Effect of Health Preventive Program toward COVID-19 on Knowledge, Perceptions, and Practices among Older Adults

Zakia T. Toama. [(1)], Ola Gouda Mohamed Elshiekh [(2)], Ola Ezzat Eltohamy Mohamed [(2)], Nermeen Mahmoud Abd El-Aziz[(3)]

(1) Professor Community Health Nursing Department, Faculty of Nursing, Alexandria University
(2) Lecturer of Gerontological Nursing, Faculty of Nursing, Damanhour University.
(3) Assistant Professor of Gerontological Nursing, Faculty of Nursing, Assuit University.
Corresponding author: olaelshiekh@yahoo.com

Abstract

Background: Older adults are more vulnerable to COVID-19 disease due to their reduced immunity and comorbidity. Awareness of dealing with extremely infectious respiratory diseases plays an important role in limiting the spread of the infection. **Aim of the study:** Is to investigate the effect of applying health preventive program toward COVID-19 on knowledge, perceptions and practice among older adults. **Research design:** A quasi experimental. **Setting:** The study was conducted in two geriatric clubs (Legitimacy Assembly and Islamic Cultural Center) affiliated to Assiut city, Egypt. **Subjects:** 120 older adults from the previously mentioned settings were selected. **Tool I**: Older adults' health status and, socio – demographic characteristics, **Tool II:** Knowledge questionnaire about COVID-19 among older adults, & **Tool III:** perceptions of the older adults about COVID-19. In addition to, **Tool IV:** practices of the participants related to COVID-19. Data were analyzed using percentages & ANOVA with repeated measures, Friedman test and Student t-test. **Results:** Statistically significant improvement of COVID-19 Knowledge, Perceptions, and Practices immediately after the program implementation and the improvement still apparent across all the studied subjects regardless of their demographic characteristics and clinical data**. Conclusion:** It was concluded that older adult's knowledge, perceptions, and practice toward COVID-19 was greatly enhanced by applying the health preventive program. **Recommendation:** Development of health preventive programs targeting older adults, designing guidelines by healthcare authorities to improve access for education and health services.

Keywords: COVID-19, aging, Knowledge, perceptions, practice, Older adults.

Introduction:

The world is facing COVID-19 pandemic, which is highly infectious. Several measures have been put in place to prevent its spread among the population. The COVID-19 is a respiratory illness first identified during an investigation into an outbreak in Wuhan, China, on December 12, 2019, the origin of which was traced to the Huanan seafood market in Wuhan **(Zhou et al., 2020; Aleem et al., 2021).** The highly contagious virus, which caused the disease called coronavirus disease (COVID-19) **(Shigemura et al., 2020).** This was later officially named as an spread of a new COVID-19 by World Health Organization (WHO) **(World Health Organization [WHO], 2019)**, and as the severe acute respiratory syndrome coronavirus (SARS-CoV-2) by Coronavirus Study Group (CSG) of the International Committee on Taxonomy of Viruses, on 11 February 2020 **(European Centre for Disease Prevention and Control [ECDC], 2020; Sun et al., 2020).** This highly contagious virus, spread outside China and has since become a global public health emergency **(Aleem et al., 2021)**.

COVID-19 is transmitted from person-to-person by close contact through the respiratory droplets in coughs or sneezes or by touching contaminated surfaces or objects **(Cascella et al., 2021)**. The virus incubation

period is 2–14 days with the majority of patients (80%) have mild symptoms that do not require medical intervention. About 20% of COVID-19 cases had serious illness and can be fatal in about 2% of cases **(Centers for Disease Control Prevention (CDC), 2020a; Li et al., 2020a).** The most clinical symptoms of COVID-19 include fever, cough, fatigue, malaise, and shortness of breath. Global concerns about the virus have increased due to its high transmission capability, which may be associated with morbidity and mortality **(Huang et al., 2020; Cennimo et al., 2021; Finelli et al., 2021).**

WHO declared that there were 362,019 confirmed cases of SARS-CoV-2 reported from 168 various countries, with 15,488 deaths and an overall case fatality rate of 4.3%. CDC reported that although individuals older than age 65 comprise 17% of the total population in the United States, they make up 31% of COVID-19 infections, 45% of hospitalizations, 53% of intensive care unit admissions, and 80% of deaths caused by this infection. This suggests that the elderly people are more likely to get COVID-19 and have worse outcomes compared with the general population **(Centers for Disease Control Prevention (CDC), 2020b; Cennimo et al., 2021).**

As of 28th April 2020, a total of 2, 954,222 cases of COVID-19 had been confirmed worldwide 22,376 reported in Africa with 202, 597deaths and 899 deaths registered in Africa that giving a crude fatality ratio of 6.9% worldwide and 4 % in Africa **(Culp, 2020; Ssebuufu et al., 2020)**. Egypt is showing massive resistance in limiting the total number of positive cases to about 23,000 cases and 913 confirmed cases of death on account of COVID-19 **(Centers for Disease Control and Prevention [CDC], 2020; World Health Organization [WHO], 2020c).**

The highly infectious characteristics of COVID-19 makes it dangerous, and causes a high fatality rate, Egypt Ministry of Health and Population announced that most COVID-19 deaths recorded in Egypt were among cancer patients and those who suffer from digestive, heart, liver and kidney diseases, that 80 percent of the country's coronavirus cases are aged between 30 and 60 years while 20 percent are older than 60 years of age. As more as, the death rate among COVID-19 patients older than 60 years of age is 60 percent, while the infection rate is seven percent for people older than 70 years **(Fahim et al., 2021; Saied et al., 2021)**.

Older adults are susceptible to both acute and chronic infections due to reduced immunity. Immune senescence, which is the down regulation of the immune system at multiple levels, is mainly related to aging and increase the vulnerability to a multitude of infections which leads to reduced cell-mediated immunity and poor antibody response to immunogens. Moreover, comorbidities such as diabetes, renal failure, and neuromuscular disorders and the long-term use of medications such as glucocorticoids and proton pump inhibitors make elderly more vulnerable to infections **(Bajaj et al., 2020; Guo et al., 2020)**.

Furthermore to host-related factors, environmental or social factors lead to the high infection risk among older adults. These include poor living conditions, nutrition, ventilation, sanitation, and overcrowding, especially among older adults in long-term care. The interactions between host and environmental factors, make older adults highly susceptible to infections. Also, these factors interfere with the clinical recovery of patients **(Halter et al., 2016).**

Along with that, proper control of comorbid conditions is important to preserve immunity, prevent unnecessary hospitalizations, and thereby reduce the infection risk. Facilities should be provided for home monitoring of temperature, blood pressure, and blood sugar. More observation is required to identify early and atypical symptoms of infections, and the screening criteria should be available for older people. Early screening of COVID-19 and treatment of older adults may avoid the need for intensive care and life support measures **(Egypt Today staff, 2020)**.

Thence, a good educating of the underlying factors for the older adults, and enhancing their knowledge related to COVID-19 preventive measures, plays a major role in change their risk perception and motivate them for practicing and implementation of health preventive measures during pandemics. These measures including, hand washing, wearing of mask, household ventilation and disinfection, and decrease of interpersonal contacts by avoiding visiting crowded spaces. Also, using of hand sanitizer as possible, avoid handshaking and touching high-traffic surfaces in public places–for example, elevator buttons, door handles, handrails, or counters **(Lekamwasam & Lekamwasam, 2020).**

Moreover, with a COVID-19 vaccine development process progresses, getting a COVID-19 vaccine is an important step to prevent getting sick from COVID-19 for older adults. Further emphasizes the importance of boosters, as a preventive measures to increase the immune response for older adults is needed for enhanced protection against COVID-19 **(Centers for Disease Control and Prevention [CDC], 2021; National Foundation for Infectious Diseases, 2021)**.

Significant of the Study

Compliance with preventive strategies for older adults and increase their awareness for dealing with COVID-19 are extremely crucial and plays an imperative role in limiting and preventing the widespread.

The older adults' adherence to preventive measures established by the government is likely be influenced by their knowledge and perception toward COVID-19 which is important determinant for their willingness to practice the health-preventive measures during pandemics. Additionally, many studies were conducted among older adults and confirmed that good knowledge and appropriate perceived beliefs are associated with high levels of involvement in behaviors to prevent COVID-19 **(Armitage & Nellums, 2020).**

Aim of the study

The aim of the study is to:

Investigate the effect of applying health preventive program toward COVID-19 on knowledge, perceptions, and practices among older adults.

Research Hypothesis:

1. Applying COVID-19 health preventive program will exhibit increase of knowledge, among older adults.

2. Applying COVID-19 health preventive program will exhibit increase perceptions and practices level among older adults.

Materials and Method

Material:

Research Design:

The quasi experimental design was adopted to carry out this study.

Setting:

The existent study was conducted in two geriatric clubs (Legitimacy Assembly and Islamic Cultural Center) affiliated to Assiut city, Egypt.

Subjects:

120 older adults from the previously mentioned settings were selected. The study respondents were fulfilling the following criteria; aged 60 years and above, were willing to participate in the study, able to communicate effectively, free from any neurological disorders such as stroke, dementia, and Parkinson's disease which may alter the elderly perception, and attending the previous settings during the time of data collection.

Sampling technique:

Using the equal allocation method, a sample of 60 older adults was selected from each of the previously mentioned settings. The

total sample size was 120 male or female older adults.

Sample size:

The sample size was estimated using Epi info 7 statistical program using the following parameters; prevalence of the problem 50%, 95% confidence level with 5% margin of error. The minimum sample size estimated to be 118 male or female older adults from both setting. The final sample size was 120 male or female older adults from both clubs to compensate possible non response.

Tools of the study:

Four tools were used to collect the required data

Tool (I): Older adults' health status and, socio – demographic characteristics: it was developed by the researchers based on relevant literature to collect information from the study subjects about socio-demographic data **(Geldsetzer P et al., 2020; Talaat, 2020)**

It comprised two parts:

Part 1: this part of the questionnaire included 6 items related to the health status and, socio-demographic characteristics of the older adults such as age, sex, education, occupation, monthly income and type of chronic disease.

Part 2: older adults' source of information of about COVID-19. The questionnaire included 2 items, firstly the hearing about COVID-19, and secondly the main source of knowledge about COVID-19 such as Ministry of health and population (MOHP), WHO website, social media, newspaper and television / radio, physicians, and friends or family.

Tool (II): Knowledge questionnaire about COVID-19 among older adults.

This questionnaires were established by the researcher on the basis of some published literature **(Geldsetzer, 2020; World Health Organization [WHO], 2020a)** to assess the knowledge among the participants. It contained 33 items was answered on a true or false basis and an additional "I don't know" option. Each "correct" response was scored as one point and an "incorrect" response as zero, giving the possible range of scores from 0 to 33. The percent score equal total score divided by number of items multiply by one hundred, scores < 50% indicate a poor knowledge, scores ranged from 50% to 75% reflect a fair knowledge, and scores ≥ 75% indicate a good knowledge. Cronbach Alpha Coefficient was used to ascertain the reliability of the study (r= 0.972)**(Akalu et al., 2020, Geldsetzer, 2020; WHO, 2020a)**.

It comprised three parts

Part 1: mode of transmission (9items), the older adults were asked to assess their knowledge about potential sources and modes of transmission. Droplets when an infected person coughs, sneezes or speaks, kissing an infected person, handshake an infected person, dealing with domestic animals, touching a contaminated surface, from person- to-person within close distance, and touching coins and banknotes…. etc.

Part 2: common symptoms (10 items), used to assess their knowledge about common symptoms of corona virus as headache, Fever, sore throat, and dry cough….etc.

Part 3: precaution measures against COVID-19 (14 items), The questionnaire assessing their knowledge related to washing hands frequently after being in a public place after nose-blowing, coughing or sneezing with soap and water for at least 20 seconds or use an alcohol based hand sanitizer (70%), putting on facemask, avoiding crowdedness in public places, keep at least one meter distance between people, avoid public gatherings, healthy food and drinking water, stay at home as much as possible ,avoid shaking hands when greeting others, avoid kissing others when greeting them …..etc.

Tool (III): perceptions of the older adults about COVID-19, the questionnaires were developed by the researcher to assess the older adults, perceptions towards COVID-19 infection. It comprised by 7 questions. The response could be either yes, no, or not sure. Each "correct" response was scored as three

point and an "incorrect" response as one, and "not sure" scored as two point, giving the possible range of scores from 7 to 21. The percent score equal average score minus one divided by two multiply by one hundred. Causes of risk perception of more susceptibility to COVID-19 or perception of fear from catching covid19 were encountered. Cronbach Alpha Coefficient was used to ascertain the reliability (r = 0.734) **(Wolff et al., 2019; Dryhurst et al., 2020; Zhong et al., 2021)**

Tool (IV): Practices of the participants related to COVID-19

The questionnaires were modified by the researcher to assess the participants' practices for COVID-19 prevention. It consisted of 15 items with two responses were answered yes or no, the correct answer was assigned 1 point and an incorrect answer was assigned 0 point. The overall practice score was categorized using the same Bloom's cut-off point, as good if the score was between 80 and 100% (12–15 points), moderate if the score was between 60 and 79% (9 – 11.9 points), and poor if the score was less than 60% (< 9 points). Cronbach Alpha Coefficient was used to ascertain the reliability (r=0.778) **(Akalu et al., 2020)**.

Method:

The study was executed according to the following steps:

Administrative Process

- An official letter was issued from the Faculty of Nursing, Assiut University to the Legitimacy Assembly and Islamic Cultural Center clubs managers for data collection approval.

- Meetings were held with the directors of the selected settings to clarify the purpose of the study and to gain their cooperation and support during data collection.

Study Tool

- The study tools were arranged either constructed by the researchers after reviewing the recent relevant literature (i.e. tool I, tool II, and tool III), it was validated by juries of (5) experts in the field. Their suggestions and recommendations were taken into consideration or adopted (i.e. tool IV).

- The adopted tools were already tested for reliability in previous studies.

Pilot Study

- Was carried out on 12 (10%) community residing older adults who were randomly chosen from the each of the previously mentioned settings and were not included in the sample in order to ascertain the relevance, clarity and applicability of the tools, test wording of the questions and estimate the time required for the interview. Based on the obtained results, the necessary modifications were done. The pilot study confirmed that the needed time for the study sample to complete the questionnaire ranged from 30- 45 minutes.

The COVID-19 health preventive program:

I- Assessment phase:

● Initial assessment of each older adult in the previously mentioned settings using **(tool 1)** for assessing of the socioeconomic status, **(tool II)** for assessing the knowledge related to COVID-19, **(tool III)** for assessing the participant perceptions towards COVID-19 infection, **(tool IV)** for assessing the participant's practices related to the prevention of COVID-19. These tools was carried out before applying the preventive program, the researchers conducting booklets, and pamphlets.

II- Developmental phase:

The program objectives and methodology were prepared based on reviewing of all relevant and recent literature **(Wolff et al., 2019; Dryhurst et al., 2020; Geldsetzer, 2020; World Health Organization [WHO], 2020a; Zhong et al., 2021)** and the results of the assessment phase and the older adults knowledge needs to include the main source of knowledge on COVID-19, positive effects of properly precaution measures against COVID- 19, gave information on how to act, and what

to do. Provide explanations and details for reducing the risk of getting COVID-19 in individual discussion, about delay or cancel visits with family and friends, or things to consider to help make the visit as safe as possible, encourage social distancing, wear masks, learning them how wash hands and using sanitizer, limit contact with commonly touched surfaces or shared items, receiving the recommended vaccinations against COVID-19, continue medicines and do not change the treatment plan without talking to healthcare provider **(Akalu et al., 2020)**.

III- Implementation phase:

● Each older adults included in the study was interviewed individually to collect the necessary data using tool I, II, III,IV privacy was maintained.

● The older adults were divided into 10 groups at every club. Each group composed of 6 older adults for each group, the program was conducted on 4 sessions along 4 weeks, 2 sessions per week. Each session duration took about 30 - 45 minutes.

● The researcher conducted this program at the club using different methods of teaching such as discussion, brain storming, also using booklet and pamphlets during the session.

IV- Evaluation phase:

● The older adults in the present program were evaluated to determine the extent to which they have acquired the desired knowledge and skills for hand washing, putting on facemask and practiced it.

● Evaluation of the older adults' prior the program was done in the form of pretest administered to them using tool (II), (III) and (IV). At the end of the program, a post test was carried out using the same tools as in pre-test. Post tests were conducted twice, immediately after the end of the program and one month later to evaluate to evaluate the effectiveness of the program and achieve the proposed aim.

Data Collection:

Data was collected by the researchers during the period from the beginning of August 2020 to the end of January 2021.

Ethical Considerations:

An informed consent was obtained from older adults to participate in the study after explanation of the study purpose and its potential benefits. Issues related to privacy/ anonymity and confidentiality of the collected data were maintained.

Statistical Analysis:

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, and standard deviation. Significance of the obtained results was judged at the 5% level.

The used tests were

Components of Educational program	**Number of sessions**
- Over view COVID-19, Mode of transmission,	2
- Common symptoms of COVD-19	2
- Precaution measures against COVD-19, follow the direction of Egyptian ministry of health.	2
- instruction about the delay in seeking care, and remain in the community undetected, aggravate the spread of infection and the outbreaks of COVID-19 , can often lead to negative social phenomena such as fear, stigma.	2

● ANOVA with repeated measures

For normally distributed quantitative variables, to compare between more than two

periods or stages, and Post Hoc test (Bonferroni adjusted) for pairwise comparisons

- **Friedman test**

For abnormally distributed quantitative variables, to compare between more than two periods or stages.

- **Student t-test**

For normally distributed quantitative variables, to compare between two studied groups

Results:

Table 1 shows distribution of the health status and socio-demographic characteristics of the older adults. The results indicated that about two thirds (66.7 %) of the studied older adults were females and less than half (46.7 %) of the studied older adults had a preparatory or secondary school level as well as less than one third of them (30.8 %) had a university educational level. The monthly income of a large proportion of the studied older adults (70.0 %) less than 2000 Egyptian pounds. Supplementary Table 1 demonstrates that the studied older adults had a history of one or more chronic diseases with (56.7%, 50.0%, 45.0%, and 35.0%) of them had heart disease, hypertension, diabetes mellitus, and chronic lung disease, respectively.

Figure 1: Illustrate that the main source of information about COVID-19 among the studied older adult, were all of them had heard about COVID-19. Moreover, they had one or more source of information, 83.3% were television / radio, 62.5% were friends/family, and 44.2 % were social media.

Table 2: Portrays the distribution of correct answers of the older adults, knowledge related to COVID-19 transmission and Common symptoms and precaution measures. It shows an apparent improvement in the studied older adults' knowledge regarding all items mode of transmission, common symptoms and precaution measures against COVID-19. Overall, the results revealed significant effect of health education program on older adults, knowledge about COVID-19 disease in the pre, post program and follow up phases (F test (ANOVA) =634.168, p=<0.001) as shown in this table. The Total Score M ± SD were (M ± SD = 2.63 ± 4.17, 11.23 ± 2.78, 10.66 ± 3.56, respectively). Significant differences were observed between three phases (p=<0.001, p=<0.001, p=0.003, respectively).

Table 3: presents the final total scoring of the older adults' knowledge level related to COVID-19 in pre-post program and follow up stages. The table reveals that more than three quarters **(87.5%)** of the older adults had poor knowledge prior the program implementation compared to **(91.7%)** of them had good knowledge immediately after the program. While in the follow up stages after one month, it dropped to **(86.7%),** and only **(2.5%)** of them had fair knowledge with a statistically significant difference between them (Fr = 202.907, P = <0.001).

The table also shows that the total mean score of the older adults' knowledge level was **4.74 ± 7.95** before the program, then it elevated to **29.70 ± 7.40** in the immediate post program evaluation. In follow up stages after one month, it slightly dropped to **28.46 ± 9.12** with a statistically significant difference between them (**F = 634.168, P = <0.001).**

Table (4): represents the distribution of the older adults related to their perceptions about COVID-19 in the pre, post program and after one month follow up. The results revealed significant effect of health preventive program on the older adults' perception regarding Corona virus (COVID-19) in the pre, post program and follow up where (F test (ANOVA) =883.969, p=<0.001) as shown in this table. The Total Score M + SD were (M ± SD = 12.73 ± 1.51, 19.68 ± 1.14, 19.58 ± 1.27, respectively). Significant differences were observed between phases (p=<0.001, p=<0.001, respectively).

Table (5) clarifies the distribution of the older adults for their correct practices related to COVID-19 with mean scores and standard deviations across preprogram, post program & after one month follow up. The results showed improvement significant effect of health preventive program among the older adults regarding their correct practices related to Corona virus in the preprogram, post program and follow up as stated by (F test (ANOVA) =294.205, p=<0.001), with

Percent Score of preprogram was M ± SD = 40.25 ± 21.47increased to 87.31 ± 16.86 post program; and slightly decreased to 85.43 ± 19.26in the follow up phase. Likewise, significant differences was observed between three phases (p=<0.001, p=<0.001, p=0.035, respectively).

Table (6) illustrates the effect of program implementation on the older adult regarding the correct practices related to COVID-19 (preprogram, post program & follow up). It elaborates that more than three quarters of them (80.0%) had poor practice score before implementation of program compared to the most (91.7 %) of older adults showed a marked good practice post program. Likewise, the follow up phase shows that 88.3% of older adults still had Good correct practices regarding to Corona virus. This reflect that there was a strong statistically significant difference between preprogram, post program & follow up phase as measured by Friedman test = 183.785 and p = <0.001. Also, the improvement was noticeable, as stated by (F test (ANOVA) =294.205, p=<0.001), with Total Score of preprogram was M ± SD = 5.82 ± 3.30 increased to 12.37 ± 2.38 post program; and slightly decreased to 12.10 ± 2.71 in the follow up phase. Moreover, significant differences were observed between three phases (p=<0.001, p=<0.001, p=0.035, respectively).

Table (7) portrays the relation between the socio-demographic characteristics and older adults' knowledge, perception, and practices mean scores related to COVID-19 across pre-post program and follow up stages. Starting with older adults' sex in responses to Knowledge mean scores, the table reveals that their mean score for male and female were raised to (84.26 ± 26.15, 93.53 ± 1.79, respectively) immediately after the program, While in the follow up phase, it dropped to (79.96 ± 31.37, 91.18 ± 10.88, respectively) with a statistically significant difference between them (t=2.871, P=0.005).Concerning to perception, the table shows that the mean scores of male and female were (30.86 ± 9.96, 26.88 ± 7.65, respectively) compared to(72.03 ± 8.55, 75.00 ± 0.00, respectively) immediately after the program and(71.09 ± 9.45, 75.00 ± 0.00, respectively) after one month with statistically significant differences between them(t=2.424, 3.105, 3.696, P= 0.017, 0.003, <0.001, respectively). Furthermore, their practice' mean score were changed to 84.58 ± 20.13, 92.75 ± 1.00 immediately after the program. While, in follow up phase the practice' mean score slightly decreased to 82.02 ± 22.81, 92.24 ± 2.48 with a statistically significant difference between them (t=3.958, P=<0.001).

With respect to older adults' age group, the age group 60 – 64, had a knowledge mean score of 93.40 ± 2.19 after the program with a statistically significant difference (F=9.338, P=<0.001) and lessened to 89.97 ± 13.93 after one month with a statistically significant difference between them (F=5.036, P= 0.008). The same picture was portrayed, that their perception mean score were raised to 74.24 ± 4.32 after program with a statistically significant difference (F=5.185, P=0.007), it dropped to 73.24 ± 4.72 in the follow up with a statistically significant difference between them (F=4.814, P=0.010). Moreover, the practice mean scores for the same age group were elevated to 91.74 ± 3.92 post program with statistically significant difference (F=8.698, P=<0.001). Then, it lightly decreased to 90.00 ± 5.05after one month with a statistically significant difference between them (F=7.853, P=0.001).

Lastly, regarding to the level of education, a knowledge mean score for university education increased to 93.45 ± 9.21 immediately after the program with a statistically significant difference (F=8.831, P=<0.001). While, significantly dropped to 89.90 ± 16.67 in follow up phase (F=4.892, P=0.003). The same picture noticed in their perception mean scores where were elevated to 75.65 ± 5.73 after the program and 74.97 ± 6.92 in follow up phase with statistically significant differences between them (F=4.521, P=0.005). On the other hand, practice' mean score rose to 92.13 ± 6.39 immediately after the program with statistically significant differences (F=9.379, P=<0.001), then significantly dropped to 89.25 ± 12.40 after one month (F=5.672, P=0.001).

Table (1): Distribution of the health status and, socio-demographic characteristics of the older adults (n = 120)

Socio-demographic characteristics	No.	%
Part I:		
Sex		
Female	80	66.7
Male	40	33.3
Age (years)		
60-	66	55.0
65-	39	32.5
Above 70	15	12.5
level of education		
Read and write	17	14.2
Primary school	10	8.3
Preparatory/secondary school	56	46.7
University	37	30.8
Occupation		
Employed	35	29.2
Retirement	63	52.5
Housewife	22	18.3
Monthly income (LE)		
< 2000	84	70.0
2000–< 5000	36	30.0
Type of chronic disease*		
Diabetes mellitus	54	45.0
Hypertension	60	50.0
Heart Disease	68	56.7
Chronic lung disease	42	35.0

* More than one answer

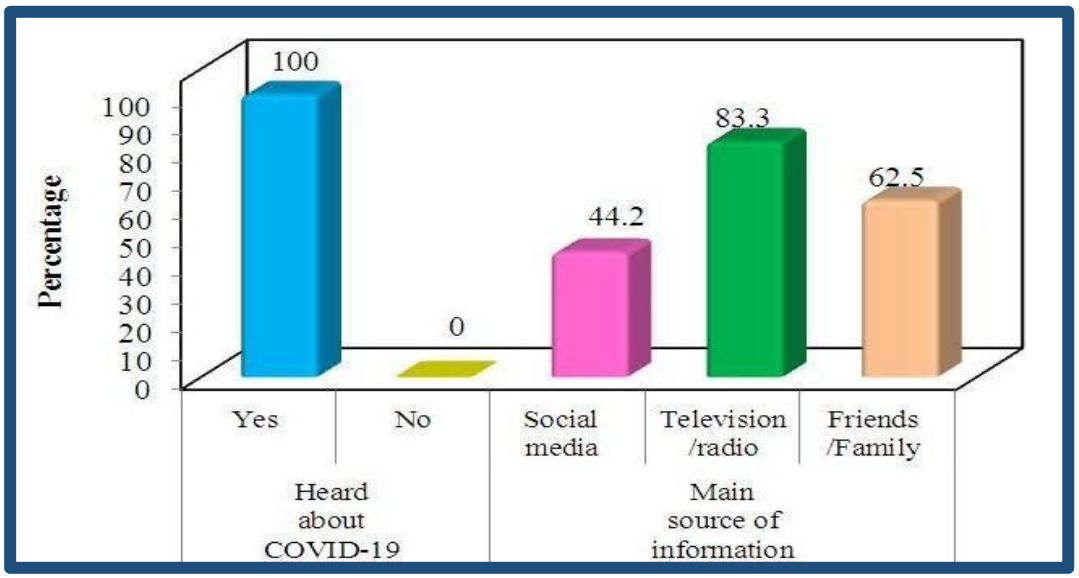

Figure 1. Distribution of the studied older adult according to their main source of information about COVID-19 (*More than one answer.)

Table (2): Distribution of correct answers of the older adults' knowledge related to COVID-19 transmission, Common symptoms and precaution measures

Knowledge items	Preprogram N=(120)		Post program N=(120)		Follow up N=(120)		F	p
	No	%	No	%	No	%		
1.Mode of Corona virus transmission								
Droplets when an infected person coughs, sneezes or speaks	16	13.3	110	91.7	100	83.3		
Kissing an infected person	7	5.8	112	93.3	107	89.2		
Handshake an infected person	----	----	112	93.3	110	91.7		
dealing with domestic animals	2	1.7	110	91.7	108	90.0		
Touching a contaminated surface and then touching one's eyes, nose or mouth	4	3.3	112	93.3	110	91.7		
From person-to-person within close distance of each other	9	7.5	113	94.2	109	90.8	974.445*	<0.001*
Touching coins and banknotes	----	-----	110	91.7	108	90.0		
Eating contaminated food	17	14.2	110	91.7	105	87.5		
The disease could be transmitted from asymptomatic person	2	1.7	113	94.2	110	91.7		
Total Score M + SD	0.51 ± 1.49		9.26 ± 2.50		8.95 ± 2.87			
Sig. bet. periods	p1<0.001*		p2<0.001*		p3=0.006*			
2. Common symptoms include								
Headache	6	5.0	109	90.8	105	87.5		
Fever	65	54.2	115	95.8	112	93.3		
sore throat	5	4.2	115	95.8	111	92.5		
Dry cough	6	5.0	116	96.7	114	95.0		
Body aches	10	8.3	105	87.5	100	83.3		
Difficulty in breathing	15	12.5	113	94.2	111	92.5		
Vomiting	13	10.8	100	83.3	98	81.7		
Corona virus leads to pneumonia, respiratory failure, and death	31	25.8	112	93.3	97	80.8	637.566*	<0.001*
The virus may be more dangerous for the elderly	20	16.7	113	94.2	105	87.5		
The virus may be more dangerous in patients with chronic diseases	21	17.5	112	93.3	104	86.7		
Total Score M + SD	1.60 ± 2.58		9.21 ± 2.23		8.85 ± 2.78			
Sig. bet. periods	p1<0.001*		p2<0.001*		p3=0.001*			

Table (2): (Cont.)

Knowledge items	Preprogram N=(120)		Post program N=(120)		Follow up N=(120)		F	p
	No	%	No	%	No	%		
3.Preventive measures against COVID-19								
Washing hands frequently after being in a public place, after nose-blowing, coughing or sneezing with soap and water for at least 20 seconds or use an alcohol based hand sanitizer (60%)	**20**	**16.7**	**113**	**94.2**	**109**	**90.8**		
Avoid touching eyes, nose and mouth	**6**	**5.0**	**112**	**93.3**	**105**	**87.5**		
Putting on facemask	**33**	**27.5**	**113**	**94.2**	**109**	**90.8**		
Avoiding crowdedness in public places	**27**	**22.5**	**110**	**91.7**	**107**	**89.2**		
Keep at least one meter distance between people(Follow social distancing)	**18**	**15.0**	**111**	**92.5**	**103**	**85.8**		
Avoid public gatherings	**30**	**25.0**	**113**	**94.2**	**106**	**88.3**		
Healthy food and drinking water increase the body's immunity and resistance to Corona virus	**4**	**3.3**	**112**	**93.3**	**105**	**87.5**		
Stay at home as much as possible	**42**	**35.0**	**111**	**92.5**	**104**	**86.7**	**346.907***	**<0.001***
Avoid eating outside	**53**	**44.2**	**113**	**94.2**	**106**	**88.3**		
Avoid shaking hands when greeting others	**22**	**18.3**	**110**	**91.7**	**107**	**89.2**		
Avoid kissing others when greeting them	**22**	**18.3**	**112**	**93.3**	**108**	**90.0**		
An effective vaccine against the virus is currently available	**----**	**-----**	**111**	**92.5**	**107**	**89.2**		
An effective treatment against the virus is currently available	**9**	**7.5**	**113**	**94.2**	**104**	**86.7**		
People who have contact with someone infected with the Corona virus should be immediately isolated in a proper place (the observation period is 14 days)	**27**	**22.5**	**113**	**94.2**	**104**	**86.7**		
Total Score M + SD	**2.63 ± 4.17**		**11.23 ± 2.78**		**10.66 ± 3.56**			
Sig. bet. periods	**p1<0.001***		**p2<0.001***		**p3=0.007***			

F: F test (ANOVA) with repeated measures p_1**:** p value for comparing between pre and post program, p_2**:** p value for comparing between pre and after 1 month follow up, p_3**:** p value for comparing between post program and After 1 month follow up ***:** Statistically significant at $p \leq 0.05$

Table (3): The final total scoring of the older adults' knowledge level related to COVID-19

Items	Preprogram N=(120)		Post program N=(120)		Follow up N=(120)		Test of Sig	p
	No.	%	No.	%	No.	%		
Poor knowledge	**105**	**87.5**	**8**	**6.7**	**13**	**10.8**	**Fr= 202.907***	**<0.001***
Fair knowledge	**10**	**8.3**	**2**	**1.7**	**3**	**2.5**		
Good knowledge	**5**	**4.2**	**110**	**91.7**	**104**	**86.7**		
Total Score M + SD	**4.74 ± 7.95**		**29.70 ± 7.40**		**28.46 ± 9.12**		**F = 634.168***	**<0.001***
Sig. bet. periods	**p_1<0.001***		**p_2<0.001***		**p_3=0.003***			

F: F test (ANOVA) with repeated measures, Fr: **Friedman test**

P_1: p value for comparing between **Pre** and **After 1 week**, **P_2:** p value for comparing between **Pre** and **After 1 month follow up , P_3:** p value for comparing between **After 1 week** and **After 1 month, *:** Statistically significant at $p \leq 0.05$

Table (4): Distribution of the older adults related to their perceptions about COVID-19

Perceptions items	Preprogram N=(120)			Post program N=(120)			Follow up N=(120)			F	p
	1 %	2 %	3 %	1 %	2 %	3 %	1 %	2 %	3 %		
I believe that this disease is dangerous	4.2	1.7	94.2	95.0	1.7	3.3	91.7	3.3	5.0		
I am worried that I or another family member might get infected by this virus.	5.0	2.5	92.5	94.2	2.5	3.3	92.5	3.3	4.2		
I am believed that Covid-19 infection is associated with stigma and feels that people are afraid of dealing with them.	88.3	----	11.7	2.5	94.2	3.3	4.2	91.7	4.2		
I believe that media coverage about this disease is overstated.	14.2	----	85.8	3.3	95.0	1.7	3.3	91.7	5.0	**883.969***	**<0.001***
If a family member where to get diagnosed with COVID-19, I would prefer it to stays a secret.	87.5	1.7	10.8	2.5	94.2	3.3	3.3	91.7	5.0		
If I got infected, I would be worried about the way the health-workers, hospitalization process will deal with me.	88.3	1.7	10.0	2.5	91.7	5.8	5.8	87.5	6.7		
If I got infected, I would try to do anything to avoid isolation.	89.2	0.8	10.0	3.3	94.2	2.5	3.3	91.7	5.0		
Total Score M + SD	**12.73 ± 1.51**			**19.68 ± 1.14**			**19.58 ± 1.27**				
Sig. bet. periods	**p1<0.001***			**p2<0.001***			**p3=0.492**				

1 = Yes 2 = No 3 = Not sure **F: F test (ANOVA) with repeated measures, P_1:** p value for comparing between **Pre** and **After 1 week**, **P_2:** p value for comparing between **Pre** and **After 1 month**

P_3: p value for comparing between **After 1 week** and **After 1 month, *:** Statistically significant at $p \leq 0.05$

Table (5): Distribution of the older adults for their correct practices related to COVID-19

practices items	Preprogram N=(120)		Post program N=(120)		Follow up N=(120)		F	p
	No	%	No	%	No	%		
Do you participate in meetings, religious activities, events, and other social gatherings or any crowded place	102	85.0	8	6.7	10	8.3		
Have you worn a mask when leaving home?	42	35.0	113	94.2	111	92.5		
Do you reuse a mask?	30	25.0	20	16.7	22	18.3		
If yes:	21	70.0	2	10.0	3	15.0		
- Disposable mask								
- Cotton mask	9	30.0	18	90.0	17	85.0		
Do you wash your hands with soap and water frequently for at least 20seconds or use sanitizer/60% alcohol	37	30.8	113	94.2	110	91.7		
Have you frequently washed your hands with soap and water, for at least 40 seconds, especially after going to a public place, or after nose-blowing, coughing, or sneezing?	27	22.5	112	93.3	109	90.8		
Do you clean and disinfect frequently touched objects and surfaces	21	17.5	113	94.2	110	91.7	**294.205***	**<0.001***
Do you use other persons' phones, desks, offices, or other equipment?	101	84.2	11	9.2	15	12.5		
Have you recently avoided cultural behaviors, such as shaking hands?	23	19.2	110	91.7	111	92.5		
Have you been practicing social distancing?	21	17.5	112	93.3	109	90.8		
Do you take a vaccine against COVID-19?	---	----	38	31.7	60	50.0		
Do you cover your nose and mouth during coughing or sneezing with the elbow or a tissue, then throw the tissue in the trash	35	29.2	113	94.2	111	92.5		
Did you avoid unnecessary travel or outing during the outbreak?	23	19.2	112	93.3	109	90.8		
Do you stay home when you were sick due to common cold-like infection during the transmission period	62	51.7	114	95.0	110	91.7		
Do you listen and follow the direction of Egyptian ministry of health?	38	31.7	113	94.2	111	92.5		
Percent Score M ± SD	**40.25 ± 21.47**		**87.31 ± 16.86**		**85.43 ± 19.26**			
Sig. bet. periods	**p_1<0.001***		**p_2<0.001***		**p_3=0.035***			

F: F test (ANOVA) with repeated measures, P_1: p value for comparing between **Pre** and **After 1 week, P_2:** p value for comparing between **Pre** and **After 1 month**
P_3: p value for comparing between **After 1 week** and **After 1 month, *:** Statistically significant at p ≤ 0.05

Table (6): Comparison between the total score of the overall correct practices related to COVID-19 among the older adults in pre-post program and follow up stages.

Items	Preprogram N=(120)		Post program N=(120)		Follow up N=(120)		Test	p
	No	%	No	%	No	%		
Poor practice	96	80.0	7	5.8	10	8.3		
Moderate practice	9	7.5	3	2.5	4	3.3	Fr = 183.785*	<0.001*
Good practice	15	12.5	110	91.7	106	88.3		
Total Score M + SD	5.82 ± 3.30		12.37 ± 2.38		12.10 ± 2.71		F = 294.205*	<0.001*
Sig. bet. periods	p_1<0.001*		p_2<0.001*		p_3=0.035*			

F: F test (ANOVA) with repeated measures, Fr: **Friedman test, P_1**: p value for comparing between **Pre** and **After 1 week**, **P_2**: p value for comparing between **Pre** and **After 1 month, P_3**: p value for comparing between **After 1 week** and **After 1 month follow up**

Table (7): The relation between the socio-demographic characteristics and older adults' knowledge, perception, and practice mean scores related to COVID-19 across pre-post program and follow up stages.

Variables	Knowledge scores n=(120)			Perception scores n=(120)			Practice scores n=(120)		
	Pre	After week	After month	Pre	After week	After month	Pre	After week	After month
Sex									
Male	15.81 ± 26.10	84.26 ± 26.15	79.96 ± 31.37	30.86 ± 9.96	72.03 ± 8.55	71.09 ± 9.45	41.29 ± 21.36	84.58 ± 20.13	82.02 ± 22.81
Female	10.22 ± 16.38	93.53 ± 1.79	91.18 ± 10.88	26.88 ± 7.65	75.00 ± 0.00	75.00 ± 0.00	38.18 ± 21.80	92.75 ± 1.00	92.24 ± 2.48
t(p)	**1.432 (0.155)**	**3.154* (0.002*)**	**2.871 (0.005*)**	**2.424 (0.017*)**	**3.105 (0.003*)**	**3.696 (<0.001*)**	**0.746 (0.457)**	**3.619*(0.001*)**	**3.958 (<0.001*)**
Age (years)									
	15.37 ± 24.02	93.40 ± 2.19	89.97 ± 13.93	±31.67 ± 11.44	±74.24 ± 4.32	±73.24 ± 4.72	±41.33 ± 23.21	91.74 ± 3.92	90.00 ± 5.05
	13.65 ± 24.86	84.09 ± 24.48	78.73 ± 32.57	±31.25 ± 10.63	±72.92 ± 7.63	±70.83 ± 9.76	±39.30 ± 20.49	85.15 ± 18.98	80.79 ± 24.40
	8.43 ± 15.91	69.22 ± 42.75	69.02 ± 43.08	±28.03 ± 7.92	±67.92 ± 12.24	±68.33 ± 11.44	±37.97 ± 16.23	73.40 ± 32.48	72.95 ± 32.33
F(p)	**0.539 (0.585)**	**9.338* (<0.001*)**	**5.036* (0.008*)**	**1.904 (0.154)**	**5.185* (0.007*)**	**4.814* (0.010*)**	**0.203 (0.817)**	**8.698* (<0.001*)**	**7.853* (0.001*)**
level of education									
Read and write	11.25 ± 22.43	66.96 ± 43.40	66.44 ± 44.20	±28.01 ± 8.08	±68.01 ± 13.24	±66.18 ± 12.31	±37.35 ± 19.23	71.12 ± 33.21	71.12 ± 33.21
Primary school	12.94 ± 16.24	76.47 ± 34.30	68.53 ± 41.64	±29.05 ± 8.99	±70.63 ± 9.34	±70.63 ± 11.04	±38.67 ± 15.19	78.67 ± 28.40	75.81 ± 29.43
Preparatory/ secondary school	13.45 ± 22.71	92.12 ± 6.27	87.55 ± 18.68	±33.46 ± 11.89	±74.55 ± 3.34	±73.22 ± 4.92	±39.02 ± 19.76	91.23 ± 3.95	88.96 ± 11.69
University	16.22 ± 26.87	93.45 ± 9.21	89.90 ± 16.67	±34.13 ± 11.80	±75.65 ± 5.73	±74.97 ± 6.92	±40.71 ± 26.10	±92.13 ± 6.39	89.25 ± 12.40
F(p)	**0.202 (0.895)**	**8.831* (<0.001*)**	**4.892* (0.003*)**	**2.040 (0.112)**	**4.521* (0.005*)**	**5.214* (0.002*)**	**0.618 (0.605)**	**9.379* (<0.001*)**	**5.672* (0.001*)**
Occupation									
Public sector	23.91 ± 27.06	94.12 ± 0.0	93.45 ± 1.80	±27.56 ± 5.68	±73.86 ± 5.33	±73.86 ± 5.33	±42.29 ± 28.83	92.10 ± 4.20	91.19 ± 4.56
Private sector	17.76 ± 27.58	93.21 ± 2.21	89.37 ± 14.68	±30.29 ± 11.93	±73.08 ± 6.93	±73.08 ± 6.93	±51.72 ± 24.65	91.47 ± 5.45	90.95 ± 5.57
Retirement	12.61 ± 24.10	89.87 ± 16.69	85.67 ± 22.88	±28.87 ± 8.80	±74.01 ± 5.64	±73.51 ± 6.71	±37.61 ± 19.46	88.96 ± 12.95	87.62 ± 14.14
Housewife	8.02 ± 10.03	69.92 ± 38.14	64.97 ± 43.71	±32.95 ± 11.92	±69.32 ± 10.90	±67.33 ± 11.56	±38.98 ± 14.40	75.32 ± 29.80	70.13 ± 34.05
F(p)	**1.533 (0.210)**	**6.894* (<0.001*)**	**5.381* (0.002*)**	**1.440 (0.235)**	**3.598* (0.005***	**3.978* (0.010*)**	**1.675 (0.176)**	**5.273* (0.002*)**	**6.773* (<0.001*)**

t: Student t-test F: **F for ANOVA test *:** Statistically significant at $p \leq 0.05$

Discussion

COVID-19 is a serious and growing health problem all over the world. It is considered one of the most contagious diseases. Older adults continue to be one of the populations hardest hit by the COVID-19 pandemic. Since the start of the pandemic, people 60 years and older have been at greatest risk of hospitalization and death due to COVID-19 compared to other age groups. At the same time, older adults, among the first groups prioritized to receive the COVID-19 vaccine, UNICEF welcome the donations of COVID-19 vaccines, which allows well-supplied countries to share vaccine doses with other countries to help protect the most at-risk populations **(Ashworth et al., 2021; Xinhua., 2021)(Linda et al., 2021)**.

The findings of the current study portrayed that all studied sample were older adults, around two third of them were female and the rest were male. More than half of them their age range from 60-64 year. Moreover, the current study findings revealed that the majority of older adults had chronic disease such as heart disease, hypertension and diabetes mellitus. Review of the available literature indicated that, aging and comorbidities increase the vulnerability to viral infection Immunosenescence represents a recognized feature of aging. In addition, the elderly exhibit a continual production of inflammatory mediators and cytokines, also known as 'inflammaging' **(Mollica et al., 2018).** Furthermore, aberrant ciliary function anomalies might jeopardize successful clearance of virus SARS-CoV-2 particles in older adults which may indicates that the elderly people are susceptible to COVID-19, and with increased caution and adoption of home quarantine the infection rate in elderly people could be reduced. These findings come in line with **Yang et al. (2020)** who found that the elderly with comorbid conditions were more likely to progress to severe illness, so the management of chronic disease is important for elderly patients and require much more attention during the COVID-19 pandemic **(Thakur et al., 2021)**.

Notably, the main source of information about Covid-19 in the current study for older adults were television / radio 83.3% , friends/family were 62.5% followed by less than half of them were social media. It could be explained that the older adults may prefer staying at home as a preventive behavior due to the epidemic, they only went out for basic needs, such as going to the supermarket or to the drug store, also most of them had low income and different level of education that may leading to inaccessibility for reaching of mobile networks and reduced the ability of most of them to deal with the recent technology. These findings are consistent with (**Dhama et al. 2021)**, (**Akalu et al. 2020)** and (**Irigoyen- Camacho et al. 2020)** who had reported that most of the participants stated that television or radio was their source of COVID-19 information, and few participants used the web or social media as a source of COVID-19 information.

In the current study findings where the largest percentages **(87.5%)** of the older adults had poor knowledge related to transmission, common symptoms and the precaution measures against COVID-19. Otherwise, it is amazing to note that although about less than half of the older adults had a preparatory or secondary level of education, and less than one third of them had university level of education. Also, the main source of information about COVID-19 for the majority of them were television or radio, and friends or family; but they had a general poor knowledge about COVID-19. This may be attributed to many causes such as they may not be aware about the higher risk of complications of the disease on the elderly especially with chronic diseases, Also low income and financial affordability can limit the access to credible and timely information about the virus through mobile networks that help to update themselves about COVID-19. On other hand, the health information that can improve older adults' knowledge and practice are becoming more accessible online but family and friends may be

not as timely as the means of acquiring efficiently information and may have caused confusion and difficulty ascertaining correct information. Similar findings were reported by (**Heid et al. 2021**), (**Abdelhafiz et al. 2020**), (**Zhong et al. 2020**), (**Azlan et al. 2020**), (**Wolf et al. 2020**), (**Ibrahim and Mahmoud 2020**) **and Salman et al. (2020)** who found that the mean knowledge score was significantly lower among older participants with lower monthly income levels as most of them retired and this may indicate limited access to credible and timely information about the virus. However, contrast findings were reported by (**Al-Hanawi et al. 2020**), (**Chen et al. 2020**), (**Clements 2020**) **and** (**Saeed et al. 2021**) which stated that older adults had good knowledge of COVID-19; this finding may be due to the large amounts of publicity related to COVID-19 through various channels that are appropriate to the needs and characteristics of older people, such as vivid prints, marked banners, and broadcasts in dialect.

Several studies had approved that preventive programs for older people provide opportunity for better understanding of the topic and provide sufficient communication messages to increase older adults' knowledge, perceptions of the benefits of particular health-related practices and motivate them to engage in preventive measures **(Abdelhafiz et al., 2020); (Akalu et al., 2020);(Irigoyen-Camacho et al., 2020); (Shahid et al., 2020); (Ssebuufu et al., 2020) .**

The same picture was portrayed in the current study findings that revealed a statistically significant improvement of COVID-19 knowledge of the studied older adult immediately after implementation of COVID-19 preventive program than before it and the improvement still apparent one months after implementation of COVID-19 educational program. These results are consistent with those of similar previous studies **(Stirling et al., 2015; Elayeh et al., 2020; GOV.UK, 2020; Li et al., 2020b; Zheng et al., 2020).**

COVID-19 is a new disease, and its emergence and spread has caused confusion, fear, and anxiety among the general public. Fear and stigma make a difficult situation worse. There are an increasing number of reports of public stigmatization against people from areas affected by the epidemic. Stigma can drive people to hide the illness to avoid discrimination, prevent people from seeking health care immediately, and discourage them from adopting healthy behaviors. These barriers could potentially contribute to more severe health condition, ongoing transmission, and difficulties to control the outbreak of infectious diseases **(WHO, 2020b)**.

Crucially, as attested by previous studies carried-out during epidemics, older adults are vulnerable and with a high risk for their health **(Liu et al., 2020; Mehra et al., 2020; Wang et al., 2020).** As the risk perception is strictly linked to both psychological wellbeing and adherence to quarantine protocols, it is important to understand the older people's knowledge, perceived beliefs toward COVID-19, which affect the adoption of related health practice that can be a first step to prevent the spread of COVID-19 in this population **(Zhang & Ma, 2020).**

This could explain the results of the current study where the largest percentages of the older adults not believed that the disease is dangerous, believed that infection with the virus is associated with stigma, and try to do anything if they got infected to avoid isolation. This may be due to a lack of older adults' awareness regarding the COVID-19 pandemic, and ignoring disease onset, a moderate educational level may affect the level of knowledge and risk perceptions regarding COVID-19. Financial difficulties may also play a vital role in older adults' perception to deal with the pandemic as the need to purchase precautionary equipment, including alcohol, detergents, soap, gloves, and masks that may present an additional monetary burden for them. In the same line **Akalu et al. (2020)1 and Wolf et al. (2020)** who had reported that most of the respondents not at all likely to get infected with COVID-19, this perception of very low risk of infection might be due to poor

understanding of high infectiousness of COVID-19. While, contrast findings were reported by **Niu et al. (2020) and Kong et al. (2020)** which stated that older adults were found to be optimistic overall and perceived that would suffer from more severe symptoms if they were infected. Also, thought they were at high risk of acquiring the disease.

The Government of Egypt has been taking strong measures to control the spread of COVID-19, including speeding up vaccination for its population. The Ministry of Health and Population expand vaccine coverage and reach more people from priority groups, including the elderly and those suffering from underlying conditions and continue abiding by preventative measures to reduce virus transmission via wear face masks, wash hands regularly, and practice physical distancing **(Gicquel, 2021)**.

In this context, the current study revealed that the vast majority of older adults had a marked good practice related to COVID-19 prevention. 50.0% of older adults' compliance with vaccination against COVID-19 as a preventive measures one month after implementation of the program. These findings could be attributed to the improvement in their knowledge after health preventive program. In the same line **Booth et al. (2002), Barari et al. (2020), Daoust et al. (2021), Daoust (2020)** found that improvement in their participants, knowledge about COVID-19, plays an important role in practicing of protective measures.

Additionally, In line with previous research **Chen et al. (2020), Canning et al. (2020), Mousa et al. (2020), Sim et al. (2020),** our study found that older adult' demographic characteristics represented in age, level of education and occupation had a statistically significant influence on their knowledge, perception, and practice about COVID-19.

Conclusion:

The current study findings concluded that the older adults' 'knowledge, perceptions, and practice about COVID-19 was greatly enhanced by applying the health preventive program. Additionally, improve the older people's perception of their own vulnerability to COVID-19 and the effectiveness continuation for COVID-19 related preventive measures.

Recommendations

Based on findings, the study recommended:

1. Continuing raise the awareness level about COVID-19 should be directed to all older adults, this could be achieved through mass media, health classes in different community health agencies and clubs.

2. Change the negative attitude of the public and get rid of the associated stigma by raising the awareness level about COVID-19 through mass media.

3. Support and train gerantological health care professional to enrich their role in improving the 'knowledge, perceptions, and practice about COVID-19 prevention.

4. Continuing health preventive programs in certain aspects, including transmission modes and vaccines against COVID-19 are advised among older people to improve their knowledge.

Reference:

Abdelhafiz, A. S., Mohammed, Z., Ibrahim, M. E., Ziady, H. H., Alorabi, M., Ayyad, M., & Sultan, E. A. (2020). Knowledge, Perceptions, and Attitude of Egyptians Towards the Novel Coronavirus Disease (COVID-19). *Journal of community health, 45*(5), 881-890. https://doi.org/10.1007/ s10900-020-00827-7.

Akalu, Y., Ayelign, B., & Molla, M. D. (2020). Knowledge, Attitude and Practice Towards COVID-19 Among Chronic Disease Patients at Addis Zemen Hospital, Northwest Ethiopia. *Infection and drug resistance, 13*, 1949-1960. https://doi.org/10.2147/idr.s258736.

Al-Hanawi, M. K., Angawi, K., Alshareef, N., Qattan, A. M. N., Helmy, H. Z., Abudawood, Y., Alqurashi, M., Kattan, W. M., Kadasah, N. A., Chirwa, G. C., & Alsharqi, O. (2020). Knowledge, Attitude and Practice Toward COVID-19 Among the Public in the Kingdom of Saudi Arabia: A Cross-Sectional Study. *Frontiers in public health, 8*, 217. https://doi.org/10.3389/fpubh.2020.00217.

Aleem, A., Akbar Samad, A. B., & Slenker, A. K. (2021). *Emerging Variants of SARS-CoV-2 And Novel Therapeutics Against Coronavirus (COVID-19)*. StatPearls Publishing.

Armitage, R., & Nellums, L. (2020). COVID-19 and the consequences of isolating the elderly. *The Lancet Public Health, 5*, 1. https://doi.org/10.1016/S2468-2667(20)30061-X.

Ashworth, M., Thunström, L., Newbold, S. C., & Finnoff, D. C. (2021). Emphasize personal health benefits to boost COVID-19 vaccination rates. *Proceedings of the National Academy of Sciences of the United States of America,118*(32). https://doi.org/10.1073/pnas.2108225118.

Aw, D., Silva, A. B., & Palmer, D. B. (2007). Immunosenescence: emerging challenges for an ageing population. *Immunology, 120*(4), 435-446. https://doi.org/10.1111/j.1365-2567.2007.02555.x.

Azlan, A. A., Hamzah, M. R., Sern, T. J., Ayub, S. H., & Mohamad, E. (2020). Public knowledge, attitudes and practices towards COVID-19: A cross-sectional study in Malaysia. *PloS one, 15*(5), e0233668. https://doi.org/10.1371/journal.pone.0233668.

Bajaj, V., Gadi, N., Spihlman, A. P., Wu, S. C., Choi, C. H., & Moulton, V. R. (2020). Aging, Immunity, and COVID-19: How Age Influences the Host Immune Response to Coronavirus Infections? *Frontiers in physiology, 11*, 571416. https://doi.org/10.3389/fphys.2020.571416.

Barari, S., Caria, S., Davola, A., Falco, P., Fetzer, T., Fiorin, S., Hensel, L., Ivchenko, A., Jachimowicz, J., & King, G. (2020). Evaluating COVID-19 public health messaging in Italy: Self-reported compliance and growing mental health concerns. *MedRxiv*. https://doi.org/10. 1101/2020.03.27.20042820.

Booth, M. L., Bauman, A., & Owen, N. (2002). Perceived barriers to physical activity among older Australians. *Journal of aging and physical activity, 10*(3), 271-280. https://doi.org/10.1123/japa.10.3.271.

Brug, J., Aro, A. R., Oenema, A., de Zwart, O., Richardus, J. H., & Bishop, G. D. (2004). SARS risk perception, knowledge, precautions, and information sources, the Netherlands. *Emerging infectious diseases, 10*(8), 1486-1489. https://doi.org/10.3201/eid1008.040283.

Canning, D., Karra, M., Dayalu, R., Guo, M., & Bloom, D. E. (2020). The association between age, COVID-19 symptoms, and social distancing behavior in the United States. *medRxiv*. https://doi.org/10.1101/2020.04.19.20065219.

Cascella, M., Rajnik, M., Aleem, A., Dulebohn, S. C., & Di Napoli, R. (2021). *Features, Evaluation, and Treatment of Coronavirus (COVID-19)*. StatPearls Publishing.

Cennimo, D. J., Bergman, S. J., & Olsen, K. M. (2021). *Coronavirus Disease 2019 (COVID-19)*. https://emedicine.medscape.com/article/2500114-overview. [Accessed in: Dec, 2021]

Centers for Disease Control and Prevention [CDC]. (2020). *Coronavirus Disease 2019 (COVID-19) – Symptoms*. CDC.

Centers for Disease Control and Prevention [CDC]. (2021). *COVID-19 Vaccine Booster Shots*. CDC.

Centers for Disease Control Prevention (CDC). (2020a). *Coronavirus disease 2019 (COVID-19)*. CDC.

Centers for Disease Control Prevention (CDC). (2020b). Severe Outcomes Among Patients with Coronavirus Disease 2019 (COVID-19) - United States, February 12-March 16, 2020. *MMWR. Morbidity and mortality weekly report, 69*(12),

343-346. https://doi.org/10.15585/mmwr.mm6912e2.

Chen, Y., Zhou, R., Chen, B., Chen, H., Li, Y., Chen, Z., Zhu, H., & Wang, H. (2020). Knowledge, Perceived Beliefs, and Preventive Behaviors Related to COVID-19 Among Chinese Older Adults: Cross-Sectional Web-Based Survey. *Journal of medical Internet research, 22*(12), e23729. https://doi.org/10.2196/23729.

Clements, J. M. (2020). Knowledge and Behaviors Toward COVID-19 Among US Residents During the Early Days of the Pandemic: Cross-Sectional Online Questionnaire. *JMIR public health and surveillance, 6*(2), e19161. https://doi.org/10.2196/19161.

Culp, W. C. (2020). Coronavirus Disease 2019: In-Home Isolation Room Construction. *Anesthesia & analgesia practice, 14*(6), e01218. https://doi.org/10.1213/xaa.0000000000001218.

Daoust, J. F. (2020). Elderly people and responses to COVID-19 in 27 Countries. *PloS one, 15*(7), e0235590. https://doi.org/10.1371/journal.pone.0235590.

Daoust, J. F., Nadeau, R., Dassonneville, R., Lachapelle, E., Bélanger, É., Savoie, J., & van der Linden, C. (2021). How to survey citizens' compliance with COVID-19 public health measures: Evidence from three survey experiments. *Journal of Experimental Political Science, 8*(3), 310-317. https://doi.org/10.1017/XPS.2020.25.

Dhama, K., Patel, S. K., Kumar, R., Masand, R., Rana, J., Yatoo, M. I., Tiwari, R., Sharun, K., Mohapatra, R. K., Natesan, S., Dhawan, M., Ahmad, T., Emran, T. B., Malik, Y. S., & Harapan, H. (2021). The role of disinfectants and sanitizers during COVID-19 pandemic: advantages and deleterious effects on humans and the environment. *Environmental science and pollution research international, 28*(26), 34211-34228. https://doi.org/10.1007/s11356-021-14429-w.

Dryhurst, S., Schneider, C. R., Kerr, J., Freeman, A. L. J., Recchia, G., van der Bles, A. M., Spiegelhalter, D., & van der Linden, S. (2020). Risk perceptions of COVID-19 around the world. *Journal of Risk Research, 23*(4), 1466-4461. https://doi.org/10.1080/13669877.2020.175819.

Egypt Today staff. (2020). *PM: Egypt's coronavirus figures still within range.* https://www.egypttoday.com/Article/1/83291/PM-Egypt%E2%80%99s-coronavirus-figures-still-within-range.

Elayeh, E., Aleidi, S. M., Ya'acoub, R., & Haddadin, R. N. (2020). Before and after case reporting: A comparison of the knowledge, attitude and practices of the Jordanian population towards COVID-19. *PloS one, 15*(10), e0240780. https://doi.org/10.1371/journal.pone.0240780.

European Centre for Disease Prevention and Control [ECDC]. (2020). *Novel coronavirus disease 2019 (COVID-19) pandemic: increased transmission in the EU/EEA and the UK – sixth update*. ECDC.

Fahim, M., Ghonim, H., Roshdy, W. H., Naguib, A., Elguindy, N., AbdelFatah, M., Hassany, M., Mohsen, A., Afifi, S., & Eid, A. (2021). Coinfection With SARS-CoV-2 and Influenza A(H1N1) in a Patient Seen at an Influenza-like Illness Surveillance Site in Egypt: Case Report. *JMIR public health and surveillance, 7*(4), e27433. https://doi.org/10.2196/27433.

Finelli, L., Gupta, V., Petigara, T., Yu, K., Bauer, K. A., & Puzniak, L. A. (2021). Mortality Among US Patients Hospitalized With SARS-CoV-2 Infection in 2020. *JAMA network open, 4*(4), e216556. https://doi.org/10.1001/jamanetworkopen.2021.6556.

Geldsetzer, P. (2020). Knowledge and Perceptions of COVID-19 Among the General Public in the United States and the United Kingdom: A Cross-sectional Online Survey. *Annals of internal medicine, 173*(2), 157-160. https://doi.org/10.7326/m20-0912.

Gicquel, M. (2021). *Egypt receives 546,400 doses of COVID-19 vaccine donated by France through AVAT and COVAX platforms*. WHO.

GOV.UK. (2020). *Coronavirus public information campaign launched across the UK*. https://www.gov.uk/government/news/coronavir

us-public-information-campaign-launched-across-the-uk..

Guo, Y. R., Cao, Q. D., Hong, Z. S., Tan, Y. Y., Chen, S. D., Jin, H. J., Tan, K. S., Wang, D. Y., & Yan, Y. (2020). The origin, transmission and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak - an update on the status. *Military Medical Research, 7*(1), 11. https://doi.org/10.1186/s40779-020-00240-0.

Halter, J. B., Ouslander, J. G., Studenski, S., High, K. P., Asthana, S., Supiano, M., & Rithcie, C. (2016). Hazzard's geriatric medicine and gerontology (7th ed). McGraw-HillEducation.

Heid, A. R., Cartwright, F., Wilson-Genderson, M., & Pruchno, R. (2021). Challenges Experienced by Older People During the Initial Months of the COVID-19 Pandemic. *The Gerontologist, 61*(1), 48-58. https://doi.org/10.1093/geront/gnaa138.

Huang, C., Wang, Y., Li, X., Ren, L., Zhao, J., Hu, Y., Zhang, L., Fan, G., Xu, J., Gu, X., Cheng, Z., Yu, T., Xia, J., Wei, Y., Wu, W., Xie, X., Yin, W., Li, H., Liu, M., Xiao, Y., (2020). Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet, 395*(10223), 497-506. https://doi.org/10.1016/s0140-6736(20)30183-5.

Ibrahim, S. M. E., & Mahmoud, M. A. M. (2020). Relationship Between Knowledge, Preventive Practices and Fear from COVID-19 among Middle Aged and Older Adults: During the Novel Coronavirus Outbreak. *American Journal of Nursing Science, 9*(5), 333-346. https://doi.org/10.11648/j.ajns.20200905.15.

Irigoyen-Camacho, M. E., Velazquez-Alva, M. C., Zepeda-Zepeda, M. A., Cabrer-Rosales, M. F., Lazarevich, I., & Castaño-Seiquer, A. (2020). Effect of Income Level and Perception of Susceptibility and Severity of COVID-19 on Stay-at-Home Preventive Behavior in a Group of Older Adults in Mexico City. *International journal of environmental research and public health, 17*(20), 7418. https://doi.org/10.3390/ijerph17207418.

Kong, H. N., Xiao, Q., & Yang, M. (2020). Awareness on knowledge about coronavirus disease 2019 prevention and control among residents in Chaoyang district of Beijing City. *Chinese Journal of Public Health, 36*(6), 959-962. https://doi.org/10.11847/zgggws1129479.

Linda T, Todd L, L.Cherry, David C. 2021. Emphasize personal health benefits to boost COVID-19 vaccination rates. PNAS August 10, 2021 118 (32) e2108225118; https://doi.org/10.1073/pnas.2108225118.

Lekamwasam, R., & Lekamwasam, S. (2020). Effects of COVID-19 Pandemic on Health and Wellbeing of Older People: A Comprehensive Review. *Annals of geriatric medicine and research, 24*(3), 166-172. https://doi.org/10.4235/agmr.20.0027.

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., Ren, R., Leung, K. S. M., Lau, E. H. Y., Wong, J. Y., Xing, X., Xiang, N., Wu, Y., Li, C., Chen, Q., Li, D., Liu, T., Zhao, J., Liu, M., Tu, W., ... (2020a). Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus-Infected Pneumonia. *The New England journal of medicine, 382*(13), 1199-1207. https://doi.org/10.1056/NEJMoa2001316.

Li, W., Liao, J., Li, Q., Baskota, M., Wang, X., Tang, Y., Zhou, Q., Wang, X., Luo, X., Ma, Y., Fukuoka, T., Ahn, H. S., Lee, M. S., Chen, Y., Luo, Z., & Liu, E. (2020b). Public health education for parents during the outbreak of COVID-19: a rapid review. *Annals of translational medicine, 8*(10), 628. https://doi.org/10.21037/atm-20-3312.

Liu, K., Chen, Y., Lin, R., & Han, K. (2020). Clinical features of COVID-19 in elderly patients: A comparison with young and middle-aged patients. *The Journal of infection, 80*(6), e14-e18. https://doi.org/10.1016/j.jinf.2020.03.005.

Mehra, A., Rani, S., Sahoo, S., Parveen, S., Singh, A. P., Chakrabarti, S., & Grover, S. (2020). A crisis for elderly with mental disorders: Relapse of symptoms due to heightened anxiety due to COVID-19. *Asian journal of psychiatry, 51*,

102114. https://doi.org/10.1016/j.ajp.2020.102114.

Mollica, M., Nicolai, A., Maffucci, R., Gioia, M., Paoli, G., Grella, E., Calabrese, C., Forzano, I., & Perrotta, F. (2018). Obstructive sleep apnea and cardiovascular risks in the elderly population. *Journal of Gerontology and Geriatrics, 66*, 149-155.

Mousa, K. N. A., Saad, M. M. Y., & Abdelghafor, M. T. B. (2020). Knowledge, attitudes, and practices surrounding COVID-19 among Sudan citizens during the pandemic: an online cross-sectional study. *Sudan Journal of Medical Sciences, 15*(2), 32-45. https://doi.org/10.18502/sjms.v15i5.7176.

National Foundation for Infectious Diseases. (2021). *Why Vaccinations Are Vital for Older Adults*. https://www.nfid.org/2021/09/24/why-vaccinations-are-vital-for-older-adults/.

Niu, Z., Wang, T., Hu, P., Mei, J., & Tang, Z. (2020). Chinese Public's Engagement in Preventive and Intervening Health Behaviors During the Early Breakout of COVID-19: Cross-Sectional Study. *Journal of medical Internet research, 22*(8), e19995. https://doi.org/10.2196/19995.

Saeed, B. Q., Al-Shahrabi, R., & Bolarinwa, O. A. (2021). Socio-demographic correlate of knowledge and practice toward COVID-19 among people living in Mosul-Iraq: A cross-sectional study. *PloS one, 16*(3), e0249310. https://doi.org/10.1371/journal.pone.0249310.

Saied, A. A., Metwally, A. A., Madkhali, N. A. B., Haque, S., & Dhama, K. (2021). Egypt's COVID-19 Recent Happenings and Perspectives: A Mini-Review. *Frontiers in public health, 9*, 696082. https://doi.org/10.3389/fpubh.2021.696082.

Salman, M., Mustafa, Z. U., Asif, N., Zaidi, H. A., Hussain, K., Shehzadi, N., Khan, T. M., & Saleem, Z. (2020). Knowledge, attitude and preventive practices related to COVID-19: a cross-sectional study in two Pakistani university populations. *Drugs & therapy perspectives*, 1-7. https://doi.org/10.1007/s40267-020-00737-7.

Shahid, Z., Kalayanamitra, R., McClafferty, B., Kepko, D., Ramgobin, D., Patel, R., Aggarwal, C. S., Vunnam, R., Sahu, N., Bhatt, D., Jones, K., Golamari, R., & Jain, R. (2020). COVID-19 and Older Adults: What We Know. *Journal of the American Geriatrics Society, 68*(5), 926-929. https://doi.org/10.1111/jgs.16472.

Shigemura, J., Ursano, R. J., Morganstein, J. C., Kurosawa, M., & Benedek, D. M. (2020). Public responses to the novel 2019 coronavirus (2019-nCoV) in Japan: Mental health consequences and target populations. *Psychiatry and clinical neurosciences, 74*(4), 281-282. https://doi.org/10.1111/pcn.12988.

Sim, K., Chua, H. C., Vieta, E., & Fernandez, G. (2020). The anatomy of panic buying related to the current COVID-19 pandemic. *Psychiatry research, 288*, 113015. https://doi.org/10.1016/j.psychres.2020.113015.

Ssebuufu, R., Sikakulya, F. K., Mambo, S. B., Wasingya, L., Nganza, S. K., Ibrahim, B., & Kyamanywa, P. (2020). Knowledge, Attitude, and Self-Reported Practice Toward Measures for Prevention of the Spread of COVID-19 Among Ugandans: A Nationwide Online Cross-Sectional Survey. *Frontiers in public health, 8*, 618731. https://doi.org/10.3389/fpubh.2020.618731.

Stirling, B. V., Harmston, J., & Alsobayel, H. (2015). An educational programme for nursing college staff and students during a MERS-coronavirus outbreak in Saudi Arabia. *BMC nursing, 14*, 20. https://doi.org/10.1186/s12912-015-0065-y.

Sun, K., Chen, J., & Viboud, C. (2020). Early epidemiological analysis of the coronavirus disease 2019 outbreak based on crowdsourced data: a population-level observational study. *The Lancet. Digital health, 2*(4), e201-e208. https://doi.org/10.1016/s2589-7500(20)30026-1.

Talaat, W. (2020). *Social Protection And Older People In Egypt During The COVID-19 Pandemic*. https://corona-older.com/2020/06/02/social-protection-and-older-people-in-egypt-during-the-covid-19-pandemic/. [Accessed in: Nov, 2021]

Thakur, V., Ratho, R. K., Kumar, P., Bhatia, S. K., Bora, I., Mohi, G. K., Saxena, S. K., Devi,

M., Yadav, D., & Mehariya, S. (2021). Multi-Organ Involvement in COVID-19: Beyond Pulmonary Manifestations. *Journal of clinical medicine, 10*(3), 446. https://doi.org/10.3390/jcm10030446.

Wang, L., He, W., Yu, X., Hu, D., Bao, M., Liu, H., Zhou, J., & Jiang, H. (2020). Coronavirus disease 2019 in elderly patients: Characteristics and prognostic factors based on 4-week follow-up. *The Journal of infection, 80*(6), 639-645. https://doi.org/10.1016/j.jinf.2020.03.019.

Wolf, M. S., Serper, M., Opsasnick, L., O'Conor, R. M., Curtis, L., Benavente, J. Y., Wismer, G., Batio, S., Eifler, M., Zheng, P., Russell, A., Arvanitis, M., Ladner, D., Kwasny, M., Persell, S. D., Rowe, T., Linder, J. A., & Bailey, S. C. (2020). Awareness, Attitudes, and Actions Related to COVID-19 Among Adults With Chronic Conditions at the Onset of the U.S. Outbreak: A Cross-sectional Survey. *Annals of internal medicine, 173*(2), 100-109. https://doi.org/10.7326/m20-1239.

Wolff, K., Larsen, S., & Øgaard, T. (2019). How to define and measure risk perceptions. *Annals of Tourism Research, 79*, 102759. https://doi.org/10.1016/j.annals.2019.102759.

World Health Organization [WHO]. (2019). *Coronavirus Disease (Covid-19) Outbreak: Rights, Roles and Responsibilities of Health Workers, Including Key Considerations for Occupational Safety*. WHO.

World Health Organization [WHO]. (2020a). *Coronavirus Disease*. WHO.

World Health Organization [WHO]. (2020b). *Coronavirus disease 2019 (COVID-19) Situation Report – 35*. WHO. https://www.unicef.org/stories/novelcoronavirus outbreak-what-parents-should-know

World Health Organization [WHO]. (2020c). *WHO Coronavirus Disease (COVID-19) Dashboard*. WHO.

Xinhua. (2021). *Egypt starts COVID-19 vaccination for elderly, patients with chronic diseases*. http://www.xinhuanet.com/english/2021-03/04/c_139783916.htm. [Accessed in: Dec, 2021]

Yang, X., Yu, Y., Xu, J., Shu, H., Xia, J., Liu, H., Wu, Y., Zhang, L., Yu, Z., Fang, M., Yu, T., Wang, Y., Pan, S., Zou, X., Yuan, S., & Shang, Y. (2020). Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. *The Lancet. Respiratory medicine, 8*(5), 475-481. https://doi.org/10.1016/s2213-2600(20)30079-5.

Zhang, Y., & Ma, Z. F. (2020). Impact of the COVID-19 Pandemic on Mental Health and Quality of Life among Local Residents in Liaoning Province, China: A Cross-Sectional Study. *International journal of environmental research and public health, 17*(7), 2381. https://doi.org/10.3390/ijerph17072381.

Zheng, J.-S., Zhang, Y.-F., & Xu, Y. (2020). Health literacy and demand for health education on novel coronavirus pneumonia epidemic among community residents in Fujian province: an online survey during epidemic outbreak. *Chinese Journal of Public Health, 36*(2), 160-164. https://doi.org/10.11847/zgggws1128092.

Zhong, B. L., Luo, W., Li, H. M., Zhang, Q. Q., Liu, X. G., Li, W. T., & Li, Y. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: a quick online cross-sectional survey. *International journal of biological sciences, 16*(10), 1745-1752. https://doi.org/10.7150/ijbs.45221.

Zhong, Y., Liu, W., Lee, T. Y., Zhao, H., & Ji, J. (2021). Risk perception, knowledge, information sources and emotional states among COVID-19 patients in Wuhan, China. *Nursing outlook, 69*(1), 13-21. https://doi.org/10.1016/j.outlook.2020.08.005.

Zhou, P., Yang, X. L., Wang, X. G., Hu, B., Zhang, L., Zhang, W., Si, H. R., Zhu, Y., Li, B., Huang, C. L., Chen, H. D., Chen, J., Luo, Y., Guo, H., Jiang, R. D., Liu, M. Q., Chen, Y., Shen, X. R., Wang, X., Zheng, X. S., (2020). A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature, 579*(7798), 270-273. https://doi.org/10.1038/s41586-020-2012-7.