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Original Article

Nursing Students knowledge, Attitude, And Practice Regarding Health Effect of Climate Change

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1.ABSTRACT

Background: Climate change is considered one of the biggest global health threats in 21st century. Climate change is caused by human activities and results in a rise in temperature, precipitation, sea level, and extreme weather events. Climate change has already affected and will continue to affect population health, such as malnutrition, diarrhea, malaria, dengue fever, injuries, and deaths. Therefore, health professionals must become expert resources for patient communities and policymakers. The study aimed to assess nursing students' knowledge, attitude, and practice regarding health effect of climate change. **Methodology:** A cross-sectional study design was utilized in this study. This study was conducted at faculty of nursing, Mansoura university, Egypt. A convenient sample of 439 fourth level undergraduate nursing students. Four tools were developed by the researcher as: socio-demographic and academic characteristics of students; knowledge; attitude and practice of students regarding climate change. **Results:** The study revealed that more than two thirds of studied students had poor knowledge regarding climate change and poor practice regarding human causes of climate change. Additionally, it was found that more than one third of studied students had moderate score level of practice regarding adaptation to health effect of climate change. **Conclusion:** This study concluded that; most of the studied students had a poor level of knowledge and practice regarding climate change and less than one third of the studied students agreed that issues about climate change should be included in nursing curriculum. **Recommendation**: the researcher recommended integration of health effect of climate change into nursing education.

Keywords: Climate Change, Health Effect, Nursing Students, Adaptation practice, Mitigation

2.Introduction:

The World Health Organization (WHO) considers climate change as a new threat to global health **(World Health Organization 2022).**

The Sixth assessment report of the Intergovernmental Panel on Climate Change (IPCC) concluded that it is now unequivocal that heating of the planet is caused by human activities and that the 1○C of warming above preindustrial times currently being observed is already disrupting weather in every region of the planet **(Zhongming, Linong, Xiaona, Wangqiang & Wei, 2021).**

Rising atmospheric carbon dioxide levels, warmer temperatures, and altered precipitation patterns are resulting in increases in drought, wildfire, air pollution, sea-level rise, coastal flooding, ocean acidification, intense storms, and disrupted ecosystems **(Maibach et al., 2015).**

The World Bank Group 2021 confirmed that despite the very low contribution in the global greenhouse gases (0.6%), Egypt is considered as one of five highly vulnerable countries in the world to climate change as most of the country's population and infrastructure are concentrated in the Nile Delta and along the Mediterranean coast, making the country additionally vulnerable to the impacts of sea level rise **(World Bank Group, 2021).**

The impact of climate change has no border, and it directly affects global sustainable development, livelihood, and man's ability to coexist on earth **(Chika, Eze & Obodo, 2021).**

The Lancet Countdown on health and climate change 2020 report declared that climate change is already impacting health in a myriad of ways, including by leading to death and illness from increasingly frequent extreme weather events, such as heatwaves, storms and floods, the disruption of food systems, increases in zoonoses and food-, water- and vector-borne diseases, and mental health issues. Human climate change since the 1970s is reported to have claimed over 150,000 lives and 5.5 million Disability Adjusted Life Years (DALYs) per year **(Shi, 2018).**

These climate-sensitive health risks are disproportionately felt by the most vulnerable people, including women, children, ethnic minorities, poor communities, migrants or displaced persons, older populations, and those

with underlying health conditions **(Lou, Wu, Liu, Kota and Huang, 2019).**

Egypt witnessed two separate extreme heat waves at the end of May and early August in 2015 affected most part of Egypt and caused almost a hundred deaths and two separate extreme rainfall events at the end of 2016 caused flash floods in different parts of Egypt including Alexandria and the Nile Delta region and caused the death of dozens of people **(Nashwan, Shahid & Abd Rahim, 2019).**

The challenges posed by climate change to human health are unavoidable. It is our common responsibility to protect the climate of earth, slow down the global warming and prevent it from deteriorating **(Shi, 2018).**

Two strategic approaches may be considered to address climate change including mitigation and adaptation**. IPCC** defined mitigation as a human intervention to reduce the sources or enhance the sinks of greenhouse gases (GHGs). **Also,** defined adaptation as the process of adjustment to actual or expected climate and its effects **(Pachauri et al., 2014).**

WHO stated that climate change can be mitigated by transitioning to sustainable and efficient energy practices, conserving, and protecting resources, designing climate-resilient infrastructure, and adopting methods of sustainable waste disposal and management practices **(Kolbuk, Gillespie, Hilderbrand & Stone, 2021).**

Solutions to the climate crisis can provide "win–win" benefits for public health **(Mailloux et al., 2021)**. The concept of health co-benefits combines individual factors and global mitigation strategies, such that climate protection also entails acting beneficially for one's own health **(Watts, Adger & Agnolucci, 2015).** For example, a change in diet by reducing over-consumption of meat and animal by-products has positive effects on reducing greenhouse gases and health. In addition, a shift towards active mobility and public transportation increases individuals' levels of physical activity and reduces air pollution **(Quam, Rocklöv, Quam & Lucas, 2017).**

However, health adaptation needs to encompass epidemiological surveillance and planning of regional and global climate risks; governance and institutional planning; community health promotion and emergency preparedness; workforce development and education; and strategic finance and investment **(Maxwell & Blashki, 2016; Fox, Zuidema, Bauman, Burke & Sheehan, 2019).**

Despite these alarming situations, issues on climate change have not been integrated into public health programs and education. Nursing education is an optimal platform for introducing future nurses to the issues of climate change and sustainable development **(Cruz et al., 2018).**

The global pandemic of COVID-19 has starkly demonstrated that society and physicians must be ready to deal with sudden health-related events. Though more insidious in general, climate change already produces extreme weather events that need prepared health care systems. Health care workers should be trained to work on mitigation, adaptation, and policy making around climate change **(Goshua et al., 2021).**

Nurses are in a unique position to instruct their patients and the broader community about the impact of climate change on health and wellbeing. They are trusted messengers in the eyes of the community, speaking from a stance of care and expertise; this position has been enhanced by the pandemic **(Ergin, Altinel & Aktas, 2021; Byron& Akerlof, 2021).** Therefore, the aim of this study was to assess nursing students' knowledge, attitude, and practice regarding health effect of climate change

Aim of the Study

To assess nursing students' knowledge, attitude, and practice regarding health effect of climate change.

3.Method

Design

A descriptive cross-sectional study design was utilized in this study.

Setting

The study was carried out at faculty of nursing, Mansoura university.

Participants

Undergraduate Egyptian nursing students who registered in fourth level at second semester of academic year 2020-2021.

Sampling

Convenient sampling technique was used in this study.

Sample size

Senior undergraduate nursing students registered at fourth level were 439 after excluding 10% (49) students for pilot test.

Tools for Data Collection

After reviewing the relevant literature, four tools were used in this study for data collection as the following:

Tool I: Sociodemographic and academic characteristics self-administered questionnaire. this tool consists of two parts :

Part I. It was used to assess demographic and academic characteristics data of students such as age, gender, academic level, etc.

Part II. It was used to assess socioeconomic level of nursing students by using updating socioeconomic status scale **(El-Gilany, El-Wehady and El-Wasify, 2012; El Sherbini and Fahmy, 1983).** This scale includes seven domains with total score out of 84. It classifies socioeconomic level into very low, low, middle, and high levels depending on the quartiles of the score calculated as the following:

Very low socio-economic level. (0-20)

*Low socio-economic leve*l. (21-41)

Middle socio-economic level. (42-62)

High socio-economic level. (63-84)

Tool (II): **Students' knowledge self-administered structured questionnaire.** The tool was used to assess knowledge of nursing students' regarding climate change definition, causes, impacts, health effect and basic public health strategies to reduce the health effects of climate change.

The tool composed of 100 questions and classified into 14 categories. One markawarded for each correct answer.

Scoring system. the total score of knowledge ranged from 0 to 100 marks. According to the researcher's cut of point, the knowledge scores was categorized into three levels as:

Poor. Scores less than 50% of total scores (0 – 49.99)

Fair. Scores 50% to less than 65% of total sores (50– 64.99)

Good. Scores 65% and more of total scores (65- 100)

Tool (III): Students' attitude toward health effect of climate change self-administered structured questionnaire. This tool consisted of 8 statements requiring a response on four-point Likert rating scale (strongly agree, agree, disagree, and strongly disagree) assign each response a point value, from one to four common values for the options start with "strongly disagree" at one point and "strongly agree" at four for positive statements.

Tool (IV): Students' self-reported practice regarding climate change self-administered structured questionnaire. It contains two parts:

Part I: Students' self-reported practice regarding human causes of climate change self-administered structured questionnaire. This tool was used to assess nursing students' practice's that contribute to climate change as energy conservation, transportation habits, eating habits, and participating in environmental initiatives and awareness campaign.

The tool composed of 68 questions and classified into 11 categories while 7 questions of them were not included in the practice scoring system. One mark was awarded for each proper practice (dichotomous questions) and for Likert scale questions five was given to proper practice.

Scoring System. the total score of practice ranged from 0 to 225 marks. Based on **Ahamad and Ariffin (2018)** the researcher's cut of point, the practice scores were categorized into three levels as:

Poor. Scores less than 60% of total scores (0 – 134.99)

Moderate. Scores 60% to less than 80% of total sores (135 – 179.99)

High. Scores 80% and more of total scores (180- 225)

Part II: Students' self-reported practice regarding adaptation to the health effect of climate change self-administered structured questionnaire. This tool was used to assess nursing students' practice's regarding health effect of climate change as increasing in air temperature, a dust or sandstorm, floods, protection against insect bites, food preparation practices, and extreme weather events.

The tool composed of 33 questions and classified into five categories. Five was awarded for each proper practice (Likert scale questions)

Scoring System. the total score of practice part II ranged from 0 to 165 marks. According to the researcher's cut of point, the practice scores was categorized into three levels as:

Poor. Scores less than 60% of total scores (0 – 98.99)

Moderate. Scores 60% to less than 80% of total sores (99 – 131.99)

High. Scores 80% and more of total scores (132 - 165)

Procedure

Phase I: Preparatory phase.

Administrative stage. The researcher submitted an official letter from community health nursing department and the vice dean of postgraduate studies and research to vice dean of education and students' affairs, faculty of nursing, Mansoura university, and get the permission to conduct the study after explanation of the study aim.

Ethical consideration. The researcher obtained the ethical approval from research ethics committee of faculty of nursing, Mansoura university and obtained verbal consent from the participants.

The researcher introduced herself and explained the objectives of the study clearly to the students. They assured that their participation in the study was voluntary. Students' information and responses were treated anonymously, only used for the purpose of the study and confidentiality was assured. The results were used as component of the necessary research as well as for further publications and education. Students were informed that they have the right to withdraw from the study at any time without giving any reason and there wasn't any effect on their achievement scores.

Phase II: Operational phase.

Literature review. Review of the national and international literatures on climate change topic especially for their effect on human health.

Developing the study tools. The tools (I, II, III, IV) were developed by the researcher after reviewing the relevant literature. Part II of tool I adopted from El-Gilany scale.

Validity and reliability of the study tools.

- A jury of five experts in the field of community health nursing tested the content validity of the developed tools and the required modifications were carried out.
- Face validity of the developed tools was tested by conducting pilot study that carried out on (10%) of study sample (49 students) who had been excluded from the studied sample to evaluate the clarity, reliability, applicability of the study tools, and to estimate the approximate time required for data collection. The modifications were made based on pilot results, so some questions were omitted where others were rephrased .
- Cronbach's Alpha used to test the developed tools for their reliability in SPSS program version 20, which was carried out on 49 students and the results were as the following in table(A):

Table A shows total reliability for study tool was high as it ranged between 0.889 and 0. 902. This indicate that questionnaire has high level of reliability based on **Nunnally (1994)** scale which assume 0 .70 as low level for reliability.

Part	Number of items	Reliability
Knowledge	100	.893
Practice	101	.902
Attitude	8	.776
Total	220	.915

Phase IIII: Implementation stage.

Data collection.

- The researcher-initiated data collection after granted the permission and started from April 2021 to end of May 2021 after introducing herself and gave a brief explanation about the objective of the study. Then distributed the questionnaire toparticipated students.
- The researcher was present during data collection for any clarifications of questions.
- Self-administered structured questionnaires were used to assess nursing students' socioeconomic level, knowledge about climate change, health effect of climate change, mitigation and adaptation strategies, attitude regarding climate change, and self- reported practice regarding climate change. The average time consumed for completing questionnaire ranged from 15-20 minutes.
- Then, the researcher collected the questionnaire and make sure that questionnaires were being filled fully.

Data analysis.

- Statistical analysis was done according to the most currently reliable and valid statistical methods. The collected data were coded, entered, and analyzed using Stand for Statistical Product and Service Solutions (SPSS) program version 20.

- Data were presented by using descriptive statistics in the form of frequencies and percentage.
- Quantitative variables were described by the mean, standard deviation (SD).
- Chi-square and Monte-Carlo test were used to test association.
- All tests were performed at a level of significance (P-value) equal or less than 0.05 was considered statistically significant.

4.Results

Table (1) shows that 82.0% of the studied students aged from 20 to less than 22 years with a mean age of 22(0.7) years and 65.1% of them are female. Concerning their current residence 81.1% of them their residence is home.

As regards to have any information regarding climate change: 43.7% of the studied students had information regarding climate change and 33.3% of them their source of information regarding climate change were social media.

Table 1*Students' demographic and socioeconomic characteristics (n=439).*

items	N	%
Age:		
From 20 to less than 22 years	360	82.0
From 22 and more	79	18.0
Mean (SD)	22(0.7)	
Gender		
Female	286	65.1
Male	153	34.9
Current residence		
Home	356	81.1
University hostel	61	13.9
Expatriate home	22	5.0
Having information regarding climate change	192	43.7
Sources of information regarding climate change*		
Social media	146	33.3
Television and radio	79	18.0
Friends	23	5.2

Note. *The total frequency can be more than 439 as more than one answer was allowed.

Table 2 indicates that 60.8% of the studied students had poor score level of knowledge regarding definition of climate change terms with a mean. 1.5(0.7); Additionally, 90.4% and 66.5 % of them had poor score level of knowledge regarding greenhouse gases and sources of these gases with a mean. 1.2(0.5) and1.5 (0.8) respectively.

Concerning the causes of climate change 47.6% of the studied students showed good score level of knowledge with a mean 2.1 (0.9) marks.

Regarding climate change impacts, 58.5% of the studied students had poor score level of knowledge regarding climate change impacts with a mean 1.7(0.9). Also, the studied students had poor score level of knowledge regarding vulnerable populations to health effects of climate change 48.1%with a mean 2(0.9)

In addition to, 63.1% of the studied students had poor score level of knowledge towards treaties regarding climate change with a mean 1.7(0.9) and 62.0% of the studied students had poor score level of knowledge regarding basic public health strategies of climate change with a mean 1.4 (0.6) marks.

Collectively, 66.1% of the studied students had poor total score level of knowledge regarding climate change with a mean of 1.5(0.81) marks.

Table 2*Students' score level of knowledge regarding climate change (n=439).*

Items	Poor		Fair		Good		Mean (SD)
	N	%	N	%	N	%	
Definition of weather, climate, climate change and global warming (4 items)	267	60.8	125	28.5	47	10.7	1.5(0.7)
Greenhouse gases (7 items)	397	90.4	17	3.9	25	5.7	1.2(0.5)
Sources of greenhouse gases (15 items)	292	66.5	53	12.1	94	21.4	1.5(0.8)
Causes of climate change (8 items)	164	37.4	66	15.0	209	47.6	2.1 (0.9)
Climate change impacts (10 items)	257	58.5	55	12.5	127	28.9	1.7(0.9)
Vulnerable populations to health effect of climate change (9 items)	211	48.1	33	7.5	195	44.4	2(0.9)
Treaties regarding climate change (3 items)	277	63.1	0	0	162	36.9	1.7(0.9)
Basic public health strategies of climate change (4 items)	272	62.0	142	32.3	25	5.7	1.4 (0.6)
Total score level of knowledge regarding climate change (100 items)	290	66.1	61	13.9	88	20	1.5(0.81)

Note. *Poor.* Scores less than 50% of total scores.

Fair. Scores 50% to less than 65% of total scores.

Good. Scores 65% and more of total scores.

Figure (1) represents health effect of climate change, less than one fifth of the studied students reported heat related illness as a health effect of climate change. Table 3

Students' attitude regarding climate change (n =439).

Attitude items	Strongly Agree		Agree		Disagree		Strongly Disagree	
	N	%	N	%	N	%	N	%
Do you think that climate change is a universal phenomenon?	86	19.6	148	33.7	92	21.0	113	25.7
Do you think that education will influence the level of awareness regarding climate change?	98	22.3	143	32.6	87	19.8	111	25.3
Climate change is an important issue for nursing.	81	18.5	151	34.4	105	23.9	102	23.2
Issues about climate change should be included in the nursing curriculum.	62	14.1	134	30.5	157	35.8	86	19.6
Nurses have a role in educating patients about the effect of climate change on health.	78	17.8	167	38.0	111	25.3	83	18.9
Feeling fear of climate change**.**	77	17.5	154	35.1	119	27.1	89	20.3
Total positive attitude (30 marks)	Mean (SD).25(٠.٨)							
Climate change evidence is not convincing.	41	9.3	59	13.4	214	48.7	125	28.5
Climate change is only propaganda	50	11.4	40	9.1	131	29.8	218	49.7
Total negative attitude (2 marks)	**Mean (SD)**.٣ 1(٠.٨)							
Total attitude (32 marks)	**Total Mean (SD)**2.6(.7)							

Table 3 reveals that studied students agreed that climate change is a universal phenomenon by 33.7%, education will influence the level of awareness regarding climate change by 32.6%. Also, climate change is an important issue for nursing by34.4%.

Nevertheless, 30.5% of the studied students agreed that issues about climate change should be included in the nursing curriculum and ٣٨**.**0% of

the studied students agreed that nurses have a role in educating patients about the effect of climate change on health.

Concerning feeling of fear about climate change, 35.1% of the studied students is feeling of fear about climate change with a mean of total positive attitude were 2.5(0.8).

Moreover, 48.7% of the studied students were reflecting negative attitude that climate change evidence is not convincing and ٤٩.٧% of studied students strongly disagreed that climate change is only propaganda with a mean of total negative attitude of 3.1(0.8).

Health effects of climate change on human

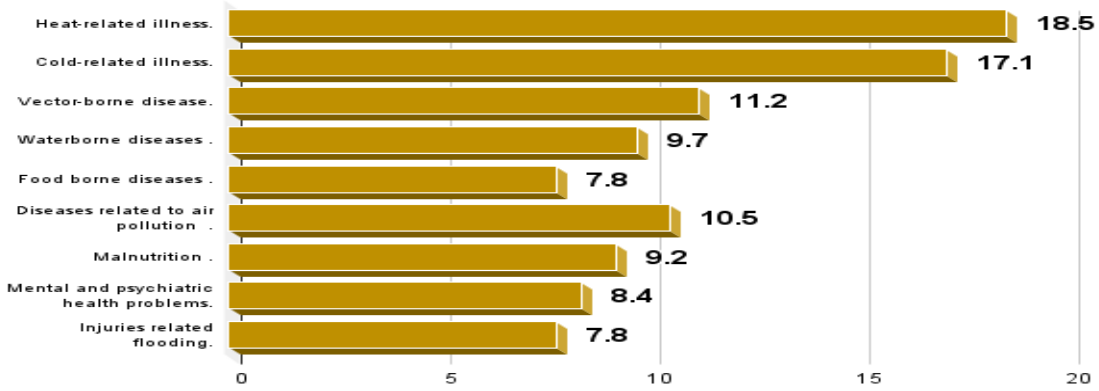

Figure 1. Health effects of climate change on human

Table 4 represents that the studied students had poor score level of practice regarding energy saving 60.1% with a mean 1.6(0.8), green purchasing 49.7% with a mean 1.7(0.7). In addition to, 60.8% of them had poor score level of practice regarding sustainable food consumption, with a mean 1.5 (0.7). However, the studied students had moderate score level of practice regarding reuse 37.4% with a mean 1.9(0.8) and recycling 40.1% with a mean 2(0.8).

The studied students had poor score level of practice regarding plastic use 82.0% with a mean 1.2(0.4), and sustainable ways of transportation used 81.8% with a mean 1.2(0.4)

In addition to, 95.9%of the studied students had poor score level of practice regarding participating in environmental initiatives and attending awareness campaign with a mean1.1(0.3).

Overall, 68.6% of the studied students had poor score level of practice regarding human causes of climate change with a mean 1.3 (0.5).

Table 4*Students' score level of practice regarding human causes of climate change (n=439).*

Items	Poor		Moderate		High		Mean (SD)
	N	%	N	%	N	%	
Practice regarding energy saving (٨items)	264	60.1	104	23.7	71	16.2	1.6(0.8)
Practice regarding green purchasing (٥ items)	218	49.7	148	33.7	73	16.6	1.7(0.7)
Practice regarding sustainable food consumption (٧ items)	267	60.8	119	27.1	53	12.1	1.5 (0.7)
Practice regarding reuse (٣ items)	146	33.3	164	37.4	129	29.4	1.9(0.8)
Practice regarding recycling (4 items)	131	29.8	176	40.1	132	30.1	2(0.8)
Practice regarding plastic use (٨ items)	360	82.0	75	17.1	4	9	1.2(0.4)
Practice regarding sustainable ways of transportation used (3 items)	359	81.8	76	17.3	4	9	1.2(0.4)
Practice regarding participating in environmental initiatives and awareness campaign (12 items)	421	95.9	10	2.3	8	1.8	1.1(0.3)
Total practice regarding human causes of climate change (61 items)	301	68.6	135	30.8	3	.7	1.3 (0.5)

Note. *Poor.* Scores less than 60% of total scores.

Moderate. Scores 60% to less than 80% of total sores.

High. Scores 80% and more of total scores.

Table 5 clarifies that the studied students had poor score level of adaptation practice regarding dust or sandstorm and floods 39.4% with a mean 2(0.8), protection against insect bites 51.3% with a mean 1.8(0.9), food preparation 37.6% with a mean 2 (0.9), extreme weather events 41.5% with a mean and 1.9(0.8).

Moreover 49.9% of the studied students had moderate score level of practice regarding increasing in air temperature with a mean 2.2(0.7).

Generally, total adaptation practice of the studied students was 41.0% with a mean 1.9 (0.8).

Table 5 *Students' score level of practice regarding adaptation measures to the health effect of climate change (n=439).*

Items	Poor		Moderate		High		Mean (SD)
	N	%	N	%	N	%	
Practices towards a dust or sandstorm and floods (5 items)	173	39.4	125	28.5	141	32.1	2(0.8)
Practices to protect against insect bites (3 items)	225	51.3	79	18.0	135	30.8	1.8(0.9)
Food preparation practices (5 items)	165	37.6	111	25.3	163	37.1	2 (0.9)
Practices towards extreme weather events (5 items)	182	41.5	128	29.2	129	29.4	1.9(0.8)
Practices regarding increasing in air temperature (15 items)	70	15.9	219	49.9	150	34.2	2.2(0.7)
Total adaptation practice (33 items)	151	34.4	180	41.0	108	24.6	1.9 (0.8)

Note. *Poor.* Scores less than 60% of total scores.

Moderate. Scores 60% to less than 80% of total sores.

High. Scores 80% and more of total scores.

Table 6 clarifies that there was a highly statistically significant association between students' gender and their total score level of knowledge and practice *P*=.000**and *P*=.002 respectively. While there was no statistically significant association between students' socioeconomic level, and their total score level of knowledge and practice, *p*= .145 and *p*=.7 respectively.

Moreover, there was no statistically significant association between students' age and their total score level of knowledge and practice *p*=.3 and *p*=.5 respectively.

Table 6 *Association between students' demographic, socioeconomic characteristics, and their total scores level of knowledge and practice regarding human causes of climate change (N=439).*

Items	Total score level of knowledge						Significance	P	Total score level of practice regarding human causes of climate change						Significance	P
	Poor		Fair		Good				Poor		Moderate		High			
	N	%	N	%	N	%			N	%	N	%	N	%		
Gender																
Male	125	28.5	12	2.7	16	3.6	Chi-square	.000**	120	27.3	32	7.3	1	0.2	MC	.002
Female	165	37.6	49	11.2	72	16.4	t=25.7		181	41.2	103	23.5	2	0.5		
Socioeconomic level																
Low	56	12.8	9	2.1	9	2.1	Chi-square	.145	50	11.4	24	5.5	0	0.0	MC	.7
Middle	204	46.5	42	9.6	64	14.6	t=6.8		216	49.2	91	20.7	3	0.7		
High	30	6.8	10	2.3	15	3.4			35	8	20	4.6	0	0.0		
Age																
20 < 22	230	52.4	53	12.1	77	17.5	MC	.3	249	56.7	109	24.8	2	0.5	MC	.5
22 < 24	58	13.2	8	1.8	11	2.5			51	11.6	25	5.7	1	0.2		
24 < 26	2	0.5	0	0.0	0	0.0			1	0.2	1	0.2	0	0.0		

5.Discussion

Although climate change is an international problem that requires global action, the health impacts of climate change vary spatially due to geographic differences in natural environment and socioeconomic factors. The prevention and treatment of health problems resulting from climate change can rely heavily on local public health agencies and healthcare workforce **(Yang, Liu, Bi, Vardoulakis& Huang, 2020).**

However, **Álvarez-Nieto, López-Medina, Abad, Grande-Gascón and Álvarez-García (2017)** reported that nursing students are being

poorly trained to understand the connections between climate change, sustainability, and health.

The current study revealed that majority of studied students aged from 20 to less than 22 years with a mean of 22(0.7) years.

As Regards having information about climate change and source of information about climate change, the current study reported that less than half of studied students had information about climate change and less than half of them their source of information about climate change is social media. This result disagrees with **Nigatu, Asamoah and Kloos (2014)** result who conducted a study in Ethiopia who found that more than three fourths of health sciences students had information about climate change and less two thirds of health sciences students their source of information about climate change is electronic mass media (TV and radio).

Regarding climate change basic terms (weather, climate, climate change and global warming), the current study illustrated that less than two thirds of studied students had poor knowledge about climate change basic definitions. As well, this finding is in the same line with **Ayanlade and Jegede (2016)** finding who studied climate change education and knowledge among Nigerian university graduates and showed that less than two thirds had poor score level of knowledge regarding climate change basic definitions. From researcher point of view, this deficit may be due to climate change was not addressed Egyptian education.

The present study illustrated that most of the studied students had poor knowledge regarding greenhouse gases. This finding is in contrast with **La Torre et al. (2020)** finding who carried out study in Rome related knowledge and perception about climate change among healthcare professionals and students. This study indicated that less than two thirds of the studied students identified greenhouse gases.

According to score level of knowledge about causes of climate change, the current study indicated that less than half of studied students had good knowledge about causes of climate change.

Yang et al**. (2018)** in China reported similar findings that less than half of the included nursing students had high level of knowledge about causes of climate change.

On the other hand, disagreements found with **Ergin et al. (2021)** study carried out in Turkey who assessed the perspective of nursing students on global warming, climate change and the role of public health nurses and revealed that majority of nursing students knew the main cause of climate change. And **Xiao, Fan, Deng, Li and Yan (2016)** conducted a study in China and assessed nurses' knowledge and attitudes regarding potential impacts of climate change on public health and illustrated that more than one third of studied nurses knew the main reason of climate change.

The present study showed that less than two thirds of the studied students had poor knowledge about climate change impacts. This finding is in contrast with **Nigatu et al. (2014)** finding in Ethiopia who found that more than three fourths of studied students had a good understanding of climate change impacts.

In relation to vulnerable populations to the health effect of climate change, the present study indicated that less than half of the studied students had poor knowledge about vulnerable population to the health effect of climate change. However, **Liao et al. (2019)** study in China aimed to assess the readiness of the next generation of health professionals to tackle climate change and showed that three fourths of the studied medical students identified vulnerable population to the health effect of climate change

Furthermore, the current study revealed that less than one fifth of the studied students reported heat related illness as a health effect of climate change. This result is in contrast with **Polivka, Chaudry and Mac Crawford (2012)** study who showed that more than half of American respondents identified vector-borne diseases as a health effect of climate change.

Generally, the present study clarified that around two thirds of studied nursing students had poor total score level of knowledge regarding climate change. This finding contrasts with two studies: the first is **Rahman et al. (2021)** study that conducted in Bangladesh to assess climate change and dengue fever knowledge, attitudes and practices and revealed that more than three fourths had good climate change knowledge, and the second one is **Domantay et al. (2021)** study that conducted in Philippines and assessed knowledge and attitudes of future physicians towards climate change and revealed that the majority of studied students had fair knowledge of climate change.

Based on the finding of the current study, one third of the studied students agreed that climate change is a universal phenomenon. This finding contrasts with **Ibrahim, Fahmy and Mahmoud (2018)** findings who conducted study in Egypt and

investigated global warming phenomenon among Assiut university students and revealed that majority of the studied students agreed that climate change is a universal phenomenon.

As regards to climate change is only propaganda, the current study verified that almost half of studied students disagreed that climate change is only propaganda. This finding is in line with **Ibrahim et al. (2018)** finding and mentioned that majority of the studied students disagreed that the climate change is only propaganda.

The current study showed that more than one third of the studied students agreed with climate change is an important issue for nursing. This finding disagrees with **Cruz et al. (2018)** finding who conducted study in multi- Arab countries and assessed factors influencing Arab nursing students' attitudes toward climate change and environmental sustainability and their inclusion in nursing curricula and found that more than half of the studied Arab nursing students agreed with climate change is an important issue for nursing.

Moreover, the current study revealed that less than one third of the studied students agreed with issues about climate change should be included in the nursing curriculum. **Cruz et al. (2018)** supported this finding.

Concerning score level of practice about energy saving. The present study reported that less than two thirds of the studied students had poor practice regarding energy saving. While **Li, Tan, and Rackes (2015)** study in China analyzed carbon footprint of student behavior for a sustainable university campus and denoted that majority of the studied students did energy saving behavior.

As regards to score level of practice about green purchasing. Almost half of the studied students had poor practice regarding green purchasing. This is not in the same line with **Vicente-Molina, Fernández-Sainz and Izagirre-Olaizola (2018)** study who carried out the study in Basque and assessed pro-environmental behavior among university students and reported that less than half of the studied students practiced green purchasing. The researcher illustrates that this deficit is due to the high prices and scarcity of green and organic products.

Regarding to score level of practice regarding recycling, the current study revealed that more than one third of the studied students had moderate practice regarding recycling. This contrasts with **Vicente-Molina et al. (2018)** finding who revealed that more than three fourths had high level of practice regarding recycling.

In relation to score level of practice about plastic use, the present study represented that majority of the studied students had poor practice regarding plastic use. **Shaira et al. (2020)** revealed similar finding in Karnataka to assess knowledge, attitude, and practice regarding single use plastics among the residents of a rural area in a coastal district of Karnataka.

The researcher argument illustrates that this may be due to plastic is cheap, easily available, convenient, and no available alternatives.

Furthermore, the present study showed that majority of the studied nursing students had poor practice regarding using sustainable ways of transportation such as walking, bicycle and public transportation. This result contrasts with **Shaira et al. (2020)** study who carried out the study in Hungary and aimed to assess environmental knowledge, attitudes, consumer behavior and everyday pro-environmental activities among high school and university students and revealed that less than one third of students walked to their place of study.

In addition to a Canadian study was done by **Nash and Mitra (2019)** demonstrated that two-thirds of studied students predominantly relied on either walking/cycling or transit.

Generally, the current study indicated that more than two thirds of studied students had poor score level of practice regarding the human causes of climate change. This study disagrees with three Malaysian studies: **Ahamad and Ariffin (2018)**; **Purnomo and Kurnia (2019, August) and Tiong et al., (2021)** who revealed that almost half, more than two thirds, and all students' practices toward sustainable consumption were moderate respectively.

Regards to score level of practice about protection against insect bites, the current study clarified that more than half of studied students had poor practice regarding protection against insect bites. This result contrasts with **Farzana et al. (2021)** study carried out in Bangladesh and showed that most of the students undertook preventive activities to avoid contact with mosquitoes.

Also, contrast with **Oche et al., (2021)** finding who conducted the study in Nigeria to assess knowledge, attitude, and practices toward dengue fever among health workers in a tertiary health institution and revealed that more than three fourths had appropriate practices regarding protection against insect bites.

The researcher arguments indicates that this may be due to the studied student current residence not exposed before to vector borne diseases outbreak.

Concerning association between student gender and their total score level of practice regarding human causes of climate change, the present study revealed that there is highly statistically significant association between student gender and their total score level of practice regarding human causes of climate change. This finding agrees with a study carried out in Portugal by **Sousa, Correia, Leite and Viseu (2021).**

6.Conclusion

The study concluded that: there was a highly statistically significant association between students' gender and their total score level of knowledge and practice; most of the studied students had a poor level of knowledge and practice related to climate change and more than one third of the studied students agreed that nurses have a role in educating patients about the effect of climate change on health.

7.Recommendations

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

1. Integration climate change education into nursing education.
2. Collaboration of the Ministry of Higher Education and Scientific Research and Ministry of Health, as the policy makers for education and health in Egypt, develop strategies relevant to this phenomenon on the context of Egypt.
3. Organizing seminars, workshops, and conference to teach and train nurses on the impact of climate change on health.
4. Creation of awareness campaigns among Mansoura university students about health consequences of climate change using different media.
5. Creation of faculty environmental team of nursing students aimed to prepare and implement environmental initiatives.

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9.Reference

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