

Knowledge and Reported Practices of Nursing Students Regarding Health Effects of Climate Change in Sohag City

Asmaa Zaker Ali¹, Asmaa Kamal Hassan² & Omaira Mostafa Abd Elzaher³

¹ Demonstrator of Family and Community Health Nursing, Faculty of Nursing, Sohag University, Sohag, Egypt

² Professor of Family and Community Health Nursing, Faculty of Nursing, Assiut University, Assiut, Egypt

³ Assistant Professor of Family and Community Health Nursing, Faculty of Nursing, Sohag University, Sohag, Egypt

Abstract

Background: Climate change is considered one of the biggest global health threats in the 21st century. Nurses can affect change through health education. They should educate the public about this phenomenon, and guide the people to adopt healthy, environmentally friendly practices to reduce its impact. **Aim:** To assess knowledge and reported practices of nursing students regarding health effects of climate change in Sohag City. **Study design:** A descriptive cross-sectional research design was used. **Setting:** The study was conducted at the faculty of nursing, technical health & technical nursing institutes in Sohag City. **Sampling:** A systematic random sample consists of 286 nursing students. **Tools:** **Tool (I):** included two parts; **part one** included demographic characteristics and **part two** included a questionnaire to assess the nursing students' knowledge regarding the health effects of climate change. **Tool (II):** assesses the nursing students' reported practices regarding climate change. **Results:** 82.5% of nursing students had poor knowledge, and 67.1% of them had unsatisfactory practices regarding climate change. **Conclusion:** Nursing students had poor knowledge and unsatisfactory practices regarding climate change. **Recommendations:** An in-service training (change to health education) program is needed to raise nursing students' awareness about climate change.

Keywords: Climate change, Health, Knowledge, Reported Practices & Nursing students

Introduction

Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun's activity or large volcanic eruptions. But since the 1800s, human activities have been the main contributor to it (**United Nations., 2023**).

The primary causes of climate change are greenhouse gases (GHGs) which lead to global warming. The most contributed gas among them is carbon dioxide (CO₂), then nitrous oxide, methane, and chlorofluorocarbons (CFCs). The Earth's temperature has increased by about 0.5 °C this century, and by 2030, it is expected to have increased to 3 °C (**Elsharkawy et al., 2023**).

Climate change has an impact on both humans and the environment. It can directly affect people's health such as heat waves, higher exposure to pollen, and extreme weather events like storms, wildfires, floods, or droughts. It also has indirect consequences on human health such as air pollution, food insecurity, population displacement, conflicts, water pollution (gastroenteritis), respiratory and cardiovascular illness. It not only affects both physical and mental wellness directly and indirectly, but it also causes biodiversity to disappear (**Mohammed et al., 2024**).

The likelihood of being at risk from climate change increases for some groups such as pregnant women, children, people with disabilities, the elderly, poor people, and outdoor workers (**Ngcamu, 2023**).

WHO reported two directions for the management of climate change & its impact on humans and the environment: mitigation, which aims to gradually decrease the release of climate-changing gases, and Adaptation, which is the process of responding to conditions that are already changed and aims to lower sensitivity to the effects of it by modifying social, economic, and ecological systems (**Ofori et al., 2023**).

Community health nurses play a crucial role in addressing the most urgent climate change issues to guide practice and policy and enhance health equity. Nurses are in a unique position to be healthful environment managers, support people, and consider the urgency of addressing its impact (**Winqvist et al., 2023**).

Nursing students could significantly reduce the effects of climate change and help individuals and communities adapt to it. They must be aware of its consequences and advocate for eco-friendly practices that will mitigate its harmful effects on health (**Ghazy, & Fathy 2023**).

Significance of the study

Globally between 2030 and 2050, climate change is expected to cause approximately 250,000 additional deaths per year, from malnutrition, respiratory diseases, malaria, diarrhea, and heat stress (WHO, 2021).

Egypt applied to host the 27th session of the Conference of States Parties to the United Nations Convention on Climate Change (COP 27) in 2022 as a representative of the challenges, efforts, and priorities of the African continent in the face of the climate change crisis (Enterprise Ventures, 2022). By the 2050s, the proportion of deaths attributable to climate change in Egypt could rise to approximately 15.2%. Egypt's increasing temperatures and severe heatwaves are expected to significantly impact heat-related deaths, particularly in vulnerable populations (World Bank., 2021).

Aim of the Study

This study aimed to assess knowledge and reported practices of nursing students regarding health effects of climate change in Sohag City.

Research questions:

1. Are the nursing students have a knowledge regarding climate change and its associated health effects?
2. What are reported practices of nursing students regarding climate change and its health effects of climate change?

Subjects and Methods

Research design:

A descriptive cross-sectional research design was utilized in the present study.

Setting of the study:

This study was conducted at faculty of nursing, technical health & technical nursing institutes in Sohag City.

Sample:

Sample technique:

Systematic random sample technique was used for selecting the students with probability proportionate to their size.

Sample size:

The total number of students during the academic year 2022-2023 in selected settings was 4056 students, by using the EPI info 2000 statistical package with a 95% confidence interval, and 80% power of the study, the final estimated sample size was 286 participants. A proportional sample was taken according to student numbers in each grade or setting. Calculated by number of students in each grade divided by the total number of students in 3 selected settings (4056), then multiplied by the estimated sample size (286).

The sample will be distributed as following:

Academic year (2022-2023)	Number of students	Sample size	Percent (%)
Faculty of nursing			
First	664	47	16.4%
Second	692	49	17.1%
Third	637	45	15.7%
Fourth	375	26	9.2%
Total	2368	167	58.4%
Technical nursing institute			
First	550	39	13.6%
Second	552	39	13.6%
Total	1102	78	27.2%
Technical Health institute			
First	336	23	8.2%
Second	250	18	6.2%
Total	586	41	14.4%
Total	4056	286	100%

Exclusion criteria: Students who refused to participate.

Tools of study: It includes two tools:

Tool (I): Included two parts:

Part (1): Included questions about the demographic characteristics. It included (5) items such as age, gender, residence, educational category, and academic years.

Part 2: Include a knowledge of the studied sample regarding the health effects of climate change, modified from (Abdallah., & Farag, 2022), & (Abdullah et al., 2022). It included (11) closed-ended questions such as the definition of climate change, its causes, most affected populations by it, its effect on body systems, etc.

The scoring system of knowledge:

Grade one was given for each correct answer and zero was given for an incorrect answer and I don't know. There was more than one answer to most of the questions. The grades for each item were summed and then converted into a percent score as poor knowledge <50% -fair knowledge 50-70% -Good knowledge >70%.

Tool (II): Assess the nursing students' reported practices that can reduce the impact of climate change, it was developed by the investigator depending on the related review of the literature. It consisted of (16) statements. Indoor practices such as switching off devices and lights when not in use, limiting use of air conditioning in summer, and using energy-saving appliances. etc. Outdoor practices such as using bikes instead of vehicles, using stairs instead of elevators, participating in tree plantation drives....etc.

Scoring system of reported practices:

Responses to each statement were "do," or "undo". A total score was calculated by the sum of done practices and then converted into a percent resulting in satisfactory practice: $\geq 60\%$ - unsatisfactory practice: < 60%.

Validity of the study tools:

The face validity of the tool was reviewed by five (5) experts in community health nursing, Assiut University. All comments and suggestions were considered, reworded and a sequence of some statements was carried out accordingly.

Reliability:

The reliability analysis was carried out to examine the internal consistency of its questions by using the alpha Cronbach test. The value was 0,825 for knowledge and 0,921 for reported practice.

Methodology:**Administrative design:**

Before starting the study, an official letter approval was obtained from the dean of the faculty of nursing, Sohag University, to vice for student affairs at the faculty of nursing, director of technical health & technical nursing institutes; this letter included permission to carry out the study and explained the purpose and nature of the study.

Pilot study:

It aimed to test the clarity of tools and estimated the time needed to fill the sheet. It was carried out before data collection on 10% (29) who were excluded from the sample for the presence of some modifications in the clarity of statements. The necessary modification in the sheet was done.

Data collection phase:**Ethical consideration:**

Ethical approval was obtained from the scientific research ethics committees of the faculty of nursing, Assiut Universities. Oral consent was obtained from students who were willing to participate in the study, after explaining the nature and purpose of the study. Confidentiality and anonymity were assured. Study subjects had the right to refuse to participate and withdraw from the study without any rationale at any time.

Fieldwork:

The researcher began collecting data from the first of April to the middle of June 2023 (10 weeks), for two days per week in the morning time from 9-10 A.M. The average number of students met per day was 13-15. The length of each class took from 15-20 minutes for filling out the questionnaire to assess students' knowledge and reported practices.

Statistical design:

The data obtained were reviewed, prepared for computer entry, coded, analyzed, and tabulated. Descriptive statistics (i.e., frequencies, percentages, mean, and standard deviation) were done by using SPSS version 20 (Statistical Package for Social Science). Chi-square and Pearson's correlation tests were used. It is considered significant when ($P < 0.05$).

Results**Table (1): Distribution of nursing students by their demographic characteristics (N=286).**

Demographic characteristics	No. (286)	%
Age		
<20 year	100	35.0
≥20 year	186	65.0
Mean ± SD (Range)	20.08±1.2 (18 – 24)	
Gender		
Male	151	52.8
Female	135	47.2
Residence		
Rural	193	67.5
Urban	93	32.5
Educational category		
Technical nursing institute	78	27.2
Technical Health institute	41	14.4
Faculty of Nursing	167	58.4
Academic year		
First	109	38.1
Second	106	37.1
Third	45	15.7
Fourth	26	9.1

Table (2): Distribution of nursing students knowledge regarding climate change, Sohag City 2022-2023 (n=286).

Items	No. (286)	%
Vulnerable populations affected by climate change #		
Children	183	64
The elderly	183	64
Pregnant women	160	55.8
Adults	45	15.7
Patients with chronic diseases	109	38.1
People with disabilities	103	36
Don't know	39	13.6

(#) More than one answer was allowed

Table (3): Distribution of nursing students knowledge regarding the effect of climate change on body systems, Sohag City 2022-2023 (n=286).

Items	No. (286)	%
Nervous system#		
Headache	196	68.5
Nervousness and violence	110	38.5
Anxiety and depression	137	47.9
Exertion and insomnia	122	42.7
Cerebrovascular stroke	77	26.9
Don't know	9	3.1
Cardiovascular system#		
High blood pressure	181	63.3
Low blood pressure	120	42.0
Increase in cholesterol	60	21.0
Irregular heartbeat	86	30.1
Weakness of the heart muscle	67	23.4
Poor peripheral blood circulation	84	29.4
Don't know	38	13.3
Respiratory system#		
Cold and flu	146	51
Sinusitis	123	43
Seasonal allergies	118	41.3
Pneumonia	129	45.1
Narrowing of the airways	108	37.8
Asthma	167	58.3
Don't know	23	8.0
Digestive system#		
Malnutrition or anemia	167	58.4
Loss of appetite	84	29.4
Indigestion	71	24.8
Weight loss	66	23.1
Diarrhea	213	74.5
Constipation	65	22.7
Nausea or vomiting	91	31.8
Abdominal pain	93	32.5
Dehydration	133	46.5
Dizziness	129	45.1
Heartburn	66	23.1
Don't know	78	27.3

(#) More than one answer

Table (4): Distribution of nursing students' knowledge about solutions to the climate change problem, Sohag City 2022-2023 (n=286).

Items	No. (286)	%
Rationalization electricity consumption	166	58.0
Use of renewable energy sources such as solar and wind energy	195	68.1
Increase the planting of trees	146	51.0
Improving agriculture and encouraging vegetarian diets	77	26.9
Buy local and seasonal foods	51	17.8
Dispose of waste in proper ways	64	22.4
Increase environmental awareness	116	40.6
Don't know	36	12.6

More than one answer

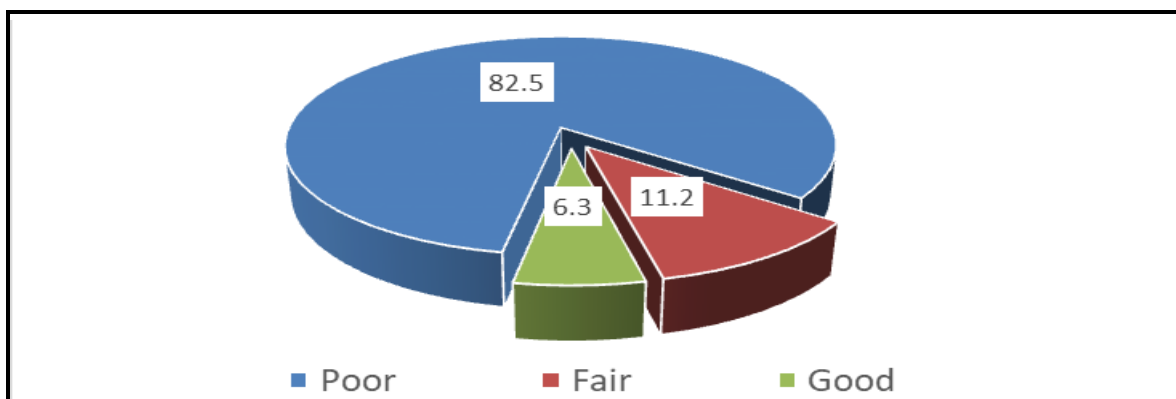


Figure (1): Total scores of nursing students' knowledge regarding health effects of climate change.

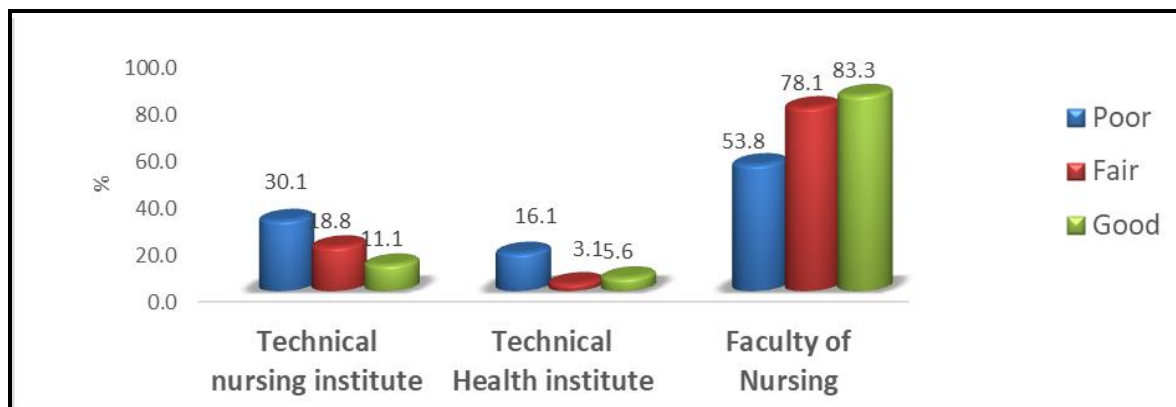


Figure (2): Relation between nursing student's total score of knowledge about climate change and their educational category

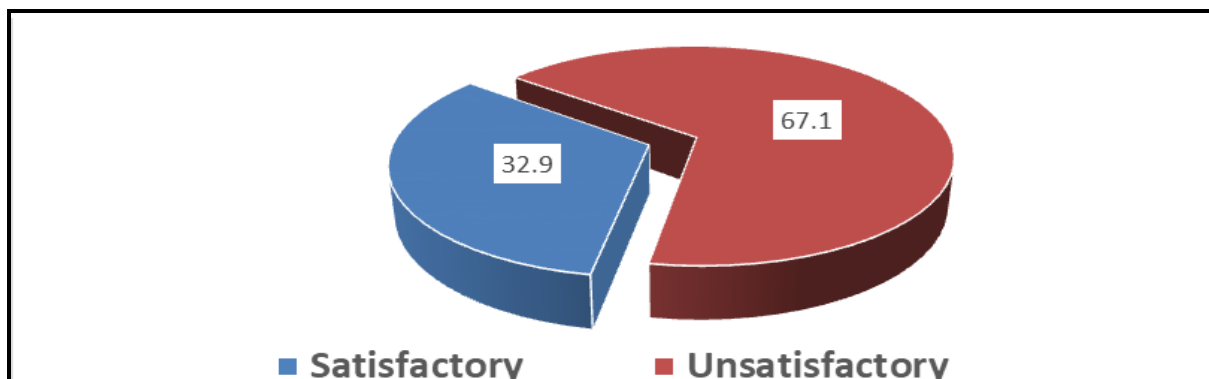


Figure (3): Total score reported practices of nursing students about climate change

Table (5): Relation between the total score of nursing students' reported practices that can reduce climate change impact and their demographic data

Demographic characteristics	Reported Practices level				X2	P. value
	Satisfactory (n=94)		Unsatisfactory (n=192)			
	No	%	No	%		
Age level						
<20 year	35	37.2	65	33.9	0.32	0.573
≥20 year	59	62.8	127	66.1		
Gender						
Male	60	63.8	91	47.4	6.84	0.009**
Female	34	36.2	101	52.6		
Residence						
Rural	64	68.1	129	67.2	0.02	0.879
Urban	30	31.9	63	32.8		
Educational category						
Technical nursing institute	26	27.7	53	27.6	11.73	0.003**
Technical Health institute	4	4.3	36	18.8		
Faculty of Nursing	64	68.1	103	53.6		

Chi-square test for qualitative data

*Statistically Significant level at P value < 0.05

**Highly Statistically Significant (p<0.01)

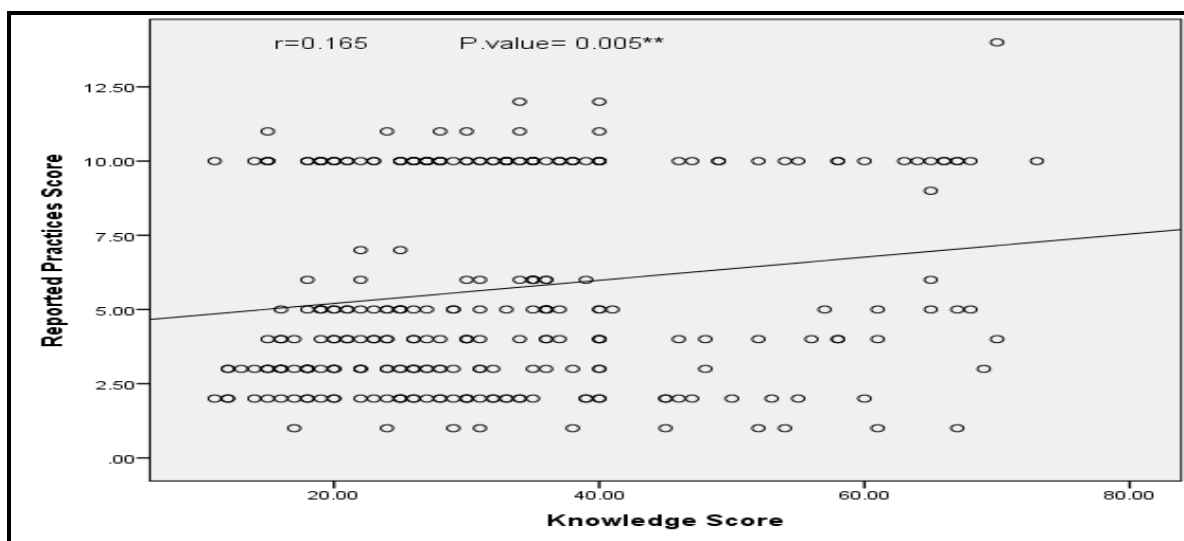


Figure (4): Correlation between the nursing students' knowledge and their reported practices

Table (1): Shows demographic characteristics of the study participants, which clarified that 65% of their age ≥20 years with Mean ± SD (Range)20.08±1.2 (18 – 24). 52.8% of them were males. 67.5% of them were living in rural areas. 58.4% of them were from the faculty of nursing. 38.1 % and 9.1% were in the first and fourth academic years respectively.

Table (2): Illustrates the knowledge of studied samples' regarding climate change, which showed that 64% and 55.8% of them mentioned children, the elderly, and pregnant women representatively as vulnerable populations affected by climate change.

Table (3): Displays the knowledge of studied students about the effect of climate change on body systems, which represented that 58.3% of them indicated asthma as a respiratory problem. According to GIT problems, 74.5 % of them selected diarrhea.

Table (4): Presents knowledge about solutions to the climate change problem, which revealed that using renewable energy sources (e.g. Solar and wind energy), rationalization electricity consumption, increasing the planting of trees, and increasing environmental awareness are noted by 68.1%, 58%,51%, and 40.6% respectively of students.

Figure (1): Clarifies the total scores of nursing students' knowledge about climate change health effects, which illustrates that 82.5% of them had a poor score of knowledge, 11.2% had a fair score and 6.3% had good scores.

Figure (2): Demonstrated that there were statistically significant differences between nursing students' level of knowledge about climate change and their educational category, also presented that good knowledge score was 83.3% for faculty of nursing students, 11.11% for technical nursing institute students, and 5.6% for technical health institute students.

Figure (3): Indicated nursing students' total scores reported practices about climate change, which revealed that 67.1% of them had unsatisfactory reported practice scores, and 32.9% had satisfactory scores.

Table (5): Reported that there were highly statistically significant differences between nursing students' level of practice, gender, and educational category (P-value = 0.009** and 0.003**) respectively.

Figure (4): Reflects a highly significant positive correlation between the total score of nursing students' knowledge and their reported practice ($r = 0.165$ & $p = 0.005^{**}$).

Discussion

Climate change could affect health in many ways. Injuries and fatalities caused by heatwaves and other extreme weather events lowered air quality due to ozone, aeroallergens, and wildfire smoke, and illnesses spread by contaminated food, water, and disease-carrying insects like mosquitoes and ticks are the majority of the health risks associated with climate change that has been identified (Lemery et al., 2021).

Nursing students must be prepared to act in a world facing climate change and contribute to sustainable healthcare and society. Students' experiences and voices are pivotal to the continuous development of education (Sperstad et al., 2020). They are expected to be actively involved in social and professional life after graduation because they must apply the knowledge, practices, attitudes, and values they gained in their academic careers to their professional and personal environments (Ahmed et al., 2023).

The findings of the current study revealed that less than two-thirds of nursing students aged ≥ 20 years. These findings were in the same line with Mohammed et al., (2024) who carried out a study about the effect of educational program regarding climate change on nursing students' awareness, attitude, and practices in Suez Canal University and found that three-quarters of nursing students aged ≥ 20

years. These findings disagreed with Ali et al., (2023) who performed a study about empowering nursing students to face climate changes and its effects on health and proved that less than three-quarters of students aged less than 20 years.

This study indicated that more than half of them were males. From the investigator's point of view, this finding refers to that there is a gradual increase in the number of male nursing students and no longer be an exclusively female profession. The findings of the study agreed with Moselhy et al., (2022) who did a study about carbon footprint knowledge and calculation among nursing students and found that more than half of the nursing students were male. On the other hand, this result contradicted with Reddy et al., (2022) who studied the knowledge, perceptions, and practices of medical students towards climate change and global warming and demonstrated that less than two-thirds of students were females.

Students who came from rural areas represented more than two-thirds in the present study. In the researcher's opinion, this may be due to the nature of Sohag governorate where most people live in rural areas. This finding parallels to Soliman et al., (2023) who conducted a study about the effect of training program about sustainability and climate change on nursing internship students' awareness and revealed that less than three-fifths of nursing students were living in rural areas. The finding is congruent with Abdel Nabi et al., (2023) who performed a study about the assessment of nursing students' awareness regarding climate change and found that less than three-quarters of nursing students were living in urban areas.

The study illustrated that more than half of nursing students were from the faculty of nursing. From the investigator's perspective, this may be due to the sample size of nursing students in the faculty being more compared to the two other settings. The finding is similar to Ali et al., (2023) who presented that more than two-thirds of students were from the faculty of nursing. While, this result disagreed with Mahmoud & Mahmoud., (2023) who performed a study about the effect of climate change on health and critical care nurses practice & Mekawy., (2023) who conducted a study about climate change and its relation to environmental sustainability practice as perceived by staff nurses, and demonstrated that nearly half of the students were from the Technical Institute of Nursing. Regarding the academic years, the current study showed that more than one-third of nursing students were present from the first academic year, and the minority of them were from the fourth academic year. In my opinion, this may be due to that the first year included the three settings while the fourth year was just in the faculty. This finding supported by

Elsharkawy et al., (2023) who studied the knowledge, perception, and practices regarding climate change among students of Al-Azhar University for girls in Cairo, Egypt, and concluded the same results. However, the finding disagreed with **Gazzaz & Aldeseet., (2021)** who performed a study about the assessment of the level of knowledge of climate change of undergraduate science and agriculture students and showed that less than one-fifth of students were from the first year and less than half of them were from fourth-year students.

Vulnerable populations affected by climate change, less than two-thirds of students illustrated children & the elderly followed by more than half of them mentioned pregnant women. In the researcher's opinion, this might be because children have immature physiology, cognitive development, and physicality. The elderly have slow physiological adaptation to environmental change and multiple comorbidities. Adverse pregnancy outcomes such as pre-eclampsia, preterm labor, low birth weight, stillbirth, and intrapartum problems can result when increased ambient temperature.

These results were congruent with **Sambath et al., (2022)** who carried out a study about knowledge, attitudes, and practices related to climate change and its health aspects among the healthcare workforce in India and revealed that more than three-quarters of nurse participants indicated children and the elderly, and more than three-fifths of them selected women. Despite that, these results were inconsistent with **Salem et al., (2022)** who performed a study about young students' knowledge, attitude, and practice toward climate change and demonstrated that more than one-third of students selected infants and children as more vulnerable people to the climate change effects. This may be due to educational level and sample size differences.

The current study revealed that more than half of students stated asthma. From the investigator's perspective, these results might be due to climate change increasing the level of air pollution and triggering respiratory problems such as asthma. These results were in accordance with **Amin et al., (2023)** who studied the predictors of climate change knowledge and risk perception among the adults in El Beheira Governorate and showed that less than two-thirds of nursing students mentioned climate change contributes to increased bronchial asthma. In contrast with **Ahmed et al., (2023)** who performed a study about the effect of health promotion program regarding environmental literacy and climate change health risks among newly nursing students, and revealed that at pre-intervention, only less than one-tenth of nursing students mentioned asthma. This may be due to sample size differences.

The existing study exposed that less than three-quarters of students presented diarrhea. In my opinion, these results might be because warmer temperatures can lead to increased proliferation of pathogens in food and water sources leading to diarrheal diseases. This finding supported by **Gautam et al., (2021)** who carried out a study about students' awareness towards climate change: a study of climate change effects on human health in Nepal and found that less than three-quarters of nursing students selected diarrhea. Conversely, this finding contradicted with **Ahmed et al., (2023)** who revealed that at the pre-intervention, only less than one-tenth of nursing students mentioned diarrheal diseases. This may be due to differences in sample size.

Regarding solutions to the climate change problem, more than half of the participants decorated using renewable energy sources (e.g. solar and wind energy), rationalization electricity consumption, increased the planting of trees and less than half of them stated increasing environmental awareness. From the researcher's perspective, these results might be because these are eco-friendly practices that lessen the sources of greenhouse gases. These results were similar to **Dalindi et al., (2020)** who studied global warming awareness on causes, consequences, and control among students of Modibbo Adama University of Technology, Yola, additionally, **Nguyen., (2023)** who conducted a study about awareness of climate change among university students: a case study at FPT University.

This finding is different from **Ganatsa et al., (2021)** who studied the factors affecting attitudes and behavior of greek secondary school students on current environmental issues and noted that a minority of students suggest the use of renewable energy sources to control climate change. Moreover, this finding disagreed with **Mulikat et al., (2022)** who performed a study about the impact of climate change awareness on undergraduates' socio-emotional well-being in Nigeria and announced that less than half of participants suggested planting trees and reducing electricity use. This may be due to mean age differences.

The results illustrated that most of the students had a poor score of knowledge about climate change. In my opinion, these results might be because the nursing curriculum doesn't provide condensed and detailed information about climate change in nursing courses. Furthermore, the absence of environmental priority in the country's national policy has an influence, as was concluded by **El-Gamal., (2021)** who found that until a few years ago, environmental issues and climate change were not at the top of the Egyptian state's priorities. This finding agreed with **Mekawy., (2023) & Mohammed et al., (2022)** who studied

nursing students knowledge, attitude, and practice regarding health effect of climate change and they disclosed that most of the studied students had a poor level of knowledge related to climate change. On the other hand, these findings contradicted with **Rahman et al., (2021)** who conducted a study about climate change and dengue fever knowledge, attitudes, and practices in Bangladesh & **Kolenatý et al., (2022)** who carried out a study about what triggers climate action: The impact of a climate change education program on students' climate literacy and their willingness to act and illustrated that more than three-quarters of students reported good climate change knowledge scores. This may be due to educational level and conditions differences.

The findings presented that more than two-thirds of students had unsatisfactory scores of reported practices about climate change. From the researcher's point of view, these results might be because students had a poor level of knowledge about climate change and they were not aware of how to modify their practices to prevent or reduce its impact. These findings agreed with **Rahman et al., (2021)** who indicated that more than three-fifths of students had inadequate scores of reported practices about climate change. This finding is congruent with **Abdel Nabi et al., (2023)** who found that three-fifths of nursing students had adequate practices regarding climate change. This difference may be due to this study including only high-level fourth-academic-year students.

The offered findings stated that there were highly statistically significant differences between nursing students' level of practice, gender, and educational category. This finding is in accordance with **Mohammed et al., (2022)** also, **Mahmoud & Mahmoud., (2023)**. On the opposite side, this finding is different with **Mohammed et al., (2024)** who announced that there were no statistically significant differences between total performed practice levels and gender & **Mahmoud et al., (2023)** who carried out a study about knowledge and practices of maternity nurses related to the potential impacts of climate change on women's health and illustrated that there was no relation between the overall score of practices and qualifications (educational category).

A highly significant positive correlation between the total score of nursing students' knowledge and their reported practice was found in the current study. As seen by the investigator, this may be due to awareness level affecting the practices of any person, and since the knowledge of the nursing students was poor, the climate change reported practice was also unsatisfactory. This finding agreed with **Abdel Nabi et al., (2023)** who found that there was a highly statistically significant positive correlation between

total knowledge and reported practices regarding climate change.

Conclusion:

Nursing students had poor knowledge and unsatisfactory practices regarding climate change.

There was a highly significant positive correlation between the total score of nursing students' knowledge and their reported practice.

Technical Health Institute & Technical Nursing Institute students had the least good knowledge and satisfactory reported practice scores regarding climate change, however, more than half of Faculty of Nursing students had poor knowledge and unsatisfactory reported practice scores. This may be due to the large sample size in the faculty of nursing setting.

Recommendations:

Based on the findings of the study, the investigator recommended the following:

- Incorporating climate change topics into nursing curriculum.
- Creation of awareness campaigns among Sohag University students about the health consequences of climate change.
- The mass media should be utilized and community organizations mobilized to disseminate correct and relevant information on climate change.
- Further researches in the field of climate change phenomenon.

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