direct patient care over long-term sustainability practices. Therefore, environmental sustainability must be integrated into practice so that healthcare workers consider the need for the future without jeopardizing the quality of their current clients (Atkinson et al., 2010).

Another challenge identified by participants in the implementation of environmental sustainability in healthcare is the lack of culturally sensitive materials. The limited content of ecology-related topics in the classroom has also been recognized by participants as a challenge. The students noted that textbooks from other countries make it difficult for them to form a meaningful connection with the materials being taught and their application to their future work in the country. These findings are also found in a previous study that claimed that students' learning and the amount of information they gain are affected by the lack of resources on the subject matter (Blanco-Portela et al., 2017).

Therefore, an interdisciplinary approach that involves experts and participants in various related fields is necessary to promote and apply environmental sustainability in healthcare. It is critical to develop a pragmatic framework that makes it easier to incorporate ecologically friendly practices into healthcare practices. The system should encompass education, training and routine activities in healthcare establishments. To achieve this, it may be imperative to participate in continuous discourse, champion policy initiatives and continuously pledge to improve healthcare and education methodologies. Prioritizing the connection between sustainability, climate change and the changing responsibilities of nursing and medical students would have a significant impact on the development of new curricula and courses that address significant global issues. The process would see substantial influence. When designing nursing and medical programs, it is crucial to prioritize addressing global concerns by explicitly emphasizing the health consequences of climate change.

Although we were able to explore the perspectives of the participants, our findings were limited in several aspects. First, the study was limited to nursing, medical and public health students only. Second, there might be a power imbalance during FGD, considering the poor status of nurses in Kazakhstan. Third, there might be a loss of meaning during the translation of the transcript. Despite these limitations, the study highlights that participants perceived the impact of the environment on health, environmental sustainability practices in healthcare, the importance of interdisciplinary collaboration in healthcare and the intrinsic motivation to engage in environmental sustainability practices in healthcare. However, it was also noted that there are challenges and barriers to practicing environmental sustainability in healthcare.

5. Conclusions

Through FGDs and semantic thematic analysis, our study revealed five major themes describing nursing, medical and public health students' perceptions on environmental sustainability in healthcare. Furthermore, the study findings suggest the critical aspect of addressing environmental sustainability through interprofessional collaboration and working on intrinsic motivation among health professionals. Furthermore, our study contributes in several ways to our understanding of environmental sustainability in healthcare. The findings provide basis for clinicians, educators and policy makers to consider adding environmental sustainability practices and policies to their agenda to prepare future health professionals. Together, addressing environmental sustainability in healthcare provides a positive impact not only on the healthcare institution but also on patients and the global community.

Ethical approval

This study was part of a research protocol approved by the Nazarbayev University Institutional Research Ethics Committee (IREC number: 636/31102022).

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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.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.nepr.2024.103917](https://doi.org/10.1016/j.nepr.2024.103917).

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