Benha Journal of Applied Sciences (BJAS) **print: ISSN ٢٣٥٦-٩٧٥١**
Vol. (٩) Issue (٤) (٢٠٢٤), (٥٧-٦٧) **online: ISSN ٢٣٥٦-٩٧٦x**
http://bjas.bu.edu.eg

Health Risks Related to Extreme Temperature Resulting from Climate Changes among Older Adults with Respiratory Diseases

Esraa I. Elsayed, Hanaa A. Abd El-Megeed, Hedya F. Mohy El-Deen, and Huda A. Afifi
Community Health Nursing Department, Faculty of Nursing, Benha University
E-Mail: esraaibrahimelsayed@gmail.com

Abstract

Background: Extreme temperatures are major environmental health hazards resulting from climate changes, represent a massive direct threat to respiratory health by aggravating respiratory diseases or indirectly by increasing exposure to risk factors for respiratory diseases and associated with an overall morbidity and mortality of older adults with chronic respiratory diseases. This study aimed to assess health risks related to extreme temperature resulting from climate changes among older adults with respiratory diseases. Research design: A descriptive research design was utilized in this study. Setting: Chest Outpatient Clinic in Benha University Hospital. The sample: A simple random sample was used which included ٢٩٧ older adults with chronic respiratory diseases. Tool: One tool was used: A structured interviewing questionnaire to assess socio-demographic characteristics of the studied older adults with chronic respiratory diseases, respiratory health risks of the studied older adults related to extreme temperature, knowledge of the studied older adults regarding extreme temperatures resulting from climate change and chronic respiratory diseases and reported practice of the studied older adults regarding their adaptation to lessen the impact of extreme temperature on their respiratory health. Results: ٦٦٪ of the studied older adults aged from ٦٠ to less than ٦٥ years with mean ±SD ٦٣.٢١±٧.٥٢, ٣٥.٧٪ of them had asthma, ٦٦.٣ % of them had average total knowledge level about extreme temperatures and chronic respiratory diseases and ٧٣.٧ % of them had satisfactory total reported practices level regarding their adaptation to lessen the impact of extreme temperature on their respiratory health. Conclusion: There was a positive highly statistically significant relation between the studied older adults' total knowledge level and their total practices level. Recommendation: Health education program should be developed and implemented to improve older adults with chronic respiratory diseases knowledge and practices regarding their adaptation to lessen the impact of extreme temperature on their respiratory health status.

.

Key words: Climate changes, Extreme temperatures, Older adults, Respiratory diseases.

Introduction

Climate changes refer to a long-term change in the average weather patterns. The changes can occur naturally as a result of variations in solar activity or large-scale volcanic eruptions, but burning fossil fuels like coal, oil, and gas has been the main human-caused source of climate change. Fossil fuel combustion emits Green-House Gases (GHGs) into the atmosphere such as carbon dioxide, nitrous oxide, water vapor and methane resulting in trapping the heat and causing the Earth's temperature to rise. Addressing climate change requires us to reduce GHGs emissions and transition to cleaner energy sources, as well as to adapting to the changes that are already underway **(Joseph & Doon, ٢٠٢٣).**

Impacts of climate change on human health are pervasive, profound and substantial. Climate change is affecting the health of every single population in the world, and is expected that the impacts will amplify in the near future. Climate change affects human health in a variety of ways, including direct impacts derived from extreme weather events, such as heat and cold waves, and natural disasters and indirect impacts through polluted air and water; ecosystem effects such as the environmental conditions which are advantageous for the transmission of water-borne, airborne, food-borne, and vector-borne pathogens, and for species which are carriers of disease and destruction; and socio-economic effects such as altering crop production, disturbing water, energy and food supplies leading to conflicts and migration **(Harper, ٢٠٢٣).**

Extreme temperatures represent a massive direct threat to respiratory health by promoting or aggravating respiratory diseases or indirectly by increasing exposure to risk factors for respiratory diseases including longer allergy seasons, worsen air quality and increase the concentrations of outdoor ozone and particulate matter at ground level. On hot days, the heat of the sun causes a reaction between pollutants and atmospheric gases to make ozone which is a lung irritant leading to a decline in lung function, increases in allergic responses and/or new cases of chronic asthma and Chronic Obstructive Pulmonary Disease (COPD), lung cancer and exacerbations of existing respiratory diseases. Cold waves are related to various acute or long- term respiratory diseases such as chronic bronchitis as cold waves cause irritation to the airways, which results in a process called bronchospasm, where airways become narrow and tighten leading to worsening of respiratory symptoms

such as cough and shortness of breath **(Vicedo-Cabrera et al., ٢٠٢٣; Andersen et al., ٢٠٢٣).**

Chronic Respiratory Diseases (CRDs) are the abnormalities of airways and lungs including COPD, asthma, occupational lung diseases and interstitial lung diseases. CRDs are significant contributors to the surging burden of Non-Communicable Diseases (NCDs) globally. In ٢٠١٧, ٥٤٤.٩ million people were estimated to be living with CRDs worldwide, a ٣٩.٨٪ increase compared to ١٩٩٠. The global prevalence of CRDs in ٢٠١٧ was ٧.١٪. CRDs were the third leading cause of death responsible for ٤.٠ million deaths with a prevalence of ٤٥٤.٦ million cases globally **(Adhikari et al., ٢٠٢٣).**

According to the report of United Nations, around the world, there will be ٧٦١ million people ٦٥ years of age or older in ٢٠٢٣. The number of people worldwide is expected to more than double by ٢٠٥٠, reaching over ١.٥ billion. In ٢٠٥٠, older persons will make up ١٦.٠٪ of the global population, up from ٩.٣٪ in ٢٠٢٠. A quarter of the world's population is projected to be ٦٥ or older by mid- century. Impacts of extreme temperatures on older adults are broad and complex. The heat-related mortality among adults aged ٦٥ and older increased by ٥٣.٧٪ over the past two decades, reaching ٢٩٦,٠٠٠ deaths in ٢٠١٨ as older persons are less thermosensitive to temperature changes and less efficient in responding to cold and heat exposures, resulting in increased health risks and even death. Older adults are more vulnerable to heat-related illnesses such as heat exhaustion, heat cramps, and heat stroke during heat waves and hypothermia during cold waves **(Pandit, ٢٠٢٣; Ou et al., ٢٠٢٣).**

Community Health Nurse (CHN) plays an important role regarding educating older adults about climate change and particularly about extreme temperature-related illnesses. CHN should raise awareness of older adults about the health risks of heat and cold waves through health consultations, workshops, public lectures, or publicity slogans, brochures, and even exhibitions as forms of health education for healthy ageing. CHN should implement appropriate public health programs such as heat warnings, heat-health action and adaptation plans and long-term communications strategies, such as heat education campaigns to help prepare older adults to self-manage and adapt to heat in order to lessen the burden of heat-related illnesses **(Guo et al., ٢٠٢٣; Sarkar et al., ٢٠٢٣).**

Significance of the study:

In ٢٠٢٠, there were approximately ٧ million older adults in Egypt, making up ٧.١٪ of the country's overall population. By ٢٠٥٢, it is predicted to increase to ١٧.٩٪ of the population. The number of older adults' males reached ٣.٥ million representing ٦.٩٪ of the total male population, while the number of older adults' females reached ٣.٥ million, representing ٧.٣٪ of the total female population. Life expectancy increased from ٧٣.٩ years in ٢٠١٩ to ٧٤.٣ years in ٢٠٢٠ (٧٣ years for males, ٧٥.٥ years for females). Around ٧.٥٪ of the population in Egypt have COPD. According to estimates, ١٤.٢٪ of older adults have COPD, compared to ١٢.٢٪ of people aged ٤٠ years. COPD morbidity, mortality rate and the prevalence are expected to increase related to a rapidly aging population. COPD is a growing serious health issue in Egypt, although data on the prevalence, morbidity and mortality are still scarce **(Mohamed et al., ٢٠٢٢; Shah, ٢٠٢٣).**

Extreme temperatures are major environmental health hazards resulting from climate changes that generally affect population and particularly affect older adults. Older adults are particularly vulnerable to the adverse effects of extreme temperatures because of more sensitivity to changes in the environment due to factors such as age-related changes in thermoregulation, age-related changes in respiratory system, decreased cardiac reserve, decreased immune response, medication use and a higher burden of comorbid conditions in addition to higher rates of social isolation, mobility impairment and limited financial resources that restrict older adults' abilities to engage in adaptive behaviors in response to extreme temperatures **(Carlson et al., ٢٠٢٣).** So that, this study aimed to assess health risks related to extreme temperature resulting from climate changes among older adults with respiratory diseases.

Aim of the study:

This study aimed to assess health risks related to extreme temperature resulting from climate changes among older adults with respiratory diseases.

Research questions:

١. What are the respiratory health risks of older adults related to extreme temperature?
٢. What is the older adults' knowledge regarding extreme temperature and respiratory diseases?
٣. What are the older adults reported practices regarding their adaptation to lessen the impact of extreme temperature on their respiratory health status?
٤. What is the relation between older adults' knowledge and their reported practice towards extreme temperature?

Subjects and Method

Research design: A descriptive research design was utilized to conduct this study.

Settings: This study was conducted at Chest Outpatient Clinic in Benha University Hospital.

Sampling: Simple random sample was used in this study. The sample was taken from previously mentioned setting. Including criteria: older adults with

chronic respiratory diseases. Exclusion criteria: older adults with acute respiratory diseases or have any other diseases.

The sample size was estimated according to the following formula.

$$n = \frac{N}{١ + N(e)^{٢}}$$

(n)= sample size =٢٩٧ patient

(N)= total number of older adults who attended to the selected setting=١١٥٢ patient in ٢٠٢١

(e)= co efficient factor =٠.٠٥

Tools of data collection:

One tool was used to collect the data:

Tool (I): A structured interviewing questionnaire: It was developed by the researchers based on reviewing related literatures, and it was written in simple clear Arabic language: It comprised of four parts to assess the following:

First part: Socio-demographic characteristics of the studied older adults. It included nine closed ended questions as age, sex, marital status, educational level, occupation before retirement, place of residence, monthly income, type of family and smoking.

Second part: Respiratory health risks of the studied older adults related to extreme temperatures. It included three closed ended questions divided as type of respiratory disease, respiratory and health risks of the studied older adults during extreme high temperatures and respiratory and health risks of the studied older adults during extreme low temperatures.

Third part (A): Knowledge of the studied older adults regarding extreme temperature resulting from climate change, which included fourteen closed ended questions (multiple choice type) as meaning of climate changes, natural causes, human causes, evidence and signs, vulnerable groups, effects on human health, general strategies to limit climate changes, meaning of extreme temperatures, causes, symptoms of extreme high temperatures effects on health of older adults , symptoms of extreme low temperatures effects on health of older adults, complications, preventive measures of exposure to extreme high temperatures and preventive measures of exposure to extreme low temperatures.

(B): Knowledge of the studied older adults regarding chronic respiratory diseases, which included eight closed ended questions (multiple choice type) as meaning, risk factors, types, signs & symptoms, diagnosis, preventive measures, treatment and complications of chronic respiratory diseases.

Scoring system:

The scoring system for the studied older adults knowledge was calculated as follows: ٢ for complete correct answer, ١ for incomplete correct answer and ٠ for don't know or wrong answer. The total score of knowledge = ٤٤

The total knowledge score was considered good if the score of total knowledge >٧٥٪ (>٣٣points), while considered average if it equaled ٥٠-٧٥٪ (٢٢-٣٣ points), and considered poor if it was < ٥٠٪ (<٢٢ points).

Fourth part: Reported practice of the studied older adults with chronic respiratory diseases regarding their adaptation to decrease the impact of extreme temperature which divided into three main areas:-

Older adults' practices to reduce respiratory symptoms resulting from extreme temperatures which divided into two items as (shortness of breath and cough).

Older adults' practices for adaptation to extreme high temperature which divided into four items as (general practices, heat exhaustion, heat stroke and heat cramps).

Older adults' practices for adaptation to extreme low temperature which divided into three items as (general practices, Hypothermia and frostbite).

Scoring system

Each step of older adults' practices has two levels: Done and not done. These were respectively scored ١,٠.

The total practices score = ٧٠ points was considered satisfactory if the score of the total practices ≥ ٦٠٪ (≥٤٢ points), while considered unsatisfactory if it was < ٦٠٪ (<٤٢ points).

Content validity and reliability:

Content validity of the tool was ascertained by five of Faculty's Staff Nursing Experts from the Community Health Nursing Specialties (three from Faculty of Nursing Benha University, one from Faculty of Nursing, Menoufia University and one from Faculty of Nursing, Mansoura University) who reviewed the tools for clarity, relevance, comprehensiveness, and applicability.

Reliability of the tool was applied by the researchers for testing internal consistency of the tool, by administration of the same tool to the same subjects under similar condition on one or more occasion. Answers from repeated testing were compared (test-re-test reliability). The reliability was done by Cronbach alpha coefficient test which revealed that the internal consistency of the knowledge was ٠.٨٥٧ and internal consistency of the reported practices was ٠.٧٥٥.

Ethical considerations

Written approval consent has been obtained from Scientific Research Ethical Committee Faculty of Nursing Benha University.

All ethical issues were assured; Oral consent has been obtained from each older adult before conducting the interview and given them a brief orientation to the purpose of the study. They were also reassured that all information gathered would be kept confidentially and used only for the purpose of the study. The older adults had right to withdraw from the study at any time without giving any reasons.

Pilot study:

The pilot study was carried out on ٣٠ older adults with chronic respiratory diseases which represented ١٠٪ of the sample size. The pilot study aimed to assess the tool clarity, applicability and time needed to fill each sheet. No modifications were done, so the pilot study sample was included in the total sample.

Preparatory phase:

An extensive review of the current and past available national and international references related to the research title was done, using a journal, textbooks and internet search was done. This was necessary for the researchers to be acquainted with and oriented about aspects of the research problem as well as to assist in the development of data collection tool, this took about two months.

Fieldwork:

The study was conducted over a period of ٦ months from the beginning of March ٢٠٢٣ to the end of September ٢٠٢٣ after took official permission from dean of Faculty of Nursing Benha University and approval of director of previously mentioned setting. The researchers visited the Chest Outpatient Clinic two days/ week (Sunday & Thursday) from ٩ am: ١ pm, to collect data and interviewed the older adults with chronic respiratory diseases individually. The average time needed to fill the questionnaire around ٣٠-٤٥ minutes, the studied older adults average number interviewed at the Chest Outpatient Clinic were ٦-٧ older adults/day depending on the responses and understanding of the older adults.

Statistical analysis:

All data collected were organized, tabulated and analyzed by using the Statistical Package for Social Science (SPSS) version ٢١, which was used frequencies and percentages for qualitative descriptive data, and chi-square coefficient x^2 was used for relation tests, and mean and standard deviation were used for quantitative data and degree of significance was identified.

Levels of significance:

P-value > ٠.٠٥ = non-Statistically significant
P-value ≤ ٠.٠٥ = Statistically significant
P-value < ٠.٠٠١ = highly Statistically significant

Results

Table (١): Shows that; ٦٦.٠% of the studied older adults aged from ٦٠ to less than ٦٥ years with mean ±SD ٦٣.٢١±٧.٥٢, ٥٩.٣٪ of them were males, ٧٧.٨٪ were married. While ٤٤.٨٪ of them had secondary education, ٣٣.٧٪ were employed before retirement, ٥٨.٦٪ of them lived in rural areas, ٦٥.٣٪ of them had enough monthly income, ٧٤.١٪ of them lived with nuclear family and ٥٥.٩٪ of them had passive smoking.

Table (٢): Shows that; ٣٥.٧٪ of the studied older adults had asthma. Regarding to respiratory and health risks resulting from extreme high temperature, ٨٥.٥٪ of the studied older adults had dry cough and ٦٠.٣٪ of them had excessive sweating. Regarding to respiratory and health risks resulting from extreme low temperature, ٩٠.٩٪ of the studied older adults had excessive mucus secretion and ٩١.٢٪ of them had coldness and discoloration of skin.

Figure (١): Illustrates that; ٦٦.٣ % of the studied older adults had average total knowledge level while ٢٦.٦ of them had poor total knowledge level and only ٧.١ of them had good total knowledge level regarding extreme temperatures resulting from climate change and chronic respiratory diseases.

Figure (٢): Illustrates that; ٧٣.٧ % of the studied older adults had satisfactory total reported practices level and only ٢٦.٣ of them had unsatisfactory total reported practices level regarding their adaptation to lessen the impact of extreme temperature on their respiratory health.

Table (٣): Reveals that; there was a positive highly statistically significant relation between the studied older adults' total knowledge level and their total practices level (p-value < ٠.٠٠١).

Table (١) Frequency distribution of the studied older adults regarding their sociodemographic characteristics (n=٢٩٧).

Sociodemographic characteristics	No.	%
Age/ years		
٦٠ <٦٥	١٩٦	٦٦.٠
٦٥ <٧٠	٨٤	٢٨.٣
٧٠ <٧٥	١٥	٥.١
≥٧٥	٢	.٧
Mean ±SD	٦٣.٢١±٧.٥٢	
Sex		
Male	١٧٦	٥٩.٣
Female	١٢١	٤٠.٧
Marital status		
Single	١	.٣
Married	٢٣١	٧٧.٨
Widowed	٤٩	١٦.٥
Divorced	١٦	٥.٤
Educational level		
Don't read and write	١٣٣	٩.٨
Basic education	١٢١	٤٠.٧
Secondary education	٢٩	٤٤.٨
University education and more	١٤	٤.٧
Occupation before retirement		
Free work	٨٠	٢٦.٩
Employed	١٠٠	٣٣.٧
Housewife	٩٠	٣٠.٣
Don't work	٢٧	٩.١
Residence place		
Urban	١٢٣	٤١.٤
Rural	١٧٤	٥٨.٦
Monthly income		
Enough and save	١٤	٤.٧
Enough	٨٩	٦٥.٣
Not enough	١٩٤	٣٠.٠
Type of family		
Nuclear family	٢٢٠	٧٤.١
Extended family	٧٧	٢٥.٩
Smoking		
Smoked	٢٥	٨.٤
Don't smoke	١٠٦	٣٥.٧
Passive smoking	١٦٦	٥٥.٩

Table (٢) Frequency distribution of the studied older adults regarding their respiratory health risks (n=٢٩٧).

Respiratory health risks	No.	%
Type of respiratory disease		
Asthma	١٠٦	٣٥.٧
COPD	٨٠	٢٦.٩
Pulmonary hypertension	٣١	١٠.٤
Occupational lung disease	٣٤	١١.٤
Allergic rhinitis	٢٨	٩.٤
Lung cancer	٩	٣.٠
Interstitial lung disease	٩	٣.٠
***Respiratory risks resulted from extreme high temperature**		
Dry cough	٢٥٤	٨٥.٥
Reproductive cough	١٠٠	٣٣.٧
Wheezing	٢٣٢	٧٨.١
Increased breathing rate (tachypnea)	١٨٩	٦٣.٦
Dryness of respiratory system	٦٢	٢٠.٩
Shortness of breath	٢٣١	٧٧.٨
None	١٨	٦.١
***Health risks resulted from extreme high temperature**		
Fever	١٦٨	٥٦.٦
Skin dryness or redness	١٣٣	٤٤.٨
Excessive sweating	١٧٩	٦٠.٣
Nausea and vomiting	١١٢	٣٧.٧
Headache	٨٦	٢٩.٠
Rapid pulse	١٣٠	٤٣.٨
Muscle pain or cramps	١٢٨	٤٣.١
Fainting	٥٤	١٨.٢
***Respiratory risks resulted from extreme low temperature**		
Cough	٢٤١	٨١.١
Excessive mucus secretion	٢٧٠	٩٠.٩
Wheezing	١٤٨	٤٩.٨
Shortness of breath	٢٠٣	٦٨.٤
Dryness of respiratory system	٨٧	٢٩.٣
Bronchitis	١٨٩	٦٣.٦
Impaired resistance of immune system for respiratory infections	٨٨	٢٩.٦
None	٣	١.٠
***Health risks resulted from extreme low temperature**		
Shivering	١٦٤	٥٥.٢
Slurred speech	١٢٠	٤٠.٤
Weak pulse	١٢٣	٤١.٤
Unconsciousness	١٠٥	٣٥.٤
Coldness and discoloration of skin	٢٧١	٩١.٢
Hard or waxy skin	٢٢٠	٧٤.١
Loss of sensation or pain	١٧٢	٥٧.٩
None	٢	٠.٧

*** The answers are not mutually exclusive**

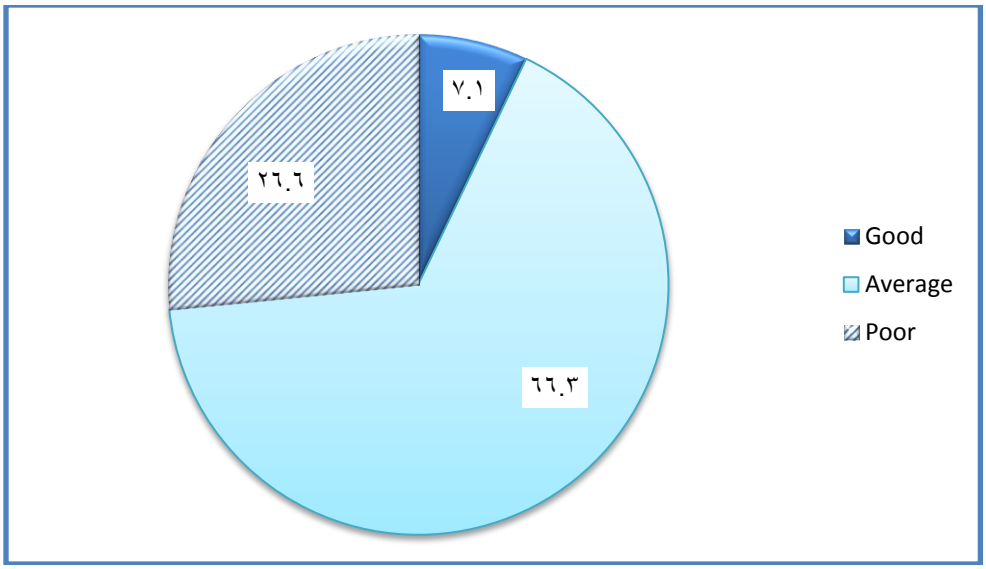

Fig. (١) Percentage distribution of the studied older adults regarding their total knowledge level about extreme temperature resulting from climate change and chronic respiratory diseases (n=٢٩٧).

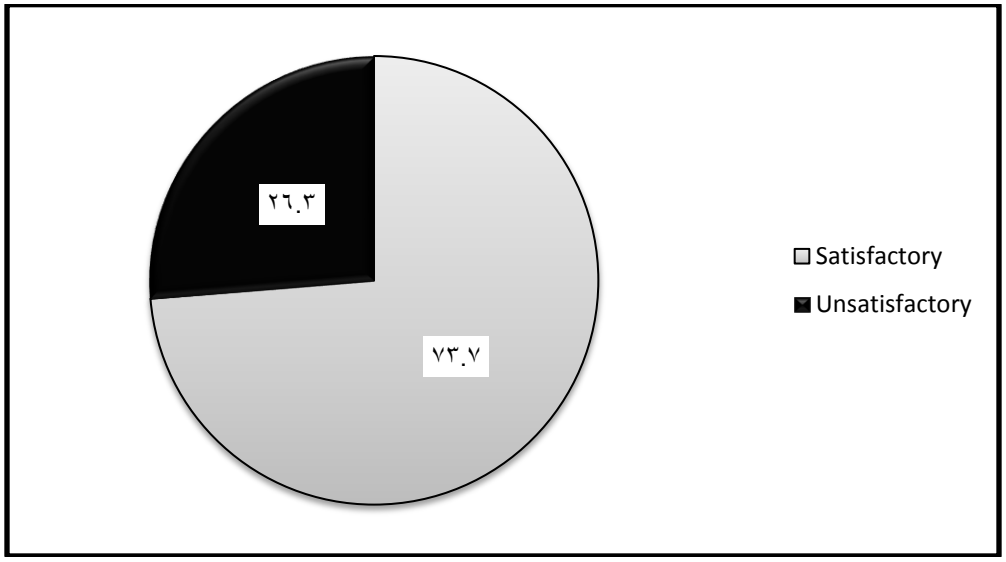

Fig. (٢) Percentage distribution of the studied older adults regarding their total reported practices level about their adaptation to decrease the impact of extreme temperature on their respiratory health status (n=٢٩٧).

Table (٣) Statistically relation between total knowledge level and total practices level of the studied older adults (n=٢٩٧).

Total Knowledge	Total practices				X^2	P-value
	Unsatisfactory (n=٧٨)		Satisfactory (n=٢١٩)			
	No.	%	No.	%		
Poor (n=٧٩)	٤٦	٥٩.٠	٣٣	١٥.١	٥٧.٠١٧	.٠٠٠**
Average (n=١٩٧)	٢٨	٣٥.٩	١٦٩	٧٧.١		
Good (n=٢١)	٤	٥.١	١٧	٧.٨		

****Highly statistically significant (P < ٠.٠٠١)****

Discussion

In the context of global climate change, the frequency and intensity of extreme temperature events are increasing rapidly with a significant impact on human health and long-term consequences leading to airway inflammation, deterioration of lung function causing respiratory symptoms as cough, wheezing and shortness of breath, emergency room visits or hospitalizations and death. Extreme temperature resulting from climate change affects all ages but the impact on the ageing population is disproportionate. Factors including the physiological ageing process, physical and cognitive impairment and socioeconomic limitations influence how the older person responds to potentially threatening temperatures changes. The unique constellation of factors together with underlying medical conditions increases vulnerability to extreme temperature events **(Han et al., ٢٠٢٣; Anu et al., ٢٠٢٣).**

Regarding to sociodemographic characteristics of the studied older adults; the current study showed that; nearly two thirds of the studied older adults were aged from ٦٠<٦٥ years old with mean age ٦٣.٢١±٧.٥٢, nearly less than three fifths of them were males, nearly more than three quarters of them were married, nearly more than two fifths of them had secondary education and one third of them employed before retirement. Also the present study showed that; slightly less than three fifths of the studied older adults were from rural areas, almost two thirds of them had enough monthly income, nearly less than three quarters of them lived in nuclear family and more than half of them had passive smoking.

Concerning types of respiratory diseases of the studied older adults, the present study reported that; more than one third of the studied older adults had asthma; this finding came in accordance with **Koirala et al. (٢٠١٩),** who studied " Overlap of sleep disorders and chronic respiratory diseases: an emerging health dilemma in Nepal (n=٥٠)" and revealed that, more than one third of their participants (٣٦%) suffered from asthma as the most reported chronic respiratory diseases. This might be due to ageing is a most common risk factor for developing asthma as a result of the natural decline in lung function with increasing age which may be associated with airflow limitation and due to exposure of the studied older adults to risk factors of asthma such as smoking and occupation for long period of time.

However this finding was incongruent with **Kang et al. (٢٠٢٠),** who studied " Current situation of asthma–COPD overlap in Chinese patients older than ٤٠ years with airflow limitation: a multicenter, cross-sectional, non-interventional study in China (n= ٢٠٠٣)" and reported that, slightly less than fifth of their participants (١٤.١٠٪) suffered from asthma only followed by asthma and COPD (٣٧.٤٠٪).

Concerning respiratory risks resulted from extreme high temperature, the results of the present study showed that; majority of the studied older adults suffered from dry cough and more than three quarters suffered from wheezing followed by shortness of breath as respiratory risks resulted from high temperature. These findings were in the same line with **Cecchi et al. (٢٠١٨),** who studied " News on climate change, air pollution, and allergic triggers of asthma in Spain" and revealed that, heat waves associated with high NO_2 concentrations in air and are also associated with reportedly cough, wheezing, and shortness of breath in asthmatic patients. This might be due to extreme high temperature impact, most of patients exposed to dust or smoke which are lung irritant so that the body react by natural defense mechanism or reflex as cough to keep breathing pathways clear from mucus.

Also These findings were supported by **Demain (٢٠١٨),** who studied " Climate change and the impact on respiratory and allergic disease: ٢٠١٨ in United States" and reported that, prolonged heat waves leading to increased CO_2 concentration and increased air pollution which have negative effects on respiratory symptoms such as cough and wheezing symptom with dyspnea.

The current study showed that; three fifths of the studied older adults suffered from excessive sweating during extreme high temperature. This finding came in accordance with **Mutic et al. (٢٠١٨),** who studied " Classification of heat- related illness symptoms among Florida farmworkers (n= ١٩٨)" and reported that, two thirds of their participants (٦٦٪) suffered from excessive sweating as the most common reported heat- related symptoms. As well as this finding was consistent with **Smith et al. (٢٠٢١),** who studied " Knowledge of heat-related illness first aid and self-reported hydration and heat-related illness symptoms in migrant farmworkers in Southeast Georgia (n= ٦٠)" and revealed that, half of their participants (٥٠٪) suffered from excessive sweating as the most common reported heat- illness symptoms. This might be due to extreme high temperature impact leading to sweating as the body's way of releasing excess heat to regulate or cool body temperature during extreme high temperature.

Concerning respiratory risks resulted from extreme low temperature, the results of the present study showed that; most of the studied older adults suffered from excessive mucus secretion as respiratory risks resulted from low temperature. This finding agreed with **Frischhut et al. (٢٠٢٠),** who studied " Effects of a heat and moisture exchanger on respiratory function and symptoms post–cold air

exposure in Austria (n= ١٣)" and reported that majority of their participants (٨٤.٦٪) suffered from excessive mucus secretion resulted from low temperature. This might be due to inhalation of cold air causes Airway Surface Liquid (ASL) to evaporate more rapidly than it can be replaced, leading to dryness of the nasal lining and airway so nasal glands produce excess mucus to keep the lining moist.

The current study showed that; most of the studied older adults suffered from coldness and discoloration of skin as health risks resulted from low temperature. This finding agreed with **Ghani et al. (٢٠١٩)** who studied " Low-temperature health hazards among workers of cold storage facilities in Pakistan (n=١٠٠)" and reported that, majority of their participants (٨٣٪) suffered from change in the skin color especially of the cheeks and nose resulted from low temperature. This might be due to exposure to cold cause vasoconstriction to vessels that supply blood flow to the skin represented by skin coldness and color changes.

Regarding to total knowledge level of the studied older adults about extreme temperature resulting from climate change and chronic respiratory diseases, the current study clarified that; two thirds of the studied older adults had average total knowledge level, more than quarters of the studied older adults had poor total knowledge level while minority of them had good total knowledge level. From the researchers point of view, this might be due to that two thirds of the studied older adults had average total knowledge level about extreme temperature resulting from climate change because climate change is a recent issue in Egypt and older adults are not aware about impacts of climate change and extreme temperature on health particularly on their respiratory health. Also due to the effect of aging and education on their ability to acquire knowledge.

Regarding to total reported practice of the studied older adults regarding their adaptation to lessen the impact of extreme temperature on respiratory health status. The current study showed that; slightly less than three quarters of the studied older adults had satisfactory total reported practices level and more than quarter of them had unsatisfactory total reported practices level. This finding came inconsistent with **Ibrahim et al. (٢٠٢٣),** who studied " Climate Change and Health: Effect of Awareness Program on Knowledge, Attitudes and Practices of Community Dwelling Elderly in Egypt (n=٧٢)" and concluded that, more than three quarters of their participants (٧٩.٢٪) had unsatisfactory total practices level and nearly one fifth of their participants (٢٠.٨٪) had satisfactory total practices level regarding adaptation to climate change impacts. This might be related to the older adults need to acquire skills to decrease impacts of extreme temperatures.

Regarding to the relation between the studied older adults' total knowledge level and their total practices level towards extreme temperatures resulting from climate changes; The current study showed that; there was positive highly statistically significant relation between the studied older adults' total knowledge level and their total practices level. This finding agreed with **Abdullah et al. (٢٠٢٢)**, who studied " Health Risks Related to Climate Changes among Older Adults in Egypt (n=١٨٥)" and found that, there was positive highly statistically significant relation between their participants total score of knowledge and their total score of practices regarding climate changes impacts. This might be due to older adults who have average knowledge about extreme temperature resulting from climate changes are more aware of how to deal with extreme temperature impacts as the knowledge is the baseline of the practices.

Conclusion

More than one third of the studied older adults had asthma. Regarding to respiratory and health risks resulting from extreme high temperature, majority of them had dry cough and three fifths of them had excessive sweating. Regarding to respiratory and health risks resulting from extreme low temperature, most of them had excessive mucus secretion and most of them had coldness and discoloration of skin. Two thirds of the studied older adults had average total knowledge level about extreme temperature resulting from climate change and chronic respiratory diseases and slightly less than three quarters of them had satisfactory total reported practices level regarding adaptation to lessen the impact of extreme temperature on their respiratory health status. There was a positive highly statistically significant relation between the studied older adults' total knowledge level and their total practices level.

Recommendations

١. Health education program should be developed and implemented to improve older adults with chronic respiratory diseases knowledge and practices regarding their adaptation to lessen the impact of extreme temperature on their respiratory health status.
٢. Booklet with illustrated picture should be developed and disseminated as educational guidelines to all older adults with chronic respiratory diseases about the adaptation to lessen the impact of extreme temperature resulting from climate change on their respiratory health status.

٣. Further studies should be conducted on climate changes particularly extreme temperatures and impact on the health of older adults as well as exploring the basic requirements for mitigation and adaption to the impact of climate changes.

References

[١] **Abdullah, Kh., Esmat, O., Hasaneen, Sh. and Ibrahim, W. (٢٠٢٢):** Health Risks Related to Climate Changes among Older Adults. Egyptian Journal of Health Care, ١٣(٣), ٦٧٨-٦٩٠.

[٢] **Adhikari, T., Paudel, K., Paudel, R., Bhusal, S., Rijal, A., Högman, M., ... and Kallestrup, P. (٢٠٢٣):** Burden and risk factors of chronic respiratory diseases in Nepal, ١٩٩٠–٢٠١٩: An analysis of the global burden of diseases study. Health Science Reports, ٦(٢), e١٠٩١.

[٣] **Andersen, Z., Vicedo-Cabrera, A., Hoffmann, B. and Melén, E. (٢٠٢٣):** Climate change and respiratory disease: clinical guidance for healthcare professionals. Breathe, ١٩(٢).

[٤] **Anu, A., Sonia, G. and Ismail, K. (٢٠٢٣):** Effect of climate change on health in older persons. Wits Journal of Clinical Medicine, ٥(٢), ٧٩-٨٤.

[٥] **Carlson, B., Kohon, J., Carder, P., Himes, D., Toda, E. and Tanaka, K. (٢٠٢٣):** Climate Change Policies and Older Adults: An Analysis of States' Climate Adaptation Plans.

[٦] **Cecchi, L., Annesi-Maesano, I. and d'Amato, G. (٢٠١٨):** News on climate change, air pollution, and allergic triggers of asthma. Journal of Investigational Allergology and Clinical Immunology, ٢٨(٢), ٩١-٩٧.

[٧] **Demain, J. (٢٠١٨):** Climate change and the impact on respiratory and allergic disease: ٢٠١٨. Current allergy and asthma reports, ١٨, ١-٥.

[٨] **Frischhut, C., Kennedy, M., Niedermeier, M. and Faulhaber, M. (٢٠٢٠):** Effects of a heat and moisture exchanger on respiratory function and symptoms post–cold air exercise. Scandinavian journal of medicine & science in sports, ٣٠(٣), ٥٩١-٦٠١.

[٩] **Ghani, N., Tariq, F., Javed, H., Nisar, N. and Tahir, A. (٢٠١٩):** Low-temperature health hazards among workers of cold storage facilities in Lahore, Pakistan. Medycyna pracy, ٧١(١), ١-٧.

[١٠] **Guo, Y., Zhang, Y., Yu, P., Wu, Y., Wen, B., Yang, Z., ... and Li, S. (٢٠٢٣):** Strategies to reduce the health impacts of heat exposure. In Heat Exposure and Human Health in the Context of Climate Change (pp. ٢٩٣-٣٢٢). Elsevier.

[١١] **Han, A., Deng, S., Yu, J., Zhang, Y., Jalaludin, B. and Huang, C. (٢٠٢٣):** Asthma triggered by extreme temperatures: from epidemiological evidence to biological plausibility. Environmental Research, ٢١٦, ١١٤٤٨٩.

[١٢] **Harper, S. (٢٠٢٣):** The Implications of Climate Change for the Health of Older Adults. Journal of Population Ageing, ١٦(٣), ٥٦٥-٥٦٨.

[١٣] **Ibrahim, S., Abd Elmawla, D. and Ali, S. (٢٠٢٣):** Climate Change and Health: Effect of Awareness Program on Knowledge, Attitudes and Practices of Community Dwelling Elderly. Tanta Scientific Nursing Journal, ٣٢(٤), ٢٤٥-٢٧٢.

[١٤] **Joseph, D. and Doon, R. (٢٠٢٣):** The Impact of Climate Change on Vulnerable Populations: Social Responses to a Changing Environment.

[١٥] **Kang, J., Zheng, J., Cai, B., Wen, F., Yao, W., Zhang, X., ... and Cao, J. (٢٠٢٠):** Current situation of asthma–COPD overlap in Chinese patients older than ٤٠ years with airflow limitation: a multicenter, cross-sectional, non-interventional study. Therapeutic Advances in Respiratory Disease, ١٤, ١٧٥٣٤٦٦٦٢٠٩٦١٦٩٩.

[١٦] **Koirala, P., Bhatta, N., Ghimire, R., Mishra, D., Bista, B. and Shah, B. (٢٠١٩):** Overlap of sleep disorders and chronic respiratory diseases: an emerging health dilemma. NMJ ٢٠١٩; ٢ (٢): ٢٤٣-٩. DOI ١٠.٣١٢٦/nmj. v٢i٢. ٢٦٠٠٧. NEPALESE MEDICAL, (٤), ٢.

[١٧] **Mohamed, S., Ahmed, H. and Abd-El Latef, M. (٢٠٢٢):** Performance of Older Adult Regarding Their Health Maintenance Measures. Egyptian Journal of Health Care, ١٣(٤), ٤١٥-٤٢٤.

[١٨] **Mutic, A., Mix, J., Elon, L., Mutic, N., Economos, J., Flocks, J., ... and McCauley, L. (٢٠١٨):** Classification of heat- related illness symptoms among Florida farmworkers. Journal of nursing scholarship, ٥٠(١), ٧٤-٨٢.

[١٩]**Ou, Y., Wang, F., Zhao, J. and Deng, Q. (٢٠٢٣):** Risk of heatstroke in healthy elderly during heatwaves: A thermoregulatory modeling study. Building and Environment, ٢٣٧, ١١٠٣٢٤.

[٢٠]**Pandit, A. (٢٠٢٣):** Number of people aged ٦٥ years or older worldwide projected to more than double by ٢٠٥٠: UN report, Available at: https://timesofindia.indiatimes.com/world/rest-of-world/number-of-people-aged-٦٥-years-or-older-worldwide-projected-to-more-than-double-by-٢٠٥٠-un-report/articleshow/٩٧٠١١٩٣٤.cms Accessed on ١٥/١/٢٠٢٤, at ١٠:٠٠ am.

[٢١]**Sarkar, S., Dhar, B., Fahlevi, M., Ahmed, S., Hossain, M., Rahman, M., ... and Rajamani, R. (٢٠٢٣):** Climate Change and Aging Health in Developing Countries. Global Challenges, ٧(٨), ٢٢٠٠٢٤٦.

[٢٢]**Shah, N. (٢٠٢٣):** Egypt Chronic Obstructive Pulmonary Disease (COPD) Therapeutics Market Analysis, Available at: https://www.insights١٠.com/report/egypt-chronic-obstructive-pulmonary-disease-copd-therapeutics-market-analysis/ Accessed on ٢٠/١/٢٠٢٤, at ١١:٠٠ am.

[٢٣]**Smith, D., Ferranti, E., Hertzberg, V. and Mac, V. (٢٠٢١):** Knowledge of heat-related illness first aid and self-reported hydration and heat-related illness symptoms in migrant farmworkers. Workplace Health & Safety, ٦٩(١), ١٥-٢١.

[٢٤]Vicedo-Cabrera, A., Melén, E., Forastiere, F., Gehring, U., Katsouyanni, K., Yorgancioglu, A., ... and Andersen, Z. (٢٠٢٣): Climate change and respiratory health: a European Respiratory Society position statement. European Respiratory Journal, ٦٢(٢).