

Health Risks Related to Climate Changes among Older Adults

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Abstract

Background Climate changes are changes in the statistical properties of the climate system that persists for several decades or longer usually at least 30 years. Climate changes not only affect ecosystems but also, these changes have an impact on health, especially in vulnerable populations such as older adults. **Aim of this study:** to assess health risks related to climate changes among older adults. **Design:** A cross-sectional descriptive study design was used. **Setting:** The study was conducted at 4 geriatric homes and 4 clubs in the Fayoum governorate and Cairo governorate. **Sample:** A convenience sample was used, they were 185 older adults 60 years old and over of both sex. **Tool:** The tool consists of 4 parts: 1st part, socio-demographic characteristics of older adults. 2nd part is the health status of older adults related to climate changes. 3rd part, older adults' knowledge regarding climate changes. 4th part, older adults' reported practice regarding their adaption towards climate changes. **Results:** The study results showed that 56.8% of the total health status of older adults related to climate changes was good and 43.2% were poor, total knowledge of older adults regarding climate changes were 16.8% had good knowledge, 40.0% had moderate knowledge and 43.2% had poor knowledge. The total practice was 44.3% of older adults had inadequate practice and 55.7% had adequate practice. **Conclusion:** there was a highly statistical significant relation between socio-demographic characteristics and total knowledge about climate changes among older adults. There was a highly significant statistical correlation between knowledge and reported practice among older adults and there was a non-significant statistical correlation between Health status and practice among older adults. **Recommendation:** Provide an educational program for older adults especially with chronic diseases how to deal with climate changes.

Keywords: Health risk, climate change, older adults.

Introduction:

The older adult is defined as a person who is over 60 years of age accompanied by major physical and cognitive changes. The process of aging is perceived in multiple ways including chronological age and biological markers such as impairment in vision and hearing, wrinkling skin, and fatigue, who represent the fastest-growing segment of populations throughout the world. However, families and communities often use other socio-cultural referents to define age, including family status (grandparents), physical appearance, or

age-related health conditions (Kohli et al., 2020).

Older adults worldwide are living longer. By 2030, 1 in 6 people in the world will be aged 60 years or over. At this time the share of the older adults aged 60 years and over will increase from 1 billion in 2020 to 1.4 billion. By 2050, the world's population of older adults aged 60 years and older will double (2.1 billion). The number of older adults aged 80 years or older is expected to triple between 2020 and 2050 to reach 426 million (WHO, 2021).

Climate change is a process of changing the climate system over a long period and a wide area due to natural processes or as a consequence of human activity. Natural processes have a small contribution to climate change, whereas human activity is the most significant contributor. Climate change is related to global economic developments that influence industrialization improvement, including greenhouse gases emission (**Intergovernmental Panel on Climate Change (IPCC), 2018**).

Climate changes affect both the environment and humankind. Climate change is already impacting health in a myriad of ways, including by leading to death and illness from increasingly frequent extreme weather events, such as heatwaves, cold, the disruption of food systems, increases in zoonoses and food-, water- and vector-borne diseases. These climate-sensitive health risks are disproportionately felt by the most vulnerable group including older adults, and those with underlying health conditions (**Singer et al., 2022**).

Older adults may be more likely to experience detrimental physical impacts such as dehydration and the worsening of symptoms of existing health problems such as respiratory and heart disease during a heatwave which make temperature regulation processes less efficient because there are biophysical differences between older adults and others, something which is important in terms of people's ability to cope with extremes of cold as well as heat. Difficulties coping in heat waves can be particularly marked when older people have other health problems which also affect thermoregulation, such as chronic cardiovascular, respiratory illness, and diabetes (**Bell et al., 2018**).

Community health nurses (CHN) should raise awareness among older adults of the potential impacts of extreme weather events such as heat and cold waves, poor air quality,

food, and water-borne diseases, and vector-borne disease on health. Nurses should advise older adults to avoid outdoor activities during extreme heatwaves and during a high level of air pollution, maintain good hydration and balanced nutrition make the place where stay well ventilated at all times, use fans and air conditioners as needed (**Casanueva et al., 2019**).

Significance of the study:

Climate change increases the temperature, affects air quality, drinking water, food, and increases vector-borne diseases, and these affect older adults' health. Older adults are vulnerable to climate change for many reasons. One reason is normal changes in the body associated with aging. And also, who is has a chronic health condition, such as diabetes. Therefore, this study will be conducted to assess health risks related to climate change among older adults (**Patella et al., 2018**).

In Egypt, the number of older adults is about 7 million, representing 7.1% of the total population, and this percentage is expected to rise to 17.9% in 2052. The number of elderly males reached 3.5 million, or 6.9% of the total male population, while the number of elderly females is 3.5 million, or 7.3% of the total female population (**Central Agency for Public Mobilization and Statistics (CAPMAS), 2020**).

Aim of the Study:

This study aimed to assess health risks related to climate changes among older adults through:

1. Assessing older adults' health status including health systems as (cardiac, respiratory and gastrointestinal systems) related to climate change.
2. Assessing older adults' knowledge regarding to health consequence related to climate change.
3. Assessing older adults' practices regarding their adaptation towards climate change.

Research questions:

1. Is there a relation between older adult socio-demographic characteristics and their knowledge regarding climate change?
2. Is there a relation between older adults' knowledge and their practice towards climate change?
3. Is there a relation between older adults' health status and their practices regarding climate change?

Subjects and Methods:**I- Technical Design:**

Includes research design, setting of the study, subjects of the study, and tools for data collection.

A. Research design:

A cross-sectional descriptive study design was used to assess health risks related climate changes among older adults.

Setting:

The sample was collected from Fayoum governate and Cairo governate: Fayoum governate (2 homes: Legitimacy Society Badr Al-Islam Complex contain 25 older adults), Shafi'i Fayoum Association "The house of the saint Anba Afram for the elderly" contain 12 older adults) and (4 clubs: Agricultural Club Association contain 20 older adults, Red Crescent Club include 60 older adults, El Hadqa Club of the Egyptian Society for Child Protection include 60 older adults, Abu Bakr Al-Siddiq Club include 30). Cairo governate (house of Umm Hani in Imbaba contain 50 older adults, House of Islamic acquaintance in the Mohandessin area contain 72 older adults), total number 329 older adults.

Sample:

Sample was composed of about 185 older adults aged 60 years old and over from both sex according to this power analysis equation.

$$n = \frac{N \times p(1-p)}{\left[\frac{N-1}{d^2} \div z^2 \right] + p(1-p)}$$

n: sample

z: The standard score corresponding to the significance level 0.95 is equal to 1.96

d: The error rate is equal to 0.05

p: Property availability and neutral ratio = 0.50

$$n = \frac{329 \times 0.50(1-0.50)}{(329-1) \times (0.05)^2 \div (1.96)^2 + 0.50(1-0.50)} = 185 \text{ older adults}$$

Tools of Data Collection:

The data was collected by using one tool: It was designed by the researcher based on reviewing related literatures. The structured interviewing questionnaire sheet was divided into 4 parts:

Part I: Socio-demographic data:

Socio-demographic characteristics of older adults include: age, sex, gender, ethnicity, marital status, race, current occupation, residence, family income, level of education, number of children, and number of years of living in the geriatric home.

Part II: Health status of older adult related to climate:

Health status of older adult related to climate change includes (smoking include (2 items), chronic diseases include (7 items), nervous system include (6 items), cardiac system include (6 items), respiratory system include (5 items), gastrointestinal system include (10 items), and muscular systems include (4 items).

❖ Scoring system:

Older adult who has a chronic disease or a problem as a result of climate change was considered as having a good health, and Older adult who suffers from more than two problems in more than one of the body's systems due to

climate change was considered as having a poor health.

Part III: Older adults' knowledge regarding climate change:

It was composed of 8 closed ended questions. Include (definition of climate change, causes of climate change, impacts of climate change on human, environment and society.

❖ Scoring systems:

The right answer was scored (1) and the wrong answer was scored (zero). These scores were summed and converted into a percentage score.

Total responses were classified into three categories:

- Good knowledge: If score $\geq 75\%$.
- Moderate knowledge: If score from 50 to less than 75%.
- Poor knowledge: If score $< 50\%$.

Part IV: Older adults 'reported practice regarding their adaption towards climate change:

It was composed of 4 questions. Include (Actions taken by older adults to lessen the impact of climate change include: preventive measures that were taken during a high temperature that include(10 items), Preventive measures that were practiced during severe cold waves include(11 items), the high rate of air pollution in the atmosphere include(6 items), measures that were practiced against infectious diseases include(11 items) and Preventive measures during the winter rains include(5 items).

❖ Scoring systems:

Total responses were classified into two categories:

- Adequate practice: $> 60\%$
- In adequate practice: $< 60\%$

II. Operational Design:

Includes preparatory phase, content validity, pilot study and fieldwork.

a) The preparatory phase:

Includes reviewing of related literature and theoretical knowledge of various aspects of the study using books, articles, scientific journal and internet with the aim of acquiring in-depth knowledge about the study.

b) Pilot study:

It was carried out on 10% (19) of older adults under the study to test the applicability, clarity and the efficiency of the tools. There were no modifications found after pilot study. So, these (19) older adults included in the study. The pilot showed very high levels of reliability. Alpha Cronbach Reliability Analysis of the Used Tool.

c)Content validity:

Revision of the tools was done by a panel of expertise composed of 3professors of community Health Nursing to measure the content validity of the tools and the necessary modifications was done accordingly.

d) Content reliability:

Reliability of the tools was tested to determine questionnaire items related to each other. **Alpha Cronbach Reliability Analysis of the Used Tool**

Items	Cronbach's Alpha	N of Items
Knowledge	0.750	8
Practice	0.710	46

This table shows Reliability in Knowledge and practice when Alpha Cronbach was > 0.5

The reliability was scaled as follows: < 0.25 weak reliability, $0.25-0.75$ moderate reliability, $0.75-1$ strong reliability, and 1 is optimum. The reliability for this questionnaire was 0.750.

Fieldwork:

The approval to conduct the study was obtained orally after explaining the aim of the study. Data collection was started and finished at 3 months from the beginning of July 2021 to the end of September 2021. Sample was collected in the first two months from geriatric homes then the last third month from the geriatric clubs during the period from 10 a.m 2:00p.m, every participant took a time about 30-45 minutes. The investigator met about 3-5 older adults per day twice a week (Monday and Tuesday) for 3 months. The structured interviewing questionnaire sheet was filled by the investigator from each participant in the study individually and some older adults were filling out the questionnaire alone. The structured interviewing questionnaire sheet took longer with participants who could not read and write. Some older adults were somewhat uncooperative.

III. Administrative Design:

An approval to carry out this study was obtained from the Director of the geriatric homes and clubs at Fayoum and Cairo Governorate.

Ethical considerations:

The research approval was obtained from scientific ethical committee in faculty of nursing at Ain Shams University before starting the study. The investigator clarified the objective of the study to older adults included in the study to gain their confidence and trust. The investigator assured maintaining anonymity and confidentiality of subjects' data. Older adults were informed that they are allowed to choose to participate or not in the study and that they have the right to withdraw from the study at any time.

IV. Statistical Design:

The data was collected, coded, and entered into a personal computer. It was analyzed with the program statistical package for social science (SPSS) version 20. Data were

presented using descriptive statistics in the form of frequencies and percentages, description of quantitative variables as mean, standard deviation, description of qualitative variables as numbers and percentages and Chi-square test was used to compare qualitative variables. Spearman correlation coefficient used to rank between two variable. Pearson product moment correlation (PPMC) and monte carlo simulation were used to shows the linear relationship between two sets of data while >0.05 Non significant $<0.05^*$ significant $<0.001^{**}$ High significant

Results:

Table (1): shows that, 44.9% of older adults were aged 65-74 years old and the mean of their age was 69.0108 ± 6.96028 . 59.5 of older adults were male and 71.3 of them were retired. 35.7% of older adults were secondary and 78.4% of their monthly income was enough. And the percentage of older adults who lived ≥ 10 in geriatric home was 1.1%.

Figure (1): Shows that 56.8% of the total health status of older adults related climate change was good and 43.2% were poor.

Figure (2): shows that the total older adults' knowledge regarding climate change was 43.2% of older adults had poor knowledge, 40% of them had moderate knowledge and 16.8% of them had good knowledge regarding climate change.

Figure (3): shows that the total practices of older adults were 55.7% adequate and 44.3% were inadequate.

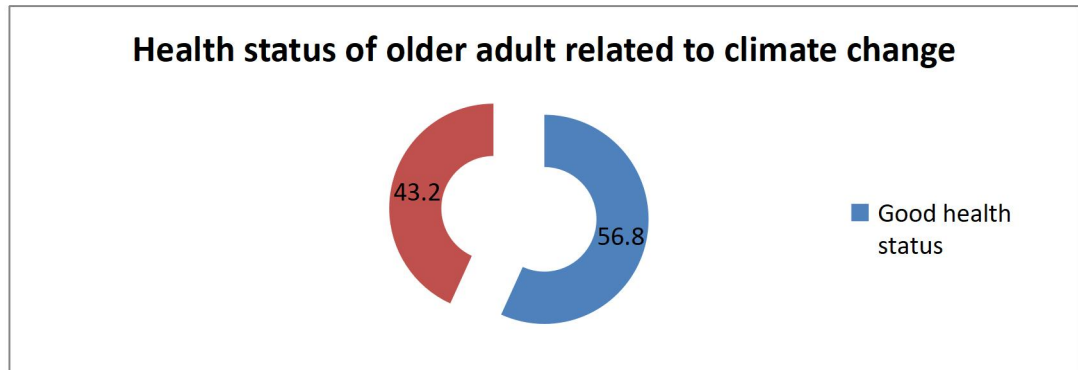
Table (2): shows that a highly statistically significant relationship between socio-demographic characteristics and total knowledge about climate change among older adults when the p-value was 0.000^{**} . Older adults who had high educational levels were more knowledgeable than other older adults.

Table (3): This table shows that, a highly significant statistically correlation between knowledge and practice among older adults when p-value was 0.000

Table (4): shows that a non-significant statistical correlation between Health status and practices among older adults when the p-value was 0.889 in which older adults who had health problems had a low level of practice than other older adults.

Table (1): Number and percentage distribution of older adults regarding their demographic characteristics (N=185).

Items	No	%
Age		
<65 years	59	31.9
65-74 years	83	44.9
75-79	27	14.6
≥80years	16	8.6
Mean and SD of older adults age	69.0108±6.96028	
Gender		
Male	110	59.5
Female	75	40.5
Marital status		
Single	10	5.5
Married	75	40.5
Divorced	30	16.2
Widow	70	37.8
Educational level		
Not read& write	47	25.4
Elementary	27	14.6
preparatory	8	4.3
Secondary	66	35.7
University	37	20.0
Occupation		
Retired	132	71.3
Not Working	27	14.6
Self-employment	21	11.4
manual work	2	1.1
Private sector	3	1.6
Monthly Income		
Enough	145	78.4
Not enough	40	21.6
child number		
No child	22	11.9
<3	24	13.0
≥3	139	75.1
Years of living in the geriatric home		
<one year	64	34.6
1-4 years	89	48.1
5-9 years	30	16.2
≥10	2	1.1



Figure(1): Percentage Distribution of older adults regarding their health status.

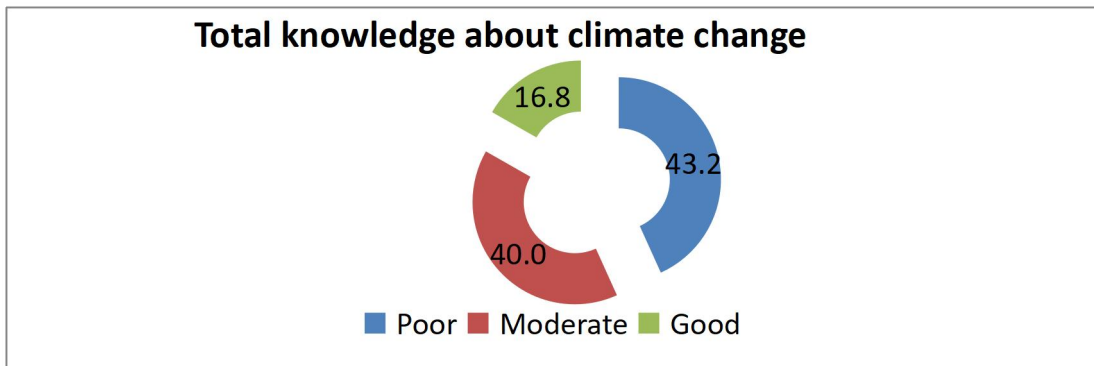


Figure (2): Percentage distribution of older adults regarding their total knowledge about climate change.

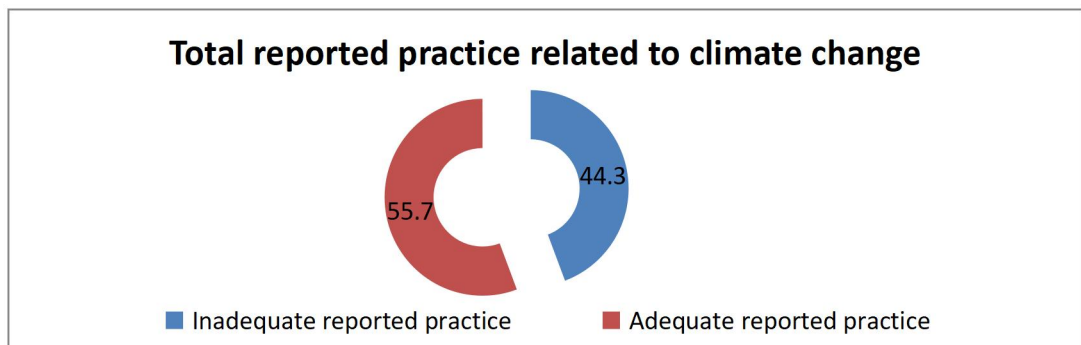


Figure (3): Percentage distribution of older adults regarding their total reported practice (N=185).

Table (2): Relation between socio-demographic characteristics and total knowledge about climate change among older adults (N= 185) (Q1).

Items	Total knowledge						statistical test	
	Poor		Average		Good		χ^2	P value
	No	%	No	%	No	%		
Age								
<65 years	18	9.7	29	15.7	12	6.5	MC	0.043*
65-74 years	34	18.4	34	18.4	15	8.1		
75-79	18	9.7	7	3.8	2	1.1		
≥80years	10	5.4	4	2.2	2	1.1		
Gender								
Male	40	21.6	52	28.1	18	9.7	6.583	0.037*
Female	40	21.6	22	11.9	13	7		
Educational level								
Not read& write	47	25.4	0	0	0	0	MC	0.000**
Elementary	26	14.1	1	0.5	0	0		
preparatory	6	3.2	2	1.1	0	0		
Secondary	1	0.5	65	35.1	0	0		
University	0	0	6	3.2	31	16.8		
Occupation								
Retired	33	17.8	68	36.8	31	16.8	MC	0.000**
Not Working	25	13.5	2	1.1	0	0		
Self-employment	19	10.3	2	1.1	0	0		
manual work	2	1.1	0	0	0	0		
Private sector	1	0.5	2	1.1	0	0		
Years of living in the geriatric home								
<one year	26	14.1	25	13.5	13	7	MC	0.973
1-4 years	38	20.5	37	20	14	7.6		
5-9 years	15	8.1	11	5.9	4	2.2		
≥10	1	0.5	1	0.5	0	0		

MC: Monte Carlo test: 2 cells have expected cell count <5

Table (3) :Correlation between knowledge and self-reported practice among older adults (N= 185) (Q2).

Items	Practice	
	r	P value
Knowledge	.372**	0.000

Table (4): Correlation between health status and self-reported practice among older adults (N= 185) (Q3).

Health status	Practice	
	r	P value
Health problems	0.010	0.889

Discussion:

The older adults have a complex relationship to the environment. They are more sensitive to changes in the environment and infectious agents. This greater sensitivity is a by-product of a lower physiological reserve capacity, slower metabolism, and a more slowly responding immune system. The cumulative effect of this increased disease burden makes specific organ systems less able to tolerate stress (**Mohr et al., 2020**).

Socio- Demographic Characteristics of older adults regarding climate change: The current study results reveal that more than half of older adults regarding climate change are male (**Table 1**). This finding is in agreement with (**Kabir et al, 2016**) who performed study at Bangladesh about” Knowledge and perception about climate change and human health” who mentioned that the most of the older adults were male. From the investigator point of view, these results might be due to older adults are unable to serve themselves and there is no one to take care of them.

The current study results reveal that nearly half of older adults are lived from 1-4 years in the geriatric homes (**Table 1**). This finding is in agreement with (**Fathy et al, 2020**), who performed study at El hlal Elahmer and Noor Wel Amal geriatrics home that is located in Beni-Suef governorate, Egypt about” quality of life among elderly people at geriatric home” who mentioned that nearly half of older adults are lived from 1-4 years in the geriatric homes. From the investigator point of view, these results might be due to feeling of loneliness, ignorance and lack of emotional support.

Regarding the health status of older adults related to climate change, the current study results reveal that more than half of older adults had a good health status (**Figure 1**). This finding is in agreement with (**Mishra, & Chalise, 2019**) which performed at Ratna Rajya Laxmi Campus, Tribhuvan University, Nepal

about” health status of elderly living in Briddaashram (old age home)” Who mentioned that more than one half of older adults 57% reported good or excellent health status. From the investigator point of view, these results might be due to older adults think that as long as they do not feel symptoms, they will be fine.

Older adults’ knowledge regarding climate change, The current study results reveal that more than half a quarter of older adults had a good knowledge; more than one third of older adults had moderate and poor knowledge (**Figure 2**). This finding is in disagreement with (**Aimulhim., 2021**) which performed at Saudi Arabia about” public knowledge and perception of climate change and global warming in the context of environmental challenges and policies in Saudi Arabia“who mentioned that only more than quarter of the total respondents had a clearly knowledge about climate change, while nearly half of respondents had partial knowledge of climate change and half quarter of respondents had a little knowledge of climate change. From the investigator point of view, these results might be due to older adults with low education do not have good knowledge of climate change unlike older adults with higher education have knowledge of climate change.

Older adults’ reported practice regarding their adaption towards climate change, the current study results found that more than half of older adults had inadequate total practice regarding climate change (**figure 3**). This finding supported with (**McDermott-Levy., et al, 2019**) which performed at Journal of gerontological nursing, Florida about” Addressing the health risks of climate change in older adults” who mentioned that more than half of older adults had a lack of total practices in how to deal with extreme weather events. From the investigator point of view, these results might be due to most of older adults have no knowledge about how to deal with climate change and due to lack of capabilities.

The current study results found a highly statistically significant relation between socio-demographic characteristics and total knowledge about climate change among older adults when p-value was 0.000**. Older adults who had high educational level more knowledgeable than other older adults and older adults who had enough monthly income more knowledgeable than other older adults (Table 2). This finding supported with (Yang et al, 2020) which performed at Singapore about "how is climate change knowledge distributed among the population in Singapore? a demographic analysis of actual knowledge and illusory knowledge. Who mentioned that there is a positive relationship between education and knowledge, older adults with higher education have more knowledge of climate change than those without higher education, and also, older adults with higher household income are more knowledgeable of climate change compared to those with lower household income which answered Q1.

The current study results found a highly significant statistically correlation between knowledge and practice among older adults when p-value was 0.000 (Table 3). This finding supported with (Monroe et al, 2019) which performed at university of Florida, Gainesville, FL, USA about "identifying effective climate change education strategies: a systematic review of the research "who mentioned that Individuals and communities who didn't had enough information about climate change were not aware of what actions can be taken. And also, this finding supported with (Bhuiyan &Khan, 2011) which performed at Kazakhstan about "climate change and its impacts on older adults' health in Kazakhstan" who reported that older adults with knowledge about climate change were more aware of how to deal with climate change which answered Q2.

The current study results found a non-significant statistical correlation between health status and practice among older adults when the

p-value was 0.889 in which older adults who had health problems had a low level of practice than other older adults (Table 4). This finding is in disagreement with Rhoades et al., (2018) which was performed at in Bridgeport, CT, USA about "Developing an in-depth understanding of elderly adult's vulnerability to climate change "who mentioned that there was a relationship between health problems and practice in which the adaptive capacity of many older adults can be limited by factors including health conditions and disabilities. From the investigator's point of view, these results might be due to that the practices of the older adults have nothing to do with chronic diseases or their health and older adults need to deal well with climate changes avoid overload on health which answered Q3.

Conclusion:

According to current study results, more than half of the total health status of older adults related to climate change was good while more than one third was poor. More than half a quarter of the total older adults' knowledge regarding climate change had a good knowledge and more than one third had poor and moderate knowledge for each one of them. Also, more than half of the total reported practices of older adults regarding climate change were inadequate while more than one third were adequate.

Based on the research and research questions, the study concluded that there is a highly statistically significant relation between socio-demographic characteristics and total knowledge about climate change among older adults. And there is a highly statistically correlation significant between knowledge and practice among older adults. Also, non-significant statistically correlation between Health status and practice among older adults which older adults who had health problems had low level of practice than other older adults.

Recommendations:

1. Provide educational program to older adults especially with chronic diseases how to deal with climate change.
2. Provide a plan to reduce the environmental risks related to climate change on the health of older adults.
3. Conducting a long-term research study on climate changes and its impact on the health of older adults as well as exploring the basic requirements for adapting and mitigating from impact of climate changes among older adults such as their need to request information, knowledge and experience, Psychological support and access to services.

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