Maximizing Student's Awareness Regarding Sustainability and Effects of Climate Change on Child Health

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Abstract

Background: Due to the substantial changes in temperature, precipitation patterns, and ecosystems brought about by climate change, children's health and general well-being are at considerable risk. **Aim:** This research aimed to assess maximizing students' awareness regarding sustainability and the effects of climate change on child health. **Design:** An awareness format program with pre- and post-tests was used in a quasi-experimental design. **Setting:** Ain Shams University's Faculty of Nursing's Department of Pediatric Nursing served as the study's location. The study's sample consisted of all 255 students enrolled in pediatric nursing programs at the designated site. **Data Collection Tools:** Data were gathered using (1) a structured interview questionnaire, (2) the Sustainability Consciousness Questionnaire (SCQ-S), and (3) student outcome evaluations. **Results:** Students' understanding of sustainability and the effects of climate change on children's health was lacking prior to the intervention. But after the awareness, there was a statistically significant improvement. Prior to and following the awareness campaign, students' knowledge and practice showed a good association. **Conclusion:** The awareness training greatly improved the pediatric nursing students' comprehension of sustainability and how climate change affects children's health. Additionally, students offered creative suggestions for implementing sustainable practices in pediatric healthcare settings. **Recommendation:** It is essential to further promote pediatric nursing students' awareness of sustainability and its role in mitigating climate change impacts.

Keywords: Sustainability, Climate change, Pediatric nursing student

Introduction:

Climate change is an urgent global issue with profound implications for human health, especially for vulnerable populations like children (WHO, 2021). Education plays a vital role in shaping young people's awareness and actions toward sustainability.

Climate change refers to shifts in the climate system caused directly or indirectly by human actions. These environmental changes threaten children's basic rights to life, growth, and reaching their full potential. Exposure to climate problems early in life can leave lasting effects that carry into adulthood. The healthcare industry is a major source of carbon emissions,

significantly impacting the environment. Healthcare facilities produce 9% of key air pollutants like carbon monoxide, ozone layer, lead, nitrogen dioxide, and sulfur dioxide. They are responsible for 12% of acid rain and contribute over 10% of yearly greenhouse gases. They also emit 1% to 2% of airborne chemicals linked to cancer and other health problems. (Sharpe I, and Davison CM.A, 2022).

Rising temperatures directly threaten children's health, future, and overall well-being. Modern pediatrics began in the 1800s, and climate patterns were stable back then. Now, they are changing rapidly. These shifts disrupt rainfall, temperature, and ecosystems. They worsen allergy seasons, spread infectious diseases, cause food shortages, and lower water and air quality. Natural disasters like heatwaves, storms, and wildfires are becoming more intense and frequent(**Trasande, L.**, 2019).

According to the American Academy of Pediatrics (AAP, 2023), the intricate aspects of climate change present new and occasionally unanticipated health hazards for kids. Pediatricians are now able to play a significant role in addressing the health-related effects of climate change because of their recognition of children's unique vulnerability

Sustainable development aims to build systems that meet current human needs while protecting future resources. Nurses are vital in helping with efforts to lessen the health problems caused by global warming. They are responsible for spotting and lowering risks from climate change and educating the public about its harmful health effects (United Nations International Children's Emergency Fund, 2021).

Practices that reduce eco-anxiety are becoming more common in healthcare today. These efforts seek to inform medical workers who care for children affected by climate change, such as nursing students specializing in pediatrics (Martin G, et al., 2023).

Significance of the study:

In 2022, the highest number of internally displaced people was recorded, mostly due to climate disasters. Over a third of these people, about 25.2 million, were children under 18. Children and teenagers are especially at risk from climate change. Their bodies and brains are still growing, so they are more likely to get sick, need ongoing care, and have trouble recognizing or handling environmental dangers. This age group also feels more fear and anxiety about climate issues compared to adults. Extreme heat can cause serious health problems, especially for babies, young kids, and pregnant women. To help, UNICEF released a technical guide to assist with planning and preparedness. The goal is to protect communities from the health risks caused by very hot weather.

Aim of the study:

The study's objective was to evaluate the impact of awareness programs on maximizing students' knowledge and attitude concerning sustainability and the effects of climate change on child health

esearch hypothesis:

H1. Nursing students who attended pediatric courses will have higher scores of knowledge regarding sustainability and the effects of climate change on child health after the awareness program

H2. Nursing students who attended pediatric courses may have regarded the benefit of sustainability on child health.

Operational definition of Sustainability is the capacity to continue a process over an extended period.

Subjects and Methods:

Research Design:

A quasi-experimental design (pre-post-test) was used to conduct this study.

Research Setting:

The study took place in the Department of Pediatric Nursing, Faculty of Nursing, Ain Shams University. It was conducted specifically with third-year students in a classroom located on the ground floor of the faculty building.

Research Subjects:

The study subjects were all third-year undergraduate nursing students, totaling 255 students who attended pediatric nursing courses in the Department of Pediatric Nursing/Faculty of Nursing/ Ain Shams University.

Tools of data collection:

Tool I: structured interview questionnaire:

It was written in plain Arabic and created (formulated) by the researcher following a survey of pertinent literature. It evaluates the following data in three sections:

Part I: students' characteristics: such as age, gender, historical achievement, part part-time work.

Part II: Knowledge about sustainability and climate changes: 28 multiple-choice questions to assess the meaning of sustainability and its application (8 questions) and climate changes as well as its consequences on child health (20 questions).

Scoring system: Answers will be graded with 1 point awarded for accurate

responses and 0 points for unknown or incorrect ones. A score of more than or equal to 75% (≤ 21) indicates knowledge satisfaction, and a score of less than 75% (> 21) indicates unsatisfactory knowledge (Akl et al., 2020). The students' knowledge was compared to pre- and post-awareness programs.

Tool II – Sustainability Consciousness Questionnaire (SCQ-S), 2020:

Originally developed by Al-Sahrawi and Al-Kasher (1998) and later adapted into Arabic by Sabah et al. (2020), this tool consists of 35 items designed to measure students' attitudes toward sustainability before and after participating in an awareness program. The questionnaire is divided into seven subscales: general impression (items 1, 8, 15, 22, 29), psychological responses (items 3, 9, 16, 23, 30), financial considerations (items 2, 14, 20, 27, 35), dependence-related concerns (items 7, 13, 21, 28, 34), health-related issues (items 4, 10, 17, 24, 31), social aspects (items 5, 11, 18, 26, 32), and anxiety about future problems (items 6, 12, 19, 25, 33).

Responses are recorded using a 3-point Likert scale, where 1 = **Agree,** 2 = **Neutral**, and 3 = **Disagree.** The total score can range from 35 to 105. Students scoring 85% or higher were categorized as agreeing, those below 65% as disagreeing, and scores between 65% and 95% were considered neutral.

III- Student outcomes: Folkman et al. (1986) developed this tool in Arabic, and Sabah et al. (2012) later modified it to evaluate students' views on sustainability, especially in creative ways. It is designed to focus on the pediatric nursing field, suggesting innovative methods to help nurses keep children healthy. The questionnaire contains 12 questions. Respondents answer with agree (scored as 1) or disagree (scored as 0). Students are considered successful if they score at least 60%, which means earning a total score of 7 or less.

Validity and reliability:

To ensure the Arabic translation was accurate, three pediatric nursing experts from Ain Shams University reviewed the face validity of the tools. The scale achieved a validity score of 94.94%. Reliability was measured with Cronbach's alpha, which was 0.78. This suggests the items in each scale are consistent and reliable.

Pilot Study

Ten percent of all pediatric nursing students in the sample were subjected to it. To evaluate and ensure the instruments' application and clarity. Although the tools were not altered, the final sample did not contain them.

Fieldwork

It took four months to finish the real fieldwork, which took place between June and September of 2024. In the following section, the steps are explained in detail. Planning, execution, assessment, and pre-planning were the four phases that made up the awareness program.

Pre-Planning Phase:

Before the study sheets were used with pediatric nursing students, they were created, tested, and adjusted. The collected data was also reviewed before the program's design and planning started.

Planning Phase:

The awareness program was developed based on preliminary data collected during the pre-planning stage. It was created in Arabic, incorporating insights from both recent and past literature in Arabic and English that addressed different dimensions of the issue. The researchers tailored the program content to align with the student's existing knowledge and practical needs regarding sustainability and climate change. The material also included suggested innovative and creative sustainability applications, designed to match the students' educational level.

Implementation Phase:

Following the creation of the program's content, the relevant instructional techniques and materials for teaching were chosen. Small groupings of subjects were formed. For each group, the curriculum was implemented in five sessions. Each session lasted one hour, including discussion time. The program and its purpose were explained to the

pediatric nursing students at the beginning of the first session, and they were also informed about the times of the next meetings. Every

session started with a summary of the topics discussed in previous sessions and the purpose of the following one.

Awareness Program Evaluation Phase:

Following implementation, a post-test was carried out to evaluate the awareness program's efficacy using the same research tools. Post-testing was done after three months of education.

Ethical Considerations

Official approval to conduct the study was obtained from the director of the designated setting following a detailed description of the goals and parameters of the study. Pediatric nursing students were also given a clear overview of the study's objectives and provided their informal consent to participate. Confidentiality was ensured for all student participants, and they were assured that any collected data would be used strictly for research purposes and to support their educational development. To protect participants' identities, code numbers were assigned to all data entered the system. Access to the database and the code key linking to personal information was restricted to the primary researcher only.

Data Analysis

- Statistical Package for Social Science (SPSS software version 20.0 was used to cod computerize, and analyze the data. The data wa described using percentage, mean, and standar deviation.

The qualitative data is described and summarized using counts and percentages.

The most popular and suitable tests for analyzing SPSS data were the Chi-Squire for comparing categorical data and the t-test for comparing continuous data between two groups. The significance of the findings was evaluated using the 0.05 level as the cut-off value for statistical significance. The reliability coefficient of the test was 0.87.

Results: The demographic characteristics of the third-year students revealed an average age of 19.64 ± 2.37 years. Over half of the students (59.6%) were female. Furthermore, over three-quarters (75.7%) of the students were urban dwellers. In terms of employment in healthcare settings, one-third (33.7%) of the students were employed at hospitals or healthcare organizations. Among these employed students, half (50%) had one year of work experience, with an average experience of 2.22 ± 1.57 years. Nearly half (48.8%) of the employees worked in other healthcare settings, such as pharmacies and clinics (Table 1).

- Regarding students' knowledge of the effects of climate change on child health, Table (2) shows that the knowledge levels of third-year students significantly improved after the intervention. Before the intervention, only one-fifth (20.4%) of the students demonstrated satisfactory knowledge, while nearly all of them (83.5%) had unsatisfactory knowledge after the intervention. The chi-square test result (X^2 = 203.615) indicates a highly significant improvement in knowledge (P < 0.001**), confirming the effectiveness of the intervention.
- Table (3): illustrates that fewer than one-fifth (13.3%) of third-year students had satisfactory knowledge about sustainability and its applications before the intervention. However, a significant majority (87.8%) demonstrated satisfactory knowledge after the intervention. The chi-square test result (X^2 = 283.176) shows a highly significant improvement in knowledge levels (P < 0.001**), emphasizing the effectiveness of the awareness program.

- Table (4): indicates that only 10.6% of students had positive attitudes towards sustainability before the intervention, whereas over three-quarters (76.5%) held positive attitudes after the intervention. The chi-square test result ($X^2 = 330.561$) shows a highly significant shift in attitudes ($P < 0.001$), emphasizing the intervention's success in positively changing students' attitudes towards sustainability.

Table (5) outlined that only one-fifth (23.9%) of the 3rd year students accepted creative and innovative applications in sustainability pre-intervention while following the intervention, acceptance significantly increased to 85.5% of the students. The chi-square test result ($X^2 = 195.053$) indicates a highly significant change in acceptance levels ($P < 0.001$), demonstrating the intervention's effectiveness in fostering a positive reception towards creative and innovative applications among the 3rd year students.

Table (6): demonstrates a significant positive correlation between total knowledge and total attitude ($r = 0.284$, $P < 0.001$), between total knowledge and the acceptance of creative and innovative applications ($r = 0.230$, $P = 0.004$), and between total attitude and acceptance of creative and innovative applications ($r = 0.234$, $P = 0.003$). These findings indicate that the intervention not only improved students' knowledge and attitudes but also increased their acceptance of creative and innovative applications. Stronger correlations suggest a more integrated understanding and a more favorable attitude toward **sustainability and innovation.**

Part I: Demographic characteristics of the 3rd year students

Table (1): Number and percentage distribution of demographic characteristics of the 3rd year students (n= 255).

Demographic characteristics of the 3rd year students		n= 255	%
Students' age (in years)	19- < 20	196	76.9
	20- < 21	52	20.4
	21- < 22	7	2.7
	Mean ±SD	19.64±2.37	
Gender	Male	103	40.4
	Female	152	59.6
Residence	Rural	62	24.3
	Urban	193	75.7
Work at a hospital or healthcare organization	Yes	86	33.7
	No	169	66.3
In case of yes, Years of experience	1 year	43	50
	2 years	24	27.9
	More than 2 years	19	22.1
	Mean ±SD	2.22±1.57	
In what department work in health care organization	Medical Surgical	22	25.6
	Neonatal Intensive Care Unit	14	16.3
	Emergency	8	9.3
	Other	42	48.8

Part II: Knowledge of the 3rd year students about the effects of climate change on child health

Table (2): distribution of the 3rd year students according to their knowledge about the effects of climate change on child h

Total Knowledge	Pre awareness program		Post awareness program		Chi-square	
Satisfactory	N	%	N	%	X2	P-value
	52	20.4	213	83.5	203.615	<0.001**

Part III: Knowledge of the students about sustai

Table (3): distribution of third-year students base 255).

Total Knowledge	Pre awareness program		Post awareness program		Chi-square	
	N	%	N	%	X^2	P-value
Satisfactory	34	13.3	224	87.8	283.176	**<0.001****
Unsatisfactory	221	86.7	31	12.2		
Total	**255**	**100**	**255**	**100**		

Table (4): Table (4): Distribution of student implementation of the awareness program (n =

Total attitude of the students toward sustainability	Pre awareness program		Post awareness program		Chi-square	
	N	%	N	%	X^2	P-value
Agree	27	10.6	195	76.5	**330.561**	**<0.001****
Neutral	46	18.0	38	14.9		
Disagree	182	71.4	22	8.6		
Total	**255**	**100**	**255**	**100**		

C- Students' outcomes: include creative and inno

Table (5): Number and percentage distribution of thi innovative applications in sustainability before and after

Total creative and innovative apps	Pre-awareness program		Post-awareness program		Chi-square	
	N	%	N	%	X^2	P-value
Accepted	**61**	**23.9**	**218**	**85.5**	**195.053**	**<0.001***
Not accepted	**194**	**76.1**	**37**	**14.5**		
Total	**255**	**100**	**255**	**100**		

D- Relation between the studied variables.

Table (6): Table (6): Correlation between knowled intervention of the awareness program.

Knowledge, Attitude, and Acceptance of Creative and Innovative Applications	Total Knowledge		Total attitude	
	R	P-value	R	P-value
Total attitude	0.284	<0.001*	0.395	<0.001*
Total creative and innovative apps	0.230	0.004*	0.234	0.003*

Discussion:

Climate change is expected to bring about significant transformations to the Earth, with profound consequences for both human and environmental health (Collins et al., 2013). In particular, the health of children born today will be directly impacted by climate change throughout their lives (Watts et al., 2019). This research aims to address and bridge the knowledge gaps among future pediatric nursing students, who will be on the front lines of addressing how climate change affects child health and sustainability.

The present study showed that the average age of third-year students was 19.64 ± 2.37 years, and one-third of the students were employed in healthcare organizations. This highlights the necessity of enhancing awareness about sustainability and the effects of climate change on child health. These findings are consistent with the work of Anåker et al. (2021), who investigated nursing students' understanding of climate change and sustainability, emphasizing the importance of recognizing these issues and the role future nurses will play in promoting sustainable healthcare.

In terms of the third-year students' knowledge about the impacts of climate change on the health of children, the current study found that

students initially had limited knowledge, which significantly improved after the intervention. This finding aligns with the research of Yang et al. (2018), who reported that nursing students generally have less knowledge about the health impacts of climate change compared to their counterparts in public health fields. However, it contrasts with the study by Tuna et al. (2022), where most nursing students reported being aware of climate change and its causes. This discrepancy in findings may be attributed to variations in the awareness programs implemented or differences in professional roles

and cultural contexts.

The current study found that students support sustainability, recognizing it as a crucial factor in maintaining child health. The significant improvement in their knowledge highlights the effectiveness of the awareness program. These findings are consistent with Anåker et al. (2021), who noted that nursing students viewed the development of sustainable strategies as essential for protecting the environment for future generations.

The study showed that students' attitudes shifted positively after the intervention. Nursing students began to see sustainability as an essential part of healthcare. This change matches the findings of Elshall et al. (2022), who found that students scored higher in knowledge, attitudes, and behavior related to sustainable development after a similar program. These results stress how important sustainability is becoming for future healthcare workers. They will face challenges where they must include sustainability in their everyday work.

The study showed that the awareness program successfully encouraged third-year students to support creative ideas for a sustainable environment. Students suggested forming a

cross-disciplinary "green" team in pediatrics to lower the clinic's carbon emissions. They also shared tips on reducing paper use by combining vaccine information into one document with QR codes for quick access. These results align with research by Anåker and Elf (2014), which found that sustainability in nursing helps protect the environment. Their work highlights that caring for the planet supports the health of both current and future generations.

Furthermore, the findings of the current study promote sustainability in pediatric healthcare settings, like the study by Yuna et al. (2023), which shared the experience of developing an interdisciplinary "green" team within their outpatient general pediatrics practice. This team worked to implement small changes aimed at reducing the carbon footprint of the workplace.

The current study revealed that the awareness program intervention not only improved students' knowledge and attitudes but also increased their acceptance of creative and innovative applications. The strengthened correlations indicate a more comprehensive understanding and a more positive attitude toward sustainability and innovation. This aligns with Agulnik et al. (2022), who emphasize the urgent need for evidence-based, theoretically driven strategies to support the sustainable implementation of interventions across various resource-level settings, particularly in healthcare environments.

Conclusion:

It can be concluded from the study's findings that there is an improvement in the knowledge of pediatric nursing students regarding sustainability and effects of climate change on child health and, there are creative ideas regarding application of sustainability in healthcare settings for children.

Recommendation:

The research suggested the following:

- Enhancing pediatric nursing students' understanding of the value of sustainability and its effect on climate change.
- Students should have monthly sessions for counseling, health education, and problem-solving.
- Family orientation awareness programs help children and their families with sustainability and its effect on climate change.
- Further research is required to confirm the long-term effects of group students on climate change and its effects on children. Additionally, to assess potential influences on children and the numerous challenges faced by family caregivers in educating kids.

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