

Maternity Nurses' Competences regarding the Potential Consequences of Heat Exposure on the Mothers and Newborns in the Face of Climate Change

1 Ashour E.S.; 2 Aida A. El-Razek; and 3 Amany Ali Abd El-Salam

1 & 3 Assistant Professors of Maternal and Newborn Health Nursing, Faculty of Nursing, Menoufia University, Egypt

2 Professor of Maternal and Newborn Health Nursing, Faculty of Nursing, Menoufia University, Egypt

Corresponding email: malakamir202@yahoo.com

Abstract

Background: One important worldwide health concern that has quickly moved to the top of the global health agenda is climate change. It affects a person's physical, psychological, and social well-being. The study **aims** to assess the maternity nurses' competencies regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change. **Design:** A descriptive cross-sectional study design was used. Settings: The study was conducted at Shebin El-Kom Teaching Hospital and University Hospital in the Menoufia Governorate, Egypt. **Sample:** A convenient sample of fifty maternity nurses was recruited. **Instruments:** Three instruments were used to gather data: a self-administered questionnaire about the personal data of maternity nurses; a self-administered questionnaire about the maternity nurses' knowledge of the potential health effects of heat exposure on expectant mothers and newborns' health in the context of climate change; and a self-administered questionnaire about the maternity nurses' practices regarding the potential health effects of heat exposure on expectant mothers and newborns' health in the context of climate change. **Results:** the average overall knowledge is 36.40 ± 7.84 , resulting in a total percentage score of 54.0%, reflecting a good level of knowledge, while the overall practices of maternity nurses regarding the potential consequences of heat exposure on the health of expectant mothers and newborns in the face of climate change exhibit unsatisfactory practices (92.0%), with an average score of 8.76 ± 2.65 . **Conclusion:** The study findings concluded that maternity nurses had a fair level of knowledge and unsatisfactory practices overall. Consequently, a disparity exists between knowledge and implementation. **Recommendations:** Organize educational programs and training workshops by maternity health authorities to increase nurses' understanding of the effects of climate change on mothers and newborns in the face of climate change.

Keywords: Mothers and newborns in the face of climate change; maternity nurses' competences; potential consequences of heat exposure.

Introduction

The sustainability of the planet's ecology, the future of humans, and the stability of the global economy are all at risk because of altering weather patterns, as highlighted in the study "Impacts of High Environmental Temperatures on Congenital Anomalies: A Systematic Review" (Haghighi et al., 2021). Meanwhile, Chersich et al. (2022) pointed out in their study "Climate change impacts on maternal and newborn health in Africa: Intervention options" that climate change poses a serious threat to global health, affecting people worldwide. They also added that it entails significant and long-lasting changes in the Earth's climate, including "temperature, precipitation, and wind," most of which are caused by human activity.

Climate change is "a broad range of global phenomena created predominantly by burning fossil fuels, which add heat-trapping gases to Earth's atmosphere," according to the National Aeronautics and Space Administration (Global Climate Change [NASA], 2022). It was also

reported that along with changes like wildfires, air pollution, ocean heating, ocean acidification, sea level rise, and ice mass loss in Greenland, Antarctica, the Arctic, and mountain glaciers worldwide that result in flooding, changes in flower and plant blooming, more intense storms, droughts, and other extreme weather events, these phenomena also include the increased temperature trends associated with global warming.

Based on COP27 (2022), Egypt is very vulnerable to the effects of climate change, which means that heat waves, dust storms, coastal storms in the Mediterranean, and other extreme weather events are predicted to increase. Also, it was documented that the rate of warming has increased significantly over the last three decades, with average annual temperatures rising by $0.53 \text{ }^\circ\text{C}$ every decade. Moreover, it is critical to acknowledge that the nation's climate-related threats will disproportionately impact the younger generations. Remarkably, there is a rapid rise in understanding of the need for Egypt to act on

climate change. As part of its 2030 vision and sustainable development strategy, Egypt has also promised to integrate climate change considerations into its national development strategies and adopt a progressively eco-friendly approach across all sectors.

The relationship between gender and climate change was the focus of several side events of the "27th annual United Nations Climate Change Conference (COP27)," which took place in Sharm el-Sheikh, Egypt, on November 18, 2022. Also, it was mentioned that speakers from a variety of groups discussed how women and girls are disproportionately affected by climate change, which exacerbates the existing gender gap. Likewise, it was noted that instances of sexual and gender-based violence (SGBV) may rise because of the negative effects of climate change on the results of reproductive and sexual health care, as well as the aggravation of economic challenges and opportunities that are inequitable to women. The main cause of this situation is the existence of laws and cultural practices that discriminate against women and girls based on their gender, which negatively impacts their access to reproductive and sexual health care as well as their opportunities in the workplace and school (COP27, 2022; Un Women, 2022).

The group most affected by climate change is girls and women, particularly those who are low-income, experience discrimination and other types of coercion, are migrants, have a disability of any kind, or reside in rural or disaster-prone areas (Giudice et al., 2021). These conditions may jeopardize their livelihood, health, and safety and increase their vulnerability to violence (World Health Organization [WHO], 2021; COP27, 2022).

Climate-related disasters have the potential to demolish transportation and health system infrastructure, which would restrict access to resources and services for family planning, pregnancy, abortion, and labor. (COP27, 2022). Similarly, it was added that reproductive and sexual health rights violations can result in fewer inter-birth intervals and an increase in unintended or unwanted pregnancies. The most common cause of SGBV and sexually transmitted infections (STDs), early or child marriage, is more likely because young females must stop their schooling. Inadequate economic prospects might also push women into careers

like transactional sex, which increases their vulnerability to abuse. Furthermore, changes in the accessibility of resources might increase the likelihood of sexual assault for women and girls, especially if they must travel great distances to acquire resources (Fan & Koski, 2022).

Climate-related water and food insecurity may have a significant negative impact on women's health, increasing their risk of malnutrition, losing strength and body weight, becoming less resistant to infection, developing major chronic illnesses, becoming disabled, having poor mental health, having a low quality of life, and dying young (Dunne, 2020). Furthermore, the health of the world's population is currently under increasing threat from air pollution. It damages vital organs like the heart, lungs, and placenta. Air pollution can have negative consequences for pregnant women, including low birth weight, stillbirth, and preterm birth. Moreover, it has been discovered that pregnant women and other susceptible populations have hypertensive issues with air pollution. According to recent research, air pollution has been linked to a wide range of consequences, such as impaired egg and sperm production, birth abnormalities, and epigenetic changes, all of which can result in infertility (Casey et al., 2019; Watts et al., 2019; Bekkar et al., 2020).

Some of the consequences of environmental chemical toxicants and climate change are related. More exposure to hazardous chemicals is due to higher temperatures and concentrated chemical discharges due to extreme weather. Furthermore, according to Borgå et al. (2022) and Jain & Singh (2023), climate change may exacerbate the impact of harmful chemicals on fertility in both males and females and increase their susceptibility to other illnesses that may also impair fertility, such as diabetes, obesity, and endocrine malignancies. Studies have indicated that elevated temperatures affect the health of the expectant mother and her developing fetus. Both at home and at work, these circumstances may increase the risk of heat-related disorders. In addition, there is a higher chance of eclampsia and placental abruption, as well as fetal congenital abnormalities such as septal heart and constrictural defects (Zhang et al., 2019; American Academy of Pediatrics, 2021).

Maternity nurses can play a major part in improving the well-being of women who may be experiencing adverse effects from climate change. As providers of an essential service, they must encourage and uphold women's health and well-being. Moreover, healthcare providers need to evaluate how climate change can affect women's health in their local communities and create detailed care strategies that address the harmful consequences of climate change on women's well-being (Martin & Vold, 2019; World Health Organization [WHO], 2022).

Furthermore, nurses are responsible for educating women about climate change and its effects on their health. They should use their skills to support and promote methods that reduce the negative impacts of climate change on patients and their families (Martin & Vold, 2019; World Health Organization [WHO], 2022). Maternity nurses must conduct extensive research, advocate effectively, and implement sustainable policies and practices as care managers.

Moreover, it is important for them to consistently start conversations on how climate change impacts women's health and bring attention to workplace practices that worsen the issue, like excessive use of air conditioning, electricity, elevators, paper, and plastic products, as well as improper waste separation and disposal of toxic fumes and chemicals. This will assist in creating a common language to work with government officials, allied health professionals, and other emergency responders (Martin & Vold, 2019; World Health Organization [WHO], 2022).

Significance of the study

One important worldwide health concern that has quickly moved to the top of the global health agenda is climate change (World Health Organization [WHO], 2021). It was also documented that it affects physical, psychological, and social well-being. Likewise, it was reported that women are a group that might be more vulnerable to the effects of climate change, which could jeopardize their standard of living. Moreover, it is important to remember that nurses are the front line of any health system; therefore, having a competent and skilled workforce is crucial to ensuring community health, especially in times of crisis like climate change. In addition, to ensure the health of the public and women specifically, it is

imperative that nurses, especially maternity nurses, have a comprehensive awareness of climate change and its effects on health. Additionally, maternity nurses must abstain from all workplace activities that negatively impact the atmosphere. Therefore, this study aims to assess the maternity nurses' competencies regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change.

The aim of the study

To assess the maternity nurses' competencies regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change.

Research Questions:

- What is the level of maternity nurses' knowledge regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change?
- What is the level of maternity nurses' practices regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change?

Operational definition:

Maternity nurses' competencies regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change are operationally defined as the knowledge and practice of maternity nurses regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change. It was measured using instruments II and III.

Method

Research Design: This study utilized a cross-sectional descriptive research design.

Research Settings: The research was conducted in the obstetrics units of the University Hospital and Shebin El-Kom Teaching Hospital, located in Menoufia Governorate, Egypt.

Sample Size Calculation: Based on an analysis of related prior research that looked at the same results and discovered important discrepancies, the sample size was determined (Borgå et al., 2022). The following formula (Fisher and Yates, 2023) has been used to determine the sample size at a power of 80% and CI of 95%. fifty maternity nurses were chosen for the study.

$$n = \frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2}$$

where ε represents the margin of error, z is the z score, the sample size is denoted by n , and the population percentage is \hat{p} .

Sample Type:

A convenient sample of fifty maternity nurses employed in the facilities were chosen for the study.

Inclusion criteria for the maternity nurses:

- All maternity nurses in the obstetrics and gynecological departments agree to participate.

Exclusion criteria for the maternity nurses:

- Maternity nurses who are working in other departments.

Instruments for data collection:

Instrument 1: A questionnaire was given to maternity nurses for self-administration. The instrument contained personal information about maternity nurses, like age, marital status, current address, skills, workplace, and years of experience.

Instrument II: Maternity nurses' level of knowledge regarding the potential consequences of heat exposure on the health of expectant mothers and newborns in the face of climate change, self-administered questionnaire: The researchers created and utilized this instrument after thoroughly reviewing recent and pertinent literature to assess maternity nurses' understanding of the possible impacts of heat exposure on the health of pregnant women and infants amidst climate change (Kircher et al., 2022; Sambath et al., 2022; Amin et al., 2023). It consisted of 31 questions, divided into two sections.

- Part one: The general understanding of climate change by maternity nurses through 15 questions.
- Part two consisted of 16 questions assessing maternity nurses' understanding of the possible impacts of heat exposure on the health of pregnant women and infants in the context of climate change and sources of information.

Scoring system: It was adopted from Amin et al. (2023). Every item is provided in both sections.

Score	Maternity nurses' knowledge
2	correct and complete answers
1	correct and incomplete answers
0	incorrect answers

The knowledge scores ranged from 0 to 62 in total and were divided into the following categories:

- Those who scored below 32.3% (0-20) are considered poor.
- Average for an overall score ranging from 32.26 to 66.12% (20.1-41).
- Good for achieving a cumulative score above 66.12% (41.1 to 62).

Instrument (III): Maternity nurses' level of practice regarding the potential consequences of heat exposure on the health of expectant mothers and newborns in the face of climate change self-administered questionnaire:

A self-administered questionnaire was created and utilized by researchers to evaluate maternity nurses' practices regarding the effects of heat exposure on expectant mothers and newborns amidst climate change. The development of this instrument involved a thorough review of current literature (Abdallah & Farag, 2022; World Health Organization [WHO], 2022; Mahmoud & Mahmoud, 2023). It included 28 items across the specified categories.

- Interactions with the patients (6 components)
- Procedures in the workplace (13 items).
- Involvement in training sessions regarding climate change (5 topics).
- Utilizing the hospital's website and social media (1 practice).
- Involvement in policies and regulations regarding the effects of climate change (1 topic).
- Customs in society (2 examples).

Scoring system: It was adopted from Mahmoud & Mahmoud (2023). Every item is given:

Score	Maternity nurses' practice
1	the presence of practice
0	no practice

- "Unsatisfactory practices for a cumulative grade <60%".

- “Satisfactory practices for a total score of $\geq 60\%$ ”.

Validity and reliability

Five professionals, including three professors from the Obstetrics and Gynecology Department at Menoufia University's Faculty of Medicine and two professors from the Maternal and Newborn Health Nursing Department at Menoufia University's Faculty of Nursing, examined the instruments for content validity. Changes were implemented to guarantee precision and inclusiveness. Test-retest reliability was utilized. We assessed the reliability of the instruments using Cronbach's alpha. The research instruments demonstrated reliability with Cronbach's alpha values of 0.89 for instrument II and 0.85 for instrument III.

Administrative Approvals: Permission was granted by the Hearing and Ethics Committee of the Faculty of Nursing at Menoufia University. Before beginning the research, the Dean of the Faculty of Nursing at Menoufia University sent a letter seeking approval to conduct the study to the directors of each study site. The letter aimed to clarify the study's objective of persuading individuals to participate and assist with gathering data. Approval to collect data was acquired from the appropriate authorities in the research location following a description of the study's objectives.

Ethical considerations: Before commencing the study, the researchers received approval from every nurse following a detailed explanation of the study's objective. The study maintained the anonymity of participating nurses and ensured the confidentiality of the collected data. Every nurse was told that taking part in the study was optional, and they could choose to leave at any time.

A pilot study was carried out on 10% of the delivery room staff, which involved 5 nurses, not part of the main study group, to evaluate the effectiveness and feasibility of the tools utilized. Afterwards, the necessary changes were implemented.

Procedures for the collection of data:

The research began in June 2022 and extended until the end of August of that same year, when the actual fieldwork took place. The researchers were in the study settings three times a week during the morning shift, which ran from 8:00 a.m. to 2:00 p.m. local time. The

researchers introduced themselves to healthcare providers in different settings, as previously mentioned. They interviewed each maternity nurse to gather information and assess their knowledge and experience regarding the possible impacts of heat exposure on pregnant women and infants due to climate change prior to beginning their research. Following the data collection on nurses' personal and pretest experiences, researchers administered a post-test for maternity nurses to evaluate their understanding and implementation of measures related to the impacts of heat exposure on pregnant women and newborns due to climate change.

Data Analysis

The analysis of the data was performed using SPSS version 25. The gathered data was subjected to classification, encoding, digitization, organization, and examination. Frequency and distribution were utilized to characterize and summarize categorical data. Cross-tabulation with percentages was used to examine the correlation between variables. The tests used included the arithmetic mean. The Pearson's correlation coefficient test was used to assess the connection between knowledge and practice. Where: a significant statistical difference with a P value lower than 0.05.

Results:

Table 1 displays the personal information of the research participants, with 38% of the maternity nurses ranging in age from 20 to under 30 years, with an average age of 36.07 ± 11.01 years. Also, 58.0% of them were married. Additionally, it was discovered that 94.0% reside in urban regions. Meanwhile, 42% of individuals hold a bachelor's degree, and 26.0% are employed in the antenatal department, and 12.0% of individuals are employed in the family planning division. Moreover, 56.0% have over a decade of work experience, with an average of 15.35 years and a standard deviation of 11.80 years.

Table 2 shows the maternity nurses' understanding of the potential impacts of heat exposure on pregnant women and infants regarding climate change. The study indicated that 66.0% of nurses had a fair level of general

knowledge about climate change. Additionally, 52.0% of the nurses demonstrated a good level of knowledge when assessing the potential impacts of heat exposure on the health of pregnant women and newborns in the face of climate change. However, the average overall knowledge is 36.40 ± 7.84 , resulting in a total percentage score of 54.0%, reflecting a good level of knowledge.

Figure 1 shows the overall level of knowledge of maternity nurses regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change. It shows that 54.0% of maternity nurses have a good level of knowledge, and 44.0% have a fair level of knowledge.

Figure 2 shows the sources of information about the potential consequences of heat exposure to mothers and newborns in the face of climate change shows that social media is the most common source of information for 43.1% of maternity nurses, followed by television, which is reported by 39% of nurses. The last reported source of information was from scientific conferences, which constituted 3.9%.

Table 3 displays the extent to which maternity nurses implement practices related to the possible effects of heat exposure on pregnant women and newborns amidst climate change. It

shows that 92.0% of the nurses had unsatisfactory interactions with the patients, but 80% of them had satisfactory procedures in the workplace. Furthermore, 100% of them display unsatisfactory practices when it comes to their involvement in training sessions regarding climate change. Additionally, 96.0% of nurses exhibit unsatisfactory behavior when it comes to utilizing the hospital's website and social media and involvement in policies and regulations regarding the effects of climate change. Regarding customs in society, 82.0% of them exhibit unsatisfactory practices. In relation to the overall level of practices of maternity nurses regarding the potential consequences of heat exposure on the health of expectant mothers and newborns in the face of climate change, it was discovered that 92.0% of them exhibit unsatisfactory practices, with an average score of 8.76 ± 2.65 .

Figure 3 shows the overall level of practice of maternity nurses regarding the potential consequences of heat exposure on expectant mothers and newborns in the face of climate change. It shows that 92.0% of maternity nurses have an unsatisfactory level of practice.

Table 1: Distribution of the Study Participants According to Their Personal Data (n = 50)

Variables	No.	%
Age		
20-<30	19	38.0
30-<40	13	26.0
≥40	18	36.0
Mean ± SD	36.07±11.01	
Marital status		
Single	15	30.0
Married	29	58.0
Divorced	2	4.0
Widowed	4	8.0
Residence		
Urban	47	94.0
Rural	3	6.0
Qualification		
Diploma of Secondary Nursing School	11	22.0
Diploma of Technical Institute of Nursing	18	36.0
Bachelor's degree in nursing	21	42.0
Work department		
Antenatal department	13	26.0
Labor department	10	20.0
Postpartum department	11	22.0
Gynecology department	10	20.0
Family planning department	6	12.0
Years of experience		
<5 years	13	26.0
5-10 years	9	18.0
>10 years	28	56.0
Mean ± SD	15.35±11.80	

Table 2: Maternity Nurses' Level of Knowledge Regarding the Potential Consequences of Heat Exposure on Mothers and Newborns in the Face of Climate Change (n = 50)

Items	Total (n= 50)		Mean scores		Mean percentage score
	No.	%	Min-Max	Mean±SD	
Nurses' level of knowledge about climate change in general.					
• Incorrect answers	1	2.0	6.00-22.00	17.64±2.68	63.00%
• Correct and incomplete answers	33	66.0			
• Correct and complete answers	16	32.0			
Nurses' level of knowledge regarding the potential consequences of heat exposure on the health of expectant mothers and newborns in the face of climate change					
• Incorrect answers	3	6.0	0.00-28.00	18.76±6.58	62.55%
• Correct and incomplete answers	21	42.0			
• Correct and complete answers	26	52.0			

Figure 1: The Overall Level of Knowledge of Maternity Nurses regarding the Potential Consequences of Heat Exposure on Mothers and Newborns in the Face of Climate Change

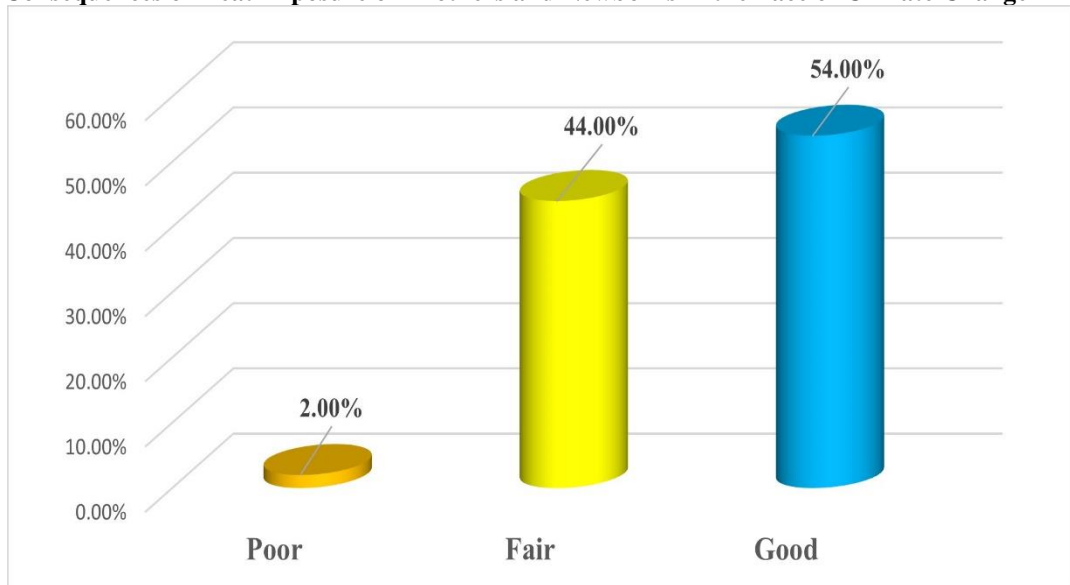


Figure 2: Sources of information about the Potential Consequences of Heat Exposure on Mothers and Newborns in The Face of Climate Change

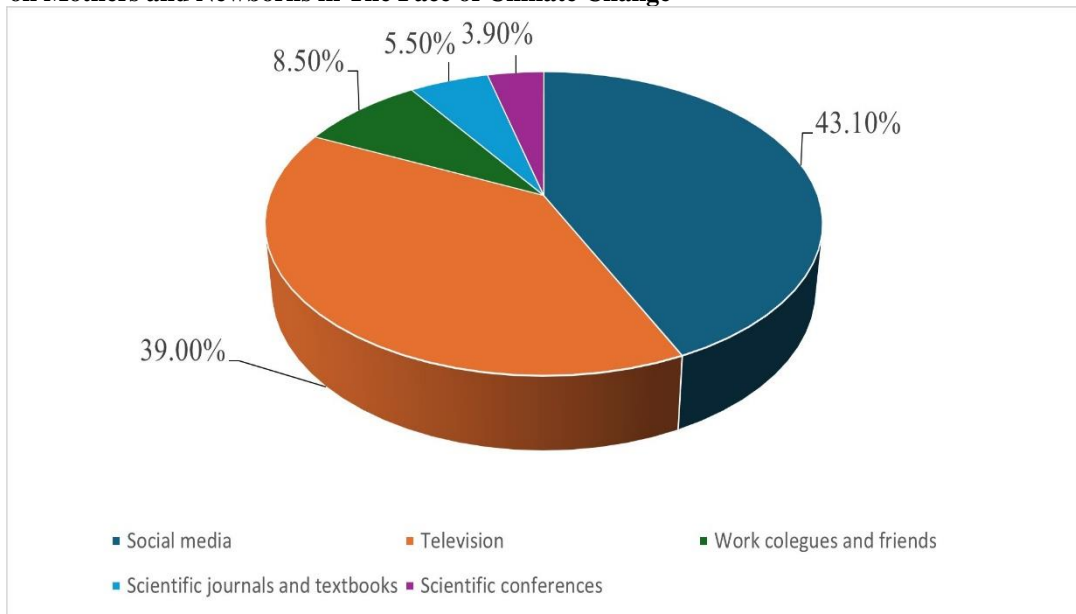


Table 3: Maternity Nurses' Level of Practice Regarding the Potential Consequences of Heat Exposure to Mothers and Newborns in the Face of Climate Change (n = 50)

Items	Total (n= 50)		Mean scores		Mean percentage score
	No.	%	Min-Max	Mean±SD	
Interactions with the patients					
• No practice	46	92.0			
• The presence of practice	4	8.0	0.00-5.00	0.75±1.01	12.48%
Procedures in the workplace					
• No practice	10	20.0			
• The presence of practice	40	80.0	4.00-11.00	7.58±1.51	58.28%
Involvement in training sessions regarding climate change					
• No practice	50	100.0			
• The presence of practice	0	0.0	0.00-2.00	0.07±0.29	1.49%
Utilizing the hospital's website and social media					
• No practice	48	96.0			
• The presence of practice	2	4.0	0.00-1.00	0.04±0.20	4.31%
Involvement in policies and regulations regarding the effects of climate change					
• No practice	48	96.0			
• The presence of practice	2	4.0	0.00-1.00	0.03±0.17	3.14%
Customs in society					
• No practice	41	82.0			
• The presence of practice	9	18.0	0.00-2.00	0.29±0.66	14.31%

Figure 3: The Overall Level of Practices of Maternity Nurses Regarding the Potential Consequences of Heat Exposure on Mothers and Newborns in the Face of Climate Change



Table 4: Correlation between Total Knowledge and Practice Scores of Maternity Nurses Regarding the Potential Consequences of Heat Exposure on Mothers and Newborns in the Face of Climate Change (n = 50).

Variables	r	P value
Overall knowledge score and overall practice score	0.220	<0.001**

r: Pearson coefficient;

**highly statistically significant at $p \leq 0.001$

Discussion:

Global health is endangered by climate change, prompting health professionals to act against its harmful effects. Climate change impacts various aspects of health by influencing access to clean air, safe drinking water, sufficient food, and secure housing. Forecasts suggest that from 2030 to 2050, approximately 250,000 extra deaths each year will occur because of malnutrition, malaria, diarrhea, and heat-related diseases caused by climate change. Areas with inadequate healthcare facilities, especially in developing nations, will encounter the biggest hurdles in getting ready and reacting without external assistance (World Health Organization [WHO], 2021; Acuña et al., 2023).

Climate change is eroding several of the key social determinants that support good health, including access to healthcare, social support structures, and livelihoods that promote equality. It is worth noting that the risks associated with climate-sensitive health outcomes disproportionately affect the most

vulnerable and marginalized members of society, including women (World Health Organization [WHO], 2021).

Both nurses in general and maternity nurses specifically play a crucial role in understanding the potential consequences of heat exposure on the health of expectant mothers and newborns in the face of climate change. Having a leading role in healthcare means having the duty to identify and respond to the impacts of climate change on the health of expectant mothers and newborns in the face of climate change. Therefore, the objective of this research was to evaluate the understanding and behaviors of maternity nurses concerning the potential consequences of heat exposure on the health of expectant mothers and newborns in the face of climate change.

The study's findings indicated that maternity nurses have a reasonable level of knowledge concerning the potential consequences of heat exposure on the health of expectant mothers and newborns in the face of climate change. This aligns with Amin et al.'s

study (2023) on predictors of climate change knowledge and risk perception among adults in El-Beheira Governorate, Egypt, who reported adequate understanding of climate change. However, this contradicts Mohammed et al.'s (2022) study on nursing students' knowledge, attitude, and practice regarding the health effects of climate change in Egypt and Abdallah and Farag's (2022) study on the impact of an awareness program regarding the health consequences of climate change on knowledge, perception, and daily life practices among nursing students in Egypt, which concluded that the overall knowledge level was low.

The results of the present study indicated that social media and television were the primary sources of information on climate change for the participants in the study. It was quite fascinating to discover that individuals still rely on television to obtain information. This could be because most of the study participants are in their late thirties and are less likely to use social media compared to younger individuals.

This discovery aligns somewhat with the research conducted by Sambath et al. (2022) about knowledge, attitudes, and practices related to climate change and its health aspects among the healthcare workforce in India—a cross-sectional study that revealed that approximately one-fourth of participants cited television and social media as their main sources of information on climate change. Another relatively stable investigation carried out by Mohammed et al. (2022) revealed that merely one-fifth of the participants in the study indicated that TV and radio were the primary sources of information regarding climate change.

Furthermore, the results of the present study indicate that nurses' actions regarding the effects of climate change on the health of expectant mothers and newborns in the face of climate change are not up to standard. This outcome reveals a disconnect between knowledge and practice, potentially due to heavy workloads, inadequate supervision, and a lack of understanding regarding necessary practices in the work environment to minimize the impact of climate change on the health of expectant mothers and newborns. These practices predominantly focus on health education, behaviors, and procedures within the work setting rather than direct patient care.

This discovery aligns with the outcome described by Kircher et al.'s (2022) study on "Understanding the knowledge, attitudes, and practices of healthcare professionals towards climate change and health in Minnesota." They uncovered inadequate behaviors concerning climate change in the research participants of the study titled "Examining the Understanding, Beliefs, and Actions of Healthcare Professionals Regarding Climate Change and Health in Minnesota" and identified barriers such as time constraints and disinterest. Similarly, Abdallah and Farag (2022) and Mohammed et al. (2022) also found that the overall practice level was insufficient among the individuals in their study. Nevertheless, the recent discovery contradicts Rahman et al.'s (2021) study on "Knowledge, attitudes, and practices on climate change and dengue in Lao People's Democratic Republic and Thailand," which found that most participants in their research on "Knowledge, Attitudes, and Practices on Climate Change and Dengue in Lao People's Democratic Republic and Thailand" had proper practices.

The present research also found a statistically significant correlation between the total knowledge score and the total practice score among the surveyed nurses. This discovery aligns with Mahmoud and Mahmoud's (2023) results regarding the "Effect of climate change on health and critical care nurses' practice" in Egypt, which showed a significant relationship between the overall knowledge and practice of the nurses in the study. Nevertheless, the findings contradict those of Abdallah and Farag (2022), as they discovered no significant correlation between the total knowledge and practice scores of the nurses in the study.

The results of the present research could assist in bridging the divide between nurses' understanding and actions, thereby enhancing the practice of nurses, which will have a positive impact on the health of expectant mothers and newborns in the face of climate change.

Conclusion:

The study findings revealed that maternity nurses had a fair level of knowledge, answering the first research question: "What is the level of maternity nurses' knowledge regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change?" Additionally, the study findings found

that maternity nurses demonstrated unsatisfactory practices overall, addressing the second research question: "What is the level of maternity nurses' practices regarding the potential consequences of heat exposure on mothers and newborns in the face of climate change?" Consequently, a disparity exists between knowledge and implementation.

Recommendations:

The present study suggests the following recommendations based on its findings:

- Organize educational programs and training workshops by maternity health authorities to increase nurses' understanding of the effects of climate change on the health of expectant mothers and newborns in the face of climate change.
- Utilize social media platforms to improve nurses' understanding and support their implementation of strategies related to climate change.
- Use digital platforms to spread evidence-based knowledge about climate change through health education.
- Include education on climate change in nursing curricula at every level.

Suggestions for further studies

- A more in-depth study is required to evaluate the understanding and behaviors of additional healthcare staff regarding climate change on a broader scale.

Acknowledgement:

I want to express my gratitude to all maternity nurses and mothers and newborns who willingly participated in this study as well as the staff of University Hospital and Shebin El-Kom Teaching Hospital who participated in providing patient centered care and who were totally helpful throughout the data collection process.

References

Abdallah, Z., & Farag, W., (2022). Impact of awareness program regarding health consequences of climate change on knowledge, perception and daily life practices among nursing students. *Egyptian Journal of Nursing and Health Sciences*, 3(1), 367-390.

Acuña, J., Baker, A., Jain, M., Renaldi, A., Riddell, J., Schulman, S., & Mendoza, V., (2023). 2023 Climate and Labor Conference: Bringing Worlds Together.

April 19 - 20, 2023.

<https://pulitzercenter.org/event/2023-climate-and-labor-conference-bringing-worlds-together>. [Accessed in: May 2023]

- American Academy of Pediatrics. (2021). *Global Climate Change and Children's Health*. American Academy of Pediatrics.
- Amin, S. M., Eldeeb, A. M. E.-M., & Elbially, A. A. (2023). Predictors of climate change knowledge and risk perception among the adults in El beheira Governorate. *Assiut Scientific Nursing Journal*, 11(34), 41-51. <https://doi.org/10.21608/asnj.2023.187563.1489>.
- Bekkar, B., Pacheco, S., Basu, R., & DeNicola, N. (2020). Association of air pollution and heat exposure with preterm birth, low birth weight, and stillbirth in the US: A systematic review. *JAMA network open*, 3(6), e208243. <https://doi.org/10.1001/jamanetworkopen.2020.8243>.
- Borgå, K., McKinney, M., Routti, H., Fernie, K., Giebichenstein, J., Hallanger, I., & Muir, D. (2022). The influence of global climate change on accumulation and toxicity of persistent organic pollutants and chemicals of emerging concern in Arctic food webs. *Environmental science. Processes & impacts*, 24(10), 1544-1576. <https://doi.org/10.1039/d1em00469g>.
- Casey, G., Shayegh, S., Moreno-Cruz, J., Bunzl, M., Galor, O., & Caldeira, K. (2019). The impact of climate change on fertility. *Environmental Research Letters*, 14(5), 054007.
- Chersich, M., Maimela, G., Lakhoo, D., Solarin, I., Parker, C., and Scorgie, F., (2022). Climate change impacts on maternal and newborn health in Africa: Intervention options. *Wits Journal of Clinical Medicine*. 2022. Vol. 4(3):169-172. DOI: 10.18772/26180197.2022.v4n3a7
- COP27. (2022). UN COP27: Sharm El-Sheikh, Egypt. Nov 07 - 18. COP27.
- Dunne, D. (2020). *Mapped: How climate change disproportionately affects women's health*.

- <https://www.carbonbrief.org/mapped-how-climate-change-disproportionately-affects-women's-health/>. [Accessed in: May 2023]
- Fan, S., & Koski, A. (2022). The health consequences of child marriage: a systematic review of the evidence. *BMC Public Health*, 22(1), 309. <https://doi.org/10.1186/s12889-022-12707-x>.
- Fisher, R. A., & Yates, F. (2023): Statistical tables for biological, agricultural, and medical research. Oliver & Boyd, London.
- Giudice, L., Llamas-Clark, E., DeNicola, N., Pandipati, S., Zlatnik, M., Decena, D., Woodruff, T., & Conry, J. (2021). Climate change, women's health, and the role of obstetricians and gynecologists in leadership. *International Journal of Gynaecology and Obstetrics*, 155(3), 345-356. <https://doi.org/10.1002/ijgo.13958>.
- Global Climate Change [NASA]. (2022). Understanding our planet to benefit humankind. <https://climate.nasa.gov/>. [Accessed in: June 2023]
- Haghighi, M., Wright, C., Ayer, J., Urban, M., Pham, M., Boeckmann, M., Areal, A., Wernecke, B., Swift, C., Robinson, M., Hetem, R., & Chersich, M., (2021). Impacts of High Environmental Temperatures on Congenital Anomalies: A Systematic Review. *International journal of environmental research and public health*, 18(9), 4910. <https://doi.org/10.3390/ijerph18094910>.
- Jain, M., & Singh, M. (2023). Environmental Toxins and Infertility. *StatPearls*.
- Kircher, M., Doheny, B. M., Raab, K., Onello, E., Gingerich, S., & Potter, T. (2022). Understanding the knowledge, attitudes, and practices of healthcare professionals toward climate change and health in Minnesota. *Challenges*, 13(2), 57. <https://doi.org/10.3390/challe13020057>.
- Mahmoud, F. H., & Mahmoud, B. H. (2023). Effect of climate change on health and critical care nurse's practice. *The Egyptian Journal of Hospital Medicine*, 90(1), 1149-1155.
- Martin, W., & Vold, N. (2019). Climate Change and Health: It's time for nurses to act. *Canadian Association of Physicians for the Environment*.
- Mohammed, E., El-Mouty, A., & Ameen, N. (2022). Nursing students' knowledge, attitude, and practice regarding health effects of climate change. *Mansoura Nursing Journal*, 9(2), 589-601.
- Rahman, M. S., Overgaard, H. J., Pientong, C., Mayxay, M., Ekalaksananan, T., Aromseree, S., Phanthanawiboon, S., Zafar, S., Shipin, O., Paul, R. E., Phommachanh, S., Pongvongsa, T., Vannavong, N., & Haque, U. (2021). Knowledge, attitudes, and practices on climate change and dengue in Lao People's Democratic Republic and Thailand. *Environmental research*, 193, 110509. <https://doi.org/10.1016/j.envres.2020.110509>.
- Sambath, V., Narayan, S., Kumar, P., Kumar, P., & Pradyumna, A. (2022). Knowledge, attitudes and practices related to climate change and its health aspects among the healthcare workforce in India – A cross-sectional study. *The Journal of Climate Change and Health*, 6, 100147. <https://doi.org/10.1016/j.joclim.2022.100147>.
- Un Women. (2022). Explainer: How gender inequality and climate change are interconnected. <https://www.unwomen.org/en/news-stories/explainer/2022/02/explainer-how-gender-inequality-and-climate-change-are-interconnected>. [Accessed in: July 2023]
- Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Belesova, K., Boykoff, M., Byass, P., Cai, W., Campbell-Lendrum, D., Capstick, S., Chambers, J., Dalin, C., Daly, M., Dasandi, N., Davies, M., Drummond, P., Dubrow, R., Ebi, K. L., Eckelman, M., Ekins, P., ... (2019). The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. *Lancet* (London, England),

394(10211), 1836-1878.
[https://doi.org/10.1016/s0140-6736\(19\)32596-6](https://doi.org/10.1016/s0140-6736(19)32596-6).

World Health organization [WHO]. (2021).
Climate change and health. WHO.

World Health organization [WHO]. (2022).
Climate Action: Fact Facts on Climate and
Health. WHO.

Zhang, W., Spero, T. L., Nolte, C. G., Garcia, V.
C., Lin, Z., Romitti, P. A., Shaw, G. M.,
Sheridan, S. C., Feldkamp, M. L., Woomert,
A., Hwang, S. A., Fisher, S. C., Browne, M.
L., Hao, Y., & Lin, S. (2019). Projected
Changes in Maternal Heat Exposure During
Early Pregnancy and the Associated
Congenital Heart Defect Burden in the
United States. *Journal of*
the American Heart Association,
8(3), e010995.
<https://doi.org/10.1161/jaha.118.010995>.