Effect of Adaptation Strategies on Raising Mother's Awareness regarding Health Consequences of Climate Change among their Children

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Abstract

Background: climate change, caused by both natural factors and human activities, is a major global health concern. **Aim**: The study aimed to evaluate the effect of adaptation strategies on raising mother's awareness regarding health consequences of climate change among their children. **Study design:** A quasi-experimental design being utilized. **Setting:** The study was performed **in** outpatient clinics for nutrition and respiratory care at the pediatric hospital affiliated with Ain Shams University hospitals and the outpatient clinic at Mustafa Hassan pediatric hospital affiliated with Fayoum University. **Sampling:** The study included sample of a convenience 90 mothers accompanied with their children under 5 years old**. Tools of Data Collection: First tool:** A structured interview questionnaire consisting of four parts was employed. **Part I:** It concentrated on the mothers' and children's demographic characteristics. **Part II:** Presented health history of children less than five years. **Part III:** Displayed mothers' knowledge about climate change. **Part IV:** It concerned with adaptive strategies scale regarding climate changes. **Second tool:** To assess the mothers' mindful attention awareness scale regarding climate change. **Third tool:** Mentioned mothers' reported practices regarding health consequences of climate change. **Results:** The finding of the current study demonstrated that the mean age of mothers were 36.11±8.22 .Also, following implementation of adaptation strategies, 81.1%, 83.3%, 80%,and 86.7% of mothers stated having good levels of knowledge, adaptive, awareness and practices about mothers' awareness regarding the health consequences of climate change among their children, respectively. Additionally, there was a highly statistically significant difference in the mothers' claimed knowledge and reported practices, as well as awareness regarding their children adaptation to change in the climate. **Conclusion:** The study's conclusions indicated that mothers' knowledge of the troubling implications of changes in the climate on their children's wellbeing was insufficient, which in turn had an impact on their practices and awareness of the issues. Improvements in the total knowledge score, reported practices and adaptive methods to mitigate influences on health of climate change after intervention were highly statistically significant. Following the program's implementation, mothers' acquaintance of the negative health effects of the changing environment on their young children also emerged. **Recommendations:** Establish a training program to help mothers become more knowledgeable about adaptable strategies that will help alleviate the detrimental effects of environmental crisis on their children.

Keywords: Climate Change, Health Consequences, Mother's Awareness, Adaptive strategies

Introduction

Egypt is among the nation's most susceptible to the implications of the changing climate, with a ranking of 104 out of 185 countries in the 2021. This is true even if their contribution to worldwide releases of greenhouse gases is only 0.6%. The Intergovernmental Panel on climate Change

(IPCC) has named Egypt's Nile Delta as one of the three most vulnerable areas in the world to climate change events. Additionally, future projections indicate that Egypt will suffer from the following climate change events: rising sea level; water scarcity and deficit; and an increase in the frequency and intensity of extreme weather conditions such as heat waves, flashfloods, heavy rains, sand, and dust storms ***(WHO, 2023).***

The term "Climate change" denotes the persistent changes in regional or worldwide weather patterns and average temperatures that are predominantly caused by human activity, particularly the emission of carbon dioxide and other pollutants throughout the external environment. It leads to increased natural disasters, vector –borne diseases, reduced agricultural productivity, compromised air quality, and extreme temperature fluctuations. These effects directly and indirectly impact human well-being and undermine healthcare services ***(Ajanovic et al., 2020)***. Climate change also results in population displacement, disruptions in familial structures, increased violence, and erosion of social norms, exacerbated poverty, conflicts, and even wars. It profoundly affects water quality and availability, food security, public health, economic infrastructure; and citizen safety, intensifying its negative impact on human health ***(Zernia et al., 2023).***

Children constitute nearly half of the population in underdeveloped nations, and consequently, they are among the most significant demographics associated with climate change. Because of the way that their bodies are still developing, children are frequently more susceptible than the broader public to the negative health effects of environmental change including warmth and airborne pollutants. In addition, children are developing emotionally, as their brains continue to grow throughout adolescence. Children can experience mental health impacts from major storms, fires and other extreme events that are expected to increase with a changing climate ***(Phoebe et al., 2021).***

Access to vital health care and other services that help children, families, and communities prepare for and recover from climate-related disasters is lacking, as well as their exposure to multiple climate hazards. Meanwhile, the overall effects of environmental degradation are expected to be negative and pose serious challenges to many basic needs for survival and health, such as food, water and shelter, the effects on health can take many widespread forms. Therefore, children's health and wellbeing are vulnerable to impacts of climate change related to extreme heat, humidity, increased air pollution, changes in food and water, changes in vector borne diseases, and extreme weather that considered a direct threat to a child's ability to survive, grow, and thrive however, adaptation to this change is necessary ***(Abutaleb et al., 2020).***

The health and well-being of children are being significantly impacted by the changing climate, which is the most significantly impacted by the changing climate, which is the highest priority global 21st century health risk. This includes their mental and physical health, well-being, nutrition and protection and security Also, the effects of warning climate disproportionately affect children due to physiological, developmental, behavioral, and social variables. The effects of these modifications throughout their lifetime including physiological factors which increase the metabolic rate that lead to an increase in the minute ventilation rate and a rise inhalation in the quantity of airborne contaminated that are inhaled. Meanwhile, the climate crisis is one of the most serious issues that raised globally lately ***(Singer et al., 2022).***

Well-designed climate adaptation strategies can prevent the most severe consequences for child health, which can have substantial advantages for child health. Meanwhile, pediatric and community nurse should effectively utilize their existing roles

as educators, advocates, change agents, leaders, caregivers, and monitors to enhance child resilience, develop coping strategies and future oriented behaviors, and advocate for policies promoting social support ***(Phoebe et al., 2021).***

In order to lessen the impacts of environmental change, the concepts of adaptation and mitigation in pediatric and community health care revolve around primary and secondary preventive techniques. Descending the atmospheric quantities of environmental pollutants in an effort to impede the rate of environmental change is known as mitigation. Developing public health methods to reduce and eventually eradicate the negative health effects that local and regional climate change is expected to cause is known as adaptation secondary prevention. However, as more women become aware of these consequences, climate change is becoming a mainstream health concern rather than just a matter of scientific curiosity ***(Alison et al., 2022).***

Pediatric and community health nurses are dedicated to the promotion and preservation of children's health. Although, climate change threatens the health, welfare, and future of current and subsequent generations of children, the nurse can incorporate considerations of the effects of climate change on health into their professional practice and personal lives in many ways, including mother's education about ideal nutrition and maintain hydration and adaptation with climate changes, lifestyle practices, and political advocacy ***(Casanueva et al., 2021 and Singer et al., 2022).*** Also, the nurse has a key role in preventing children's deaths resulting from climate changes through preventive measures as immunization, adequate nutrition, safe water and food, adequate sanitation & hygiene and appropriate care by raising mother's awareness regarding health consequences of climate change among their children ***(Ajanovic et al., 2020).***

Significance of the study:

It is anticipated that severe weather conditions including heat waves, storms, landslides and heavy rains would happen more frequently and with greater intensity in Egypt. Poor people living in cities are more at risk. Approximately 2.4 million people may be affected by coastal flooding and rising sea levels by the 2080s, and an additional 1.1 million people may be at danger of yearly river floods by the 2030s.Roughly 15.2% of Egypt's deaths may be attributable to climate change. By the 2080s, it's anticipated that there would be 47 heat- related deaths for every 100.000 people. Risks associated with the nation's climate will affect the younger generations of today ***(WHO, 2023).***

Children are growing up in the face of a raising number of challenges, hazards, and risks due to environmental degradation and climate change worldwide. In addition to the current climate crisis, there are other crises involving hunger, water, health, education, and protection. Children under the age of five bear about 90% of the global burden of diseases linked to climate change; for instance, 525.000 children worldwide may away from diarrhea each year, which is contamination water from floods ***(UNICEF, 2024).***

As a result, children under the age of five accounts for one in five of all global deaths each year due to diseases linked to climate change. In the meantime, almost 50% of pediatric fatalities are caused by malaria, diarrhea, and lower respiratory tract infections. Furthermore, climate change may make all three of these disease types worse. According to estimates from the world health organization (WHO), air pollution will kill about7000.000 people in underdeveloped nation's year, while climate change is the cause of 250.000 deaths from diseases including malaria, heat exhaustion, and malnourishment. Children will be the most affected group between 2030 and 2050 since 48.000 of them die from diarrheal illnesses and 95,000 from malnutrition. Consequently,

one of the most important factors determining ***(WHO, 2023).***

Aim of The Study

This study aimed to evaluate the effect of adaptation strategies on raising mother's awareness regarding health consequences of climate change among their children through the following:

1. Assessing mothers' knowledge about climate change.
2. Assessing mothers' awareness regarding health consequences of climate change among their children
3. Assessing mothers' reported practices regarding adaptation with climate changes.
4. Designing and implementing of adaptation strategies for raising mothers' awareness to adapt with climate changes.
5. Evaluating the effect of adaptation strategies on raising mother's awareness regarding health consequences of climate change among their children.

Research Hypothesis:

- Mothers who participate in the program will increase the level of knowledge and practices regarding the negative effects of the changing climate post adaptation intervention than before.
- Mothers participating in the program will be more knowledgeable about post- adaptation program than they were previously.
- Mothers who participate in the program will have learned post-adaptation techniques after the implementation rather than beforehand.

Subjects & Methods

Research Design: Quasi experimental research design was employed in this research study with one-group pre/post-test.

A quasi-experiment is an empirical interventional study used to estimate the causal impact of an intervention on target population without random assignment ***(Gopalan et al., 2020 & Siedlecki, 2020).***

Settings:

The research study was carried out at the pediatric hospital affiliated with Ain Shams University's nutrition and respiratory care outpatients' clinics and at Mustafa Hassan Pediatric Hospital affiliated with Fayoum University. These settings were collected in particular as it serves a wide number of children from various governments and cultures from rural and urban areas.

Sampling:

Type:

Convenience samples of mothers having children under the age of five were targeted for recruitment.

Sample size:

The sample size was 90 mothers with children under 5 years of age who was calculated according to the sample equation based on data from the literature (**Rosner, 2021)**. Considering the level of significance of 5%, and power of study of 80 %, the sample size can be calculated using the following formula:

$$n = \left(\frac{Z_{1-\alpha/2} + Z_{1-\beta}}{ES} \right)^2$$

Where:

n=Sample size
z: The standard score
d: The error rate
p: Property availability and neutral ratio
n=Size of population
Accordingly, the sample size equaled 90 mothers.

Tools of the study

Data were collected through:

Tool I: A structured interviewing questionnaire:

It included four parts:

Part I: This part consisted of two sections

- **Section (1):** To assess the demographic characteristics of the mothers having children under five years and consisted of 7 closed-ended questions such as age, level of education, occupation, marital status, family income, and residence.
- **Section (2):** To assess the general characteristics of children under five years old and consisted of 5 closed-ended questions such as age, gender, order, and number of siblings.

Part II: This part assesses the history of children under five years and consists of 10 closed – ended questions such as history from allergy, history from chronic diseases and health consequences of the changing climate on child's body systems; as consequences on Respiratory System (common cold, sinusitis, chest allergy, bronchitis, and pneumonia); Gastro-Intestinal System (loss of appetite, indigestion, loss of weight, diarrhea, constipation, nausea, abdominal pain, and dehydration); Cardiac System (hypertension, hypotension, arrhythmia, and poor peripheral circulation); and Central Nervous System (headache, dizziness, stress, insomnia, and depression).

Part III: This part assesses the mothers' knowledge about the changing climate including 7 closed-ended questions such as concept, factors, the influence of the changing climates on children's bodies and their health, as well, adaptive strategies to maintain child's heath **(pre/post program).**

Scoring system:

Researchers compared mothers' responses to pre-determined model answers. One point was awarded for each correct answer and zero was awarded for incorrect answers. The total knowledge scores was32 grades because some of questions had more than one answer. These scores were summed-up and categorized into three categories: less than 50% (0-16 points) were considered poor, 50% (17- 24 points) to less than 75% were considered average and75% (25-32) points or more be considered good knowledge.

Part IV: Adaptive strategies scale regarding the changing climate: It consists of 56 closed-ended questions including adaptive strategies were taken by mothers to eliminate the influence of climate changes on their children's health as: adaptation with high temperature (10 items), adaptation with severe cold waves (11 items), adaptation to avoid burns from high temperature (4 items), adaptation with high rate of air pollution in the atmosphere (6 items), adaptation to avoid eye dryness (4 items), adaptation to avoid respiratory diseases (10 items), and adaptation with infectious diseases (12 items).This tool has been taken from **(Cook et al., 2021)** and modified by the researcher, was used twice **(pre/post-program).**

Scoring system:

Each answer with "done" had one score and the "not done" answer had zero score. The scores of all items were summed-up and converted into a percentage. The total practice score was 56 and categorized into two categories: less than 60% (0-33 points) were considered mal-adaptive and 60% or more (33- 56 points) were considered **adaptive.**

Second tools: Mindful Attention Awareness Scale (MAAS): It derived from ***Brown & Ryan (2021)*** to assess mother's mindful attention awareness about climate change namely; a receptive state of mind in which attention, informed by a sensitive awareness of what is occurring in the present, simply observes what is taking place. This tool was modified and translated into Arabic language by the researchers, was used twice (pre/post-program).

Scoring System:

Each item was scored from 1to 6. The rating responses were 1 (Almost Always), 2 (Very Frequently), 3 (Somewhat Frequently), 4 (Somewhat Infrequently), 5 (Very Infrequently), and 6 (Almost Never). The total scores were summed up which equaled 36

degrees, then categorized into three categories: less than 50% (0- 18 points) were considered low, 50% (19- 27 points) to less than 75% were considered average and75% (28-36) points or more be considered high mindful attention awareness.

Third tools: Mothers reported practices: It was adopted from ***Singer et al. (2022)*** and modified by researchers to assess mothers reported practices regarding tooth brushing, respiratory hygiene and cough etiquette, breathing and cough exercises, eye care, food preparation and storage, nebulizer session, Chest percussion. In addition, mother's practices regarding common health problems experienced by their children as anorexia, colic, constipation, vomiting, fever, diarrhea, dehydration, and low immunity, was used twice **(pre/post-program).**

Scoring system:

Each answer with "done" had one score and the "not done" answer had zero score. The scores of all items were summed-up and converted into a percentage. The total practice score was 256 and categorized into two categories: less than 60% (0-153 points) were considered inadequate and 60% or more (154-256 points) were considered adequate.

Operational Design:

Preparatory phase:

A review of recent, past, national and international related literature or various aspects related to the topic was done using articles, textbooks and internet searches to become familiar with the research problem and to develop the tools of the study.

Content validity:

It was ascertained by a group of five experts from the Family and Community Health Nursing and pediatric nursing departments, Faculty of Nursing, Ain Shams University. Their feedback was sought on the tools' format, layout, consistency, accuracy, and relevance of content. All required modifications were completed as instructed.

Reliability:

The tool's reliability was assessed as moderate to high through the Cronbach's alpha test. The results also suggest that the tool's items are closely connected. The reliability of the developed tools was evaluated by using Cronbach's alpha; test and the results were as follows:

Tools	Alpha Cronbach
Knowledge of the mothers about climate change	0.896
Adaptive strategies scale regarding climate changes	0.901
Mindful Attention Awareness Scale	0.933
Mothers reported practices	0.889

Pilot study:

To assess the viability, lucidity, and practicality of the study's methodology, a pilot test was conducted involving 9 mothers, representing 10% of the target population, in the previously specified settings. In addition, the pilot study allowed the researchers to estimate the time needed for participants to finish the questionnaires. The pilot study demonstrated that the tools worked as intended without requiring modifications. Consequently, the mothers that took part in the trial were incorporated into the primary study group. These mothers lacked adequate knowledge, practices regarding adaptation with climate changes, and awareness regarding health consequences of climate change. As a result, they required a program to address these issues.

Field work:

Following approval, researchers introduce themselves to the head nurses of previous family medicine centers and describe the aim and components of the program. The researchers conducted their study three days a week, from 9 a.m. to 2 p.m., in the pre-mentioned settings. They began each visit by introducing themselves to the studied mothers, who had been chosen based on

predetermined criteria. The study spanned six months, beginning in February and concluding in July 2024. Researchers at nutrition and respiratory outpatients' clinics at Pediatric Hospital affiliated with Ain Shams University hospitals as well as outpatients' clinic at Mustafa Hassan Pediatric Hospital affiliated to Fayoum University collected data from an average of four to five mothers daily. The study measured the program's impact by administering pre- and post-program tests to assess the studied mothers' knowledge, practices regarding adaptation with climate changes and their awareness to lessen the impact of climate changes on their children's health before participating in the program.

Ethical considerations:

Approval was obtained from the Ethical Committee of the Faculty of Nursing at Ain Shams University (Ethical code is 24.02.234). They also discussed ethical concerns with health unit directors and head nurses of each setting. Prior to commencing the research study, the researchers discussed the purpose of the research with participating mothers. Following this, these mothers gave their formal consent to be involved in the study. Participant privacy was protected by keeping information confidential and anonymous. The only usage of the data was for study.

Administrative Design

The Dean of the Faculty of Nursing at Ain Shams University submitted a formal letter detailing the research and its goals to secure permission for the study. The letter was initially sent to the Directors of outpatient clinics, where the research would occur.

Educational Program Instruction:

It was implemented through four phases:

Phase I: Program Development

A thorough analysis of pertinent recent, current, national and international related literature was conducted. Data was collected through books, journals, magazines, and internet searches related to adaptation strategies on raising mother's awareness regarding health consequences of climate change among their children. The researchers designed the program based on pre-test results.

Phase II: Assessment

By using a pre-test to gauge the mothers' and children requirements, researchers evaluated their awareness of reducing the influence of the changing climate regarding their well-being as well as their knowledge and practices in adapting to these changes. For two weeks, the pre-test was given in each setting three times a week. It took 20 and 30 minutes to finish each test.as a whole, this process took eight weeks.

Phase III: Program Implementation

It took eight weeks to implement the program, which was conducted in the reception areas of the previously stated locations.

Program sessions:

Eight sessions in foremost, divided into two sessions per week, were implemented at the outpatient clinic over a period of four weeks. Twice, Pre-and post-program assessments were given the mothers understudy in order to assess their knowledge, reported practices, awareness and their adaptive strategies to reduce the influence of the changing climate regarding their children.

The program began with an introduction explaining its goals and purpose. Beginning with the second meeting, each session started with a brief summary of the prior session's key points and outlined the goals for the next, using language accessible to all participants. Each session concluded with a summary of the discussion, time for questions and answers, and a plan for the next session. This wasn't done for the final session, as it ended with feedback on the overall process.

General program objectives:

To raise mothers' knowledge of the influence of environmental change

regarding the health of their children by expanding their knowledge, practicing adaptation to modified conditions, and raising awareness of ways to mitigate these effects.

Teaching methods: The researcher employed a range of instructional strategies, including group discussion, brainstorming, and lectures, to educate mothers about the harm that changing the climate does to their health.

An instructional teaching video film: The researchers created a video clip, PowerPoint slides, and images about climate change that included information on the concept, factors, and health effects of the change on children's body systems as well as adaptable strategies to reduce the negative effects of the climate on their children's health.

An instructional teaching booklet in simple Arabic, using language that is straight forward and simple words and an illustrated colored paper booklet were handed to each mother entitled " Effect of Adaptation Strategies on Raising Mother's Awareness regarding Health Consequences of Climate Change among their Children" as guidance at home to ensure that mothers understood the information included in the program and to be sure that the mothers could apply.

Phase IV: Program Evaluation

This phase's goal was to ascertain how the program affected the knowledge, behaviors, and awareness of the participants. After the program, they were put to the test. The results of the programs' similarities, differences, strengths, and weaknesses are examined by the researches. All of this takes place a week after the program ends.

IV. Statistical Design

The coded data from the study was input by the researchers into computer software called SPSS (version 22) to analyze it. They used basic statistics like frequencies, means, and standard deviations to describe the data. They also used chi-square, independent t-test and one-way ANOVA test to compare the data from two groups (likely before and after a program) and Pearson's correlation to assess the relationships between two continuous variables. They considered the results statistically significant at $p < 0.05$ and highly significant at $p < 0.001$.

Results

Table (1): presents the demographic characteristics of mothers. It clarifies that the mean of women's ages included in the study was 36.11±8.22. Concerning mother's level of education, 44.5% of them were in secondary education, while 13.3% of them were illiterate. About their education, 73.3% of mothers were housewives. As well, 73.3% had insufficient monthly income for their needs.

Table (2): reveals that 57.8% of children, their age ranged from 1< 3years with a mean 3.35±1.83 years and 58.9% of them were males.

Table (3): indicates that, 43.3% of children had allergy regarding changing the climate and 18.9 % of then had history of chronic disease.

Figure (1): reveals that 88.9% of children experienced health issues related to the influence of the changing climate on their digestive systems, and 93.3% of children experienced issues with their respiratory system.

Figure (2): shows the total level of mother knowledge about the effects of climate change on their children's health pre/post implementation of adaptation strategies. It reveals that 13.3% of mothers had a good level of total knowledge; preprogram. On the other hand, 81.1% had a good level of total knowledge post-program with a highly statistically significant improvement (p=<0.001).

Table (4): displays the distribution of mothers based on the adaptive strategies to lessen health consequences of climate change among their children at pre and post implementation of adaptation strategies. It demonstrates a notable improvement in mothers' pre-and post-program adaptability to burn, high temperature, and respiratory illnesses (23.3%, 83.3% & 26.7%, 85.6%, & 20.0% and 78.9% respectively). A statistically significant improvement was observed (p=<0.001).

Figure (3): shows the total level of mothers according to their adaptive strategies to eliminate the negative health effects of changing the change on their children pre/post implementation of adaptation strategies. It reveals that 31.1% of mothers had adopted strategies at pre-program. While following the program, 83.3% of them had implemented adaptation techniques to decrease the negative health effects of changing the climate on their children post implementation of adaptation strategies**.**

Figure (4): demonstrates the total level of mothers' mindful attentive awareness before and after implementing adaptation techniques regarding health effects of changing the climate on among their children. It reveals an improvement in mothers' mindful attention awareness pre/post program as 10.0% of mothers had high mindful attentive awareness, pre-program. While, 80.0% had high mindful attentive awareness, following implementation of adaptation techniques, with a highly statistically difference in improvement between pre and post program (p=<0.001).

Figure (5): reveals that 23.3% of mothers had an adequate level of total reported practices regarding health impacts of changing the climate among their children in before implementation of adaptation strategies which improved to 86.7% in the post implementation of adaptation strategies with a highly statistically significant improvement (p=<0.001).

Table (5): reveals that there was a positive correlation between mothers' total knowledge, total reported practices, total mindful attention awareness, and total strategies adaptative score and regarding the health effects of changing the climate among their children pre/post implementation of adaptation strategies with a highly statistically significant improvement (p=<0.001).

Table (1): Frequency Distribution of Mothers According to Their Demographic Characteristics (n=90).

Items	No.	%
Age (Years)		
< 20	3	3.3
20<30	22	24.4
30<40	33	36.7
≥ 40	32	35.6
Mean ±SD	**36.11±8.22**	
Marital status		
Married	80	88.9
Divorced	6	6.7
Widowed	4	4.4
Educational level		
Read and write	12	13.3
Primary education	10	11.1
Preparatory education	10	11.1
Secondary education	40	44.5
High education	18	20.0
Occupation		
Working	24	26.7
Housewife	66	73.3
Residence		
Rural	41	45.6
Urban	49	54.4
Family income		
Sufficient	24	26.7
Insufficient	66	73.3

Table (2): Frequency Distribution of Children According to Their Characteristics (n=90).

Items	No.	%
Age (Years)		
<1	20	22.2
1<3	52	57.8
3≤5	18	20.0
Mean ±SD	**3.35±1.83**	
Gender		
Male	53	58.9
Female	37	41.1
Number of siblings		
Not	6	6.6
One	3	3.3
Two	15	16.7
Three	41	45.6
Four	14	15.6
More than four	11	12.2

SD= Standard deviation.

Table (3): Distribution of the Studied Children Regarding Their Health Problems History (n=90).

Items	No	%
History from an allergy to climate change		
Yes	39	43.3
No	51	56.7
History from chronic diseases		
Yes	17	18.9
No	73	81.1
If the answer is yes, mention the chronic diseases (n=17)		
Diabetes mellitus	9	53.0
Heart disease	3	17.6
Respiratory disease	5	29.4

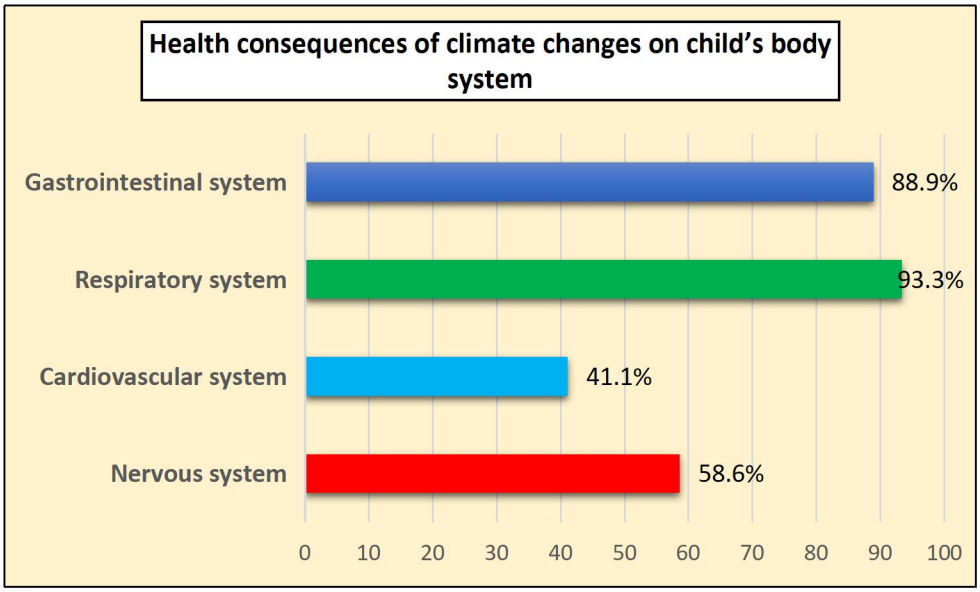
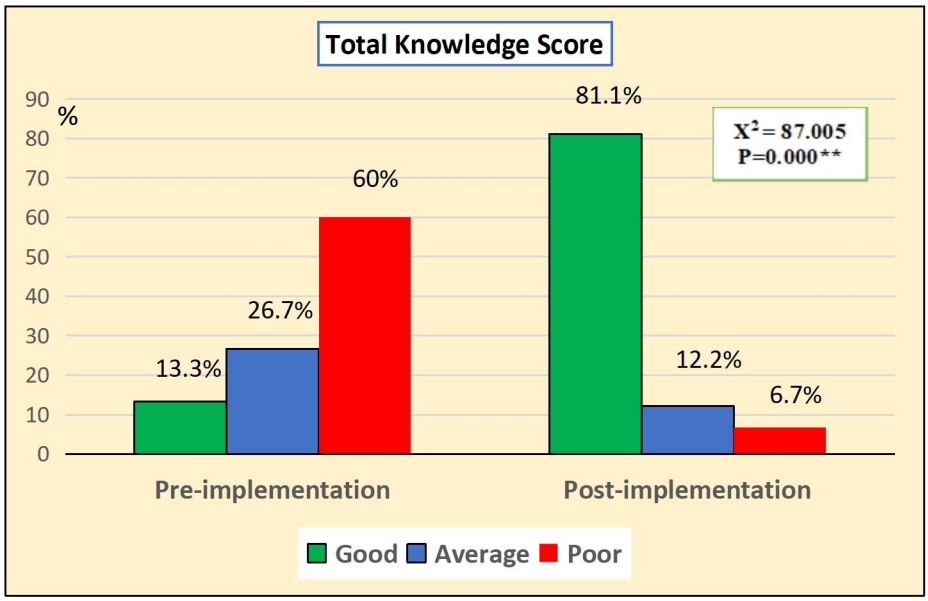


Figure (1): Distribution of Different Health Consequences of the Changing Climate on Child's Body System (n=90).



X^2: Chi-square test, **t=** Paired t. test, **SD=** Standard deviation **highly significant at p ‹ 0.001.

Figure (2): Distribution of The Studied Mothers According to Their Total Knowledge about Changing the Climate at Pre and Post Implementation of Adaptation Strategies (n=90).

Table (4): Comparison Between the Mothers Under Study According to their Adaptive Strategies to Lessen Health Consequences of Climate Changes Among Their Children at Pre and Post Implementation of Adaptation Strategies (n=90).

Items	Pre-Program				Post -Program				X^2	P-value
	Adaptive		Mal-adaptive		Adaptive		Mal-adaptive			
	No.	%	No.	%	No.	%	No.	%		
High temperature	21	23.3	69	76.7	75	83.3	15	16.7	65.089	0.000**
Severe cold waves	39	43.3	51	56.7	78	86.7	12	13.3	37.143	0.000**
Avoid burns from high temperature	24	26.7	66	73.3	77	85.6	13	14.4	63.369	0.000**
Air pollution	30	33.3	60	66.7	72	80.0	18	20.0	39.910	0.000**
Avoid respiratory diseases	18	20.0	72	80.0	71	78.9	19	21.1	62.430	0.000**
Avoid eye dryness	15	16.7	75	83.3	66	73.3	24	26.7	58.384	0.000**
Infectious diseases	18	20.0	72	80.0	67	74.4	23	25.6	53.521	0.000**
Total score	28	31.1	62	68.9	75	83.3	15	16.7	50.135	0.000**
Mean ±SD	29.48±5.81				47.56±9.50				t=19.01	0.000**

X^2: Chi-square test, **t=** Paired t. test, **SD=** Standard deviation **Highly significant at p ‹ 0.001.

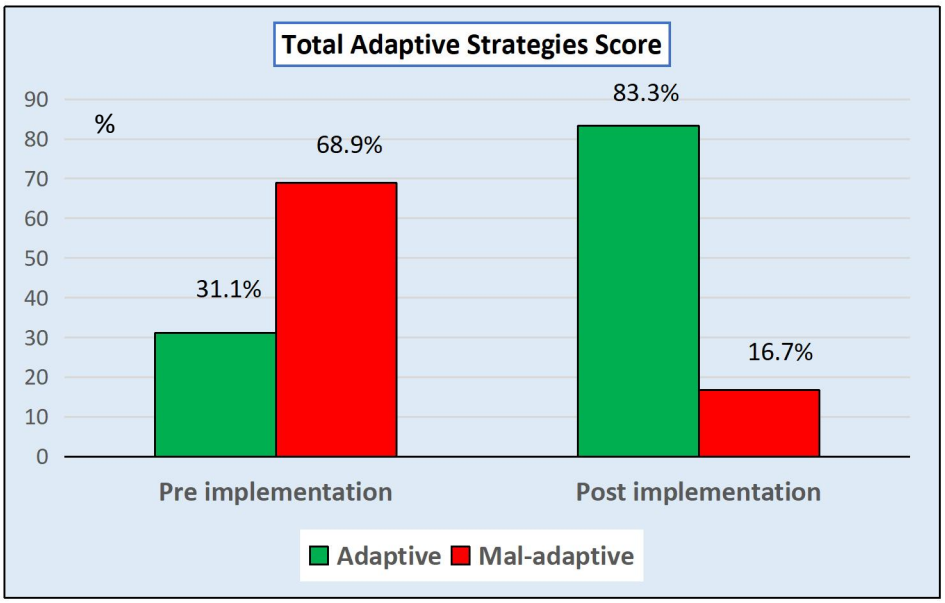


Figure (3): Distribution of the Studied Mothers According to their Total Adaptive Strategies to Decrease the Influence of Changing the Climate on Their Children's Health at Pre and Post Implementation of Adaptation Strategies (n=90).

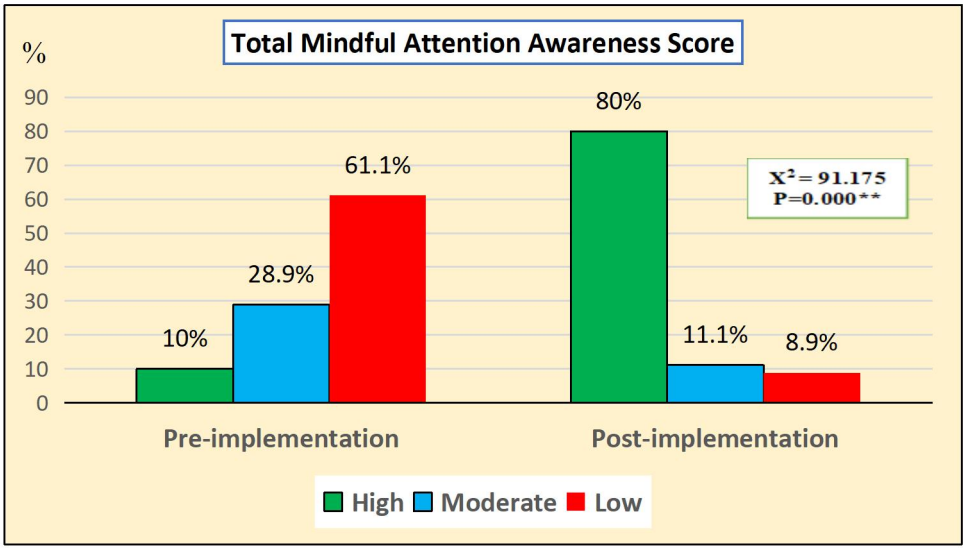
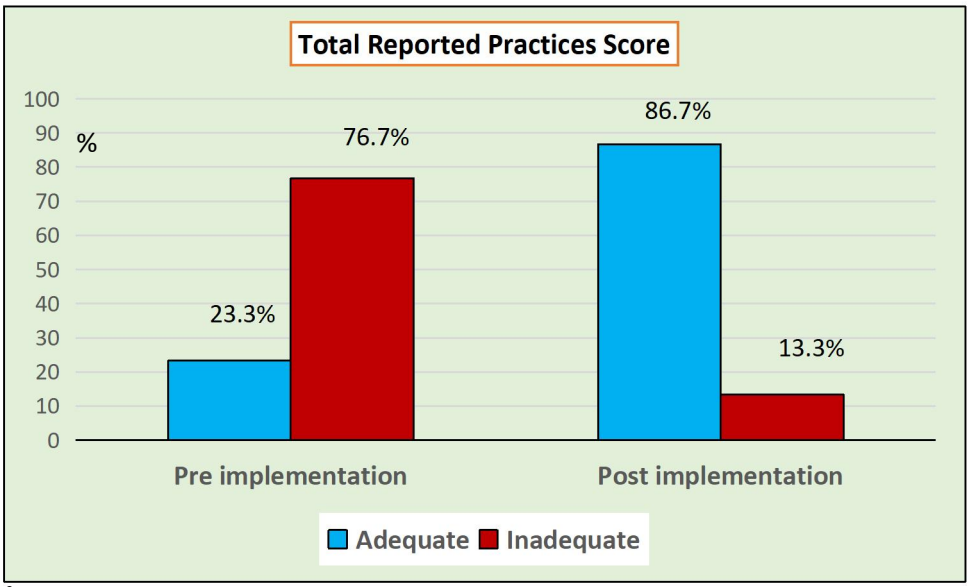


Figure (4): Distribution of the Studied Mothers According to Their Total Mindful Attention Awareness Regarding Health Consequences of Climate Change on Their Children at Pre and Post Implementation of Adaptation Strategies (n=90).



X^2: Chi-square test**, t=** Paired t. test, **SD=** Standard deviation **Highly significant at p ‹ 0.001.

Figure (5): Distribution of the Studied Mothers According to Their Total Reported Practices at Pre and Post Implementation of Adaptation Strategies (n=90).

Table (5): Correlation Between Total Mothers' Knowledge Score, Total Adaptive Strategies Score, Total Mindful Attention Awareness Score, and Total Reported Practices Score Regarding Health Consequences of Climate Change Among Their Children at Pre and Post Intervention (n=90).

Variables		Total knowledge score		Total adaptive strategies score		Total mindful attention awareness score	
		Pre	Post	Pre	Post	Pre	Post
Total knowledge score	**r**						
	p						
Total adaptive strategies score	**r**	0.902	0.827				
	p	0.000**	0.000**				
Total mindful attention awareness score	**R**	0.784	0.786	0.816	0.870		
	p	0.000**	0.000**	0.000**	0.000**		
Total reported practices score	**R**	0.917	0.845	0.955	0.934	0.758	0.933
	p	0.000**	0.000**	0.000**	0.000**	0.000**	0.000**

r= Pearson correlation coefficient test. **Highly significant at p ‹ 0.01.

Discussion

Climate change is the biggest threat to children and youth worldwide. Climate change poses major hazards to their health, nutrition, education, and future. Children are more susceptible to diseases, dangerous materials, and changes in temperature. Additionally, they are less resilient to severe weather. Children are more vulnerable to acute respiratory tract infections, micro practical exposure, respiratory disorders, cardiovascular diseases, and

cardiopulmonary diseases as a result of dust storms that are becoming more intense and frequent. It is estimated that 88% of the existing global burden of disease attributed to climate change is thought to affect children under the age of five in both developed and developing nations ***(Singer et al., 2022).***

Regarding demographic characteristics of the studied mothers, the current study revealed that the mean age of the studied mothers 36.11±8.22 years; more than one third of them aged 30-< 40 years, the majority of them were married, and that more than half of them were lived in urban areas. These findings were agreed consistent with an Egyptian study by ***casanueva et al., (2021),*** who found that 54.2% of mothers aged from 25 and under 40 years and 86.6% of them were married and resided in cities. Also, these results aligned with a study conducted by ***Ekholm, (2020),*** which found that that 92.7% of mothers were aged from 30 to less than 40 years, and 85.7% of mothers resided in urban areas. Furthermore, this result was in the same line with ***Zernia et al., (2023),*** who indicated that 87.9% of them were married.

The current study indicated about half of the mothers had secondary education. This study was disagreed with an Egyptian study done by ***Rashed et al., (2022),*** which discovered that the 88.9 % of the participants had a higher level of education. Also, the findings conflicted with those of a study carried out by ***Laue et al. (2022),*** which found that 79.3% of the mothers in the study were illiterate.

In the current study, less than three quarter of the mothers were housewives. This finding could be explained by the possibility that, depending on the specifics of the mother's job, the mother's career could have a beneficial or harmful impact on the child's health. In a good way, if the mother's work outside the home has increased her experience and awareness of the health needs of children; in a bad way, if the mother feels too worn out to care for her child after work.

The current study found that the mean age of the children under study were 3.35±1.83 years with more than half of them being younger than 3 years old. The results of the study contradicted that of the study conducted by ***Williams et al., (2021),*** indicated that the children under study had a mean age of 8.515 ± 0.336 years.

The study findings indicated that 58.9% of the children were male, that finding was consistent with a study done by ***Dabaieh et al., (2021),*** which found that the male-to-female ratio is 1.38:1 and that 66.9% of the children were male. This result contrasted to a study conducted by ***Zernia et al., (2023),*** who found that 36.4% of the samples under study were male.

Regarding the health consequences of climate system on the bodily systems of children, the results of this study indicate that the respiratory, gastrointestinal, and neurological systems of the children under study are affected by climate change at rates of 93.3%, 88.9%, and 58.6%, respectively. This result was in line with the findings of a study by ***Ajanovic et al., (2020),*** which found that greater rates of asthma exacerbation were linked to high mean daily temperatures, especially for children between the ages of 2 and <5 years.

This finding agreed with that of the study conducted by ***Cook et al., (2022)***,who observed that were associated with of asthma exacerbation particularly for children aged 2 to <5 years. Similarly, the study findings correspond with those of ***Phoebe et al., (2021)*** they found that a complex link between air pollution, climate change, and the onset and severity of asthma.

Moreover, these results bear some resemblance to those of the study conducted by ***Alison et al., (2022),*** which noted that children are among the groups most susceptible to the consequences of the climate emergency and mental issues,

making more susceptible to mental illness such as depression, anxiety, post-traumatic stress disorder. Furthermore, according to climate change poses a hazard to children's physical and mental health due to its effects on temperature, precipitation, extreme weather, and disruption of communities. From the researcher's perspectives, the early years are particularly vulnerable because of fast cognitive growth and physiological immaturity. Children are more likely to be exposed to air, able to adjust to heat, water, and foodborne pollutants, and have more years of life ahead of them to be exposed to both new and worsening climate change dangers.

Concerning the total level of mothers' knowledge regarding health consequences of climate change among their children, about more than half of the studied mothers had poor knowledge of preprogram implementation. Meanwhile, in the post- program, it raised to majority with a highly statistically significant difference (P- value <0.001). the findings of the present study agreed with those of a study by ***Abutaleb et al., (2020),*** about "Climate Changes Impacts, vulnerabilities and adaptation Measures for Egypt's Nile Delta, in Egypt (n=98)", which illustrated that 63.8% of the mothers in the study had knew very little about the damaging impacts of heat stress related to climate change. Also, the results of this investigation aligned with the conclusions of the research conducted by ***Laue et al. (2022),*** about "Heat stress adaptation within informal, low income urban settlements, in Africa" (n=348), which reflected that 89.1% of mothers with low income had poor knowledge about climate change and heat stress.

Furthermore, the current study's finding are confirmed by ***Dabaieh et al. (2021),*** who conducted research in Egypt and showed that 65.2% of mothers had good knowledge following the implementation of educational program. This is explained by the reason for this is that enhanced knowledge leads to better practice and vice versa, highlighting the significance of programs.

Regarding mother's total reported adaptive strategies regarding measures to lessen health consequences of climate changes among their children, the findings of this research showed that fewer than two thirds of the mothers who were examined possessed maladaptive pre- implementation strategies. Meanwhile, the majority of them had adjusted to the health outcomes of weather change at the post-program, considering the highly statistically significant difference (P- value <0.001).

The outcomes are consistent with research carried out through ***Ahmed et al. (2023),*** who conducted a study in rural Bangladesh and who illustrated that 58.6% of mothers there weren't coping well with the effects of environmental change. This might due to mothers' low levels of education and poverty nay be to blame for this.

Regarding the total level score of mothers' mindful attention awareness toward health effects of weather change on their children, the outcomes of this research clarified that one tenth of mothers exhibited high mindful attention awareness in preprogram, whereas in the post program, this percentage increased to the majority has a difference that is extremely statistically significant (p-value < 0.001). Those observations corroborated those of a study by ***Choi et al., (2021),*** which discovered that 83.9% of participants had high total awareness levels following the intervention, with a highly statistically significant difference (p-value < 0.001).

Additionally, the findings of the current study are confirmed by ***Williams et al., (2021),*** they stated that it is necessary to build scientific knowledge, abilities, and constructive pro-environmental behaviors that arise from combing mothers' awareness and comprehension with actions and practices. According to the researchers, this

finding could mean that mothers are able to regulate their health-related behaviors and adjust to the environment surrounding their children, both of which have a good impact on the mothers' awareness.

Concerning of the total reported practices level of the investigated mothers with regard to the effects of climate changes on the health of their children, The current research determined that; less than one quarter of the mothers who were evaluated had adequate preprogram implementation strategies. In the meantime, it increased to the majority with a highly significant statistical difference (P- value <0.001) in the post- program. Similarly, ***Zernia et al., (2023),*** who declared that 88.5% of mothers had a sufficient level of total practices about climate change at post-intervention, with a highly significant statistical difference (p-value < 0.001). This can be the result of the mothers attending educational sessions where they learned useful information that can improve their practices, which in turn improves their awareness.

Regarding the correlation between mothers' knowledge and their mindful awareness of the harmful effects of the changing climate on to their kids' health, pre/post implementation of adaption strategies. The current study found a positive correlation between knowledge and their total mindful attention awareness after implementation of adaption measures. Satisfactory knowledge about adaptation strategies was linked to a significantly more positive awareness among mothers. This finding aligns with the findings of ***Newsome et al., (2023),*** who reported that attending the educational intervention increased mothers' attitudes and comprehension of climate change. This highlights the value of the program and can be linked to people's increased awareness of climate changes as a result of better knowledge and comprehension of these changes.

Furthermore, the study found a highly positive statistically significant correlation between mothers' knowledge and their reported practices about the health consequences of climate changes among their children pre/post adaption techniques were implemented. These results are congruent with those of ***Breidy and Kobaidze, (2023),*** who found a statistically significant positive correlation between knowledge scores and total practices scores of the participants. Moreover, these results align with the research conducted by ***Ekholm, (2020),*** which found a statistical correlation between total mothers' knowledge and behaviors regarding the health effects of climate change. This improvement could be attributable to the adaptation techniques program's beneficial effects on mothers' understanding of the negative health effects of climate change on their children.

Conclusion

The study's conclusions indicated that mothers' knowledge of the troubling implications of changes in the climate on their kids' wellbeing was insufficient, which in turn had an impact on their practices and awareness of the issues. Improvements in the total knowledge score, reported practices and adaptive methods to mitigate influences on health of climate change after intervention were highly statistically significant. Following the program's implementation, mothers' acquaintance of the negative health effects of the changing environment on their young kids also emerged.

Recommendations

- Establish a training program to help mothers become more knowledgeable about adaptable strategies that will help alleviate the detrimental effects of environmental crisis on their children.
- The use of technology and social media has been recognized as vital tools for

combating the implications of environmental degradation and for disseminating information, especially in remote areas.

- Further studies which include need to be applied on large sample size of children under five years from various geographic locations to generalized results in Egypt.
- Further studies investigating more adaptable strategies of coping with harmful effects of environmental change on the well-being of their children.

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