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Life Expectancy and COVID-19 Infection: A Population-based Cross-Sectional Study

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ABSTRACT

Background and Objective: Life expectancy and the consequences of its impairment may affect quality of life and suicide. The aim of this study was to assess the impact of COVID-19 on life expectancy in residents of Gonabad city.

Methods: This cross-sectional study was conducted on 300 Gonabad residents (general population) from February 2021 to April 2022 using stratified-random sampling method. Data collection was performed through phone interview. Demographic questionnaire and Schneider's life expectancy scale were used. Data analysis was performed using the SPSS software version 23.

Findings: Of the 300 participants (53% female and 47% male), 153 were COVID-19 recovered and 147 did not have the history of COVID-19. The average life expectancy score in COVID-19 recovered participants was significantly lower compared to those without the history of COVID-19 (29.17 ± 5.96 and 31.94±4.34, respectively, p=0.001). Also, there was a significant and positive relationship between mean scores of life expectancy and age, gender, education, economic status, the presence of high-risk individuals at home, history of underlying diseases, and smoking ($p<0.05$).

Conclusion: The results of this study stated that life expectancy score in COVID-19 recovered participants was a lower than that of participants without COVID-19 history. Therefore, the role of other variables, including age, gender, and disease history on life expectancy was more prominent on life expectancy in COVID-19 recovered participants.

Keywords: Life expectancy; COVID-19, Corona Virus-2019

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Introduction

The coronavirus disease 2019 (COVID-19) pandemic, which rapidly started since the end of December 2019, challenged healthcare and treatment systems (1). So that COVID-19 became the most important and main health problem in the world (2). The relatively high death rate, high transmission rate, and the significant effects of COVID-19 on different sectors of countries resulted in various negative effects on the quality of life and mental health of individual (3,4). COVID-19 can affect the mental health of patients due to its nature. The existing body of literature shows that COVID-19 has profound psychological effects on the general population, patients with mild COVID-19, and healthcare workers (5-8). Stress, job stress, social isolation, lack of social support, depression and anxiety are among the mental disorders that may occur in people during and even after COVID-19 (9-13). Zvolensky et al. stated that all negative emotions caused by the mentioned disorders can have harmful effects on people's hopefulness in the society (14). Marios et al. stated that the continuous increase in COVID-19 mortality may affect life expectancy (15).

Life expectancy is considered as an important health indicator and can be defined as the average number of years a person is expected to live in a country (16). Many factors affect health and life expectancy, among which, the most important factors include health costs, income, health expenses, environmental factors, and lifestyle (17.18). In fact, hope can increase life satisfaction through the establishment of flexibility, vitality, and problem-solving ability in individuals (19). Taylor and Brown reported that hopeful thoughts and positive beliefs had a great effect on general health (20). Other studies showed that hope can facilitate change and increase physical and mental health, while on the other hand, lack of hope can affect mental health and increase susceptibility to diseases (21). Hallahan et al. also stated that having hope in life enables an individual build relationship with others and thus have a positive and better view towards the future, and maintain focus on positive things and connecting with others even is in difficult situation (22).

Researchers introduce hopelessness as the opposite of hope. Hopelessness is defined as enduring an insurmountable situation in which no expected goal is reached (19). Hopelessness is associated with depression, death wishes, and suicide (19). Lack of hope and purpose in life create despairing beliefs and decline the quality of life (19). Therefore, considering the contemporary nature of COVID-19 and the harmful effects of hopelessness on the lives of individuals in communities, it is important to determine life expectancy among community members during the COVID-19 pandemic. Furthermore, due to the great impact of COVID-19 on future national policies in terms of health care costs and designing programs based on population needs, this study was conducted to assess the impact of COVID-19 on life expectancy in residents of Gonabad city.

Methods

Study design

The protocol of this cross-sectional study was approved by the Research Council of Gonabad University of Medical Sciences (Registration code: p/3/614). The STROB check list for cross-sectional studies was used for reporting this study.

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Setting

This study was conducted in Gonabad, a city located in the northeast of Iran, in Khorasan Razavi province between February 2021 to April 2022.

Participants

Participants were selected from general population aged between 15 and 70 years old who were willing to participate in the study by providing a written informed consent for participating in the study, resided in Gonabad city at the time of data collection, able to read and write Persian language, and had no history of mental disease history. Exclusion criteria were incomplete questionnaires and refusal to continue the study.

Sample size and sampling method

Sample size was calculated using the G-Power software, version 3.9.2.1, based on the findings of the previous study (23). Considering 95% confidence interval and 95% power, the sample size was calculated as 268 individuals. Considering the 10% probable drop the final sample size was increased to 300 individuals. Stratified-random sampling method was used in the current study. Therefore, eligible individuals were identified among community health care centers in Gonabad city from the list of individuals based on the inclusion criteria. The participants were randomly assigned to study groups using random digit's table.

Study instruments

a.Demographic questionnaire

This questionnaire was used to collect demographic data including age, gender, education, economic status, occupation, and marital status, as well as history of underlying diseases, smoking, and history of hospital admission due to COVID-19.

b.Schneider's life expectancy Scale

This 12-item questionnaire was designed and validated by Schneider et al. in 1991 for adults over the age of 15 years old. The questionnaire evaluates agency thinking (4 items), strategic thinking (4 items), and deviant statements (4 items). The questionnaire includes two domains; agency and strategy. The total score of the questionnaire is calculated by adding the scores for each item. Higher scores indicate higher life expectancy. The overall score is categorized into low (12-24), moderate (24-36), and high (>36).

The Cronbach's alpha for the entire questionnaire was previously reported to range between 0.81 and 0.91 (24). The internal consistency for the entire questionnaire was reported to range between 0.74 and 0.84 and the test-re-test reliability of the questionnaire was reported to be 0.80, which increased with increasing the test-retest time to 8-1o weeks (24).

Data collection

After selecting participants based on the mentioned sampling method, they were invited to participate in the study by telephone call. The aim of the study was explained for the participants and if they were willing to participate, oral consent was obtained from the patients. In order to reduce the COVID-19 transmission, data collection was performed by phone survey. The demographic questionnaire and the Schneider's life expectancy Scale were filled for all participants through phone interview.

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Statistical analysis

Data analysis was performed using the statistical package for social sciences (SPSS) software version 23. Descriptive indices (frequency, dispersion, and central tendency indices) were used to present life expectancy scores and demographic characteristics. According to the importance of COVID-19 at the time of sampling and its undeniable impact on people's mental health (25), participants were divided into two groups; those with a history of COVID-19 and those without COVID-19 history. Linear regression model was adopted to determine the factors related to life expectancy. Therefore, the variables that had P<0.15 in simple linear regression were entered into the multiple linear regression model, and their relationship was assessed in the presence of other variables following life expectancy. A p-value less than 0.05 was considered statistically significant.

Ethical considerations

Ethics approval was obtained from the Vice Chancellor of Research and Technology, Gonabad University of Medical Sciences (Code: IR.GMU.REC.1399.111) to conduct the study based on codes of ethics. Informed consent was obtained orally from the participants. Participants were ensured about the anonymity of the collected data.

Results

The data of 300 participants was analyzed. Participants included 160 (53.3%) males and 140 (46.7%) females and the average age of the participants was 32.45 ± 10.42 years old. Frequency of other demographic characteristics of the participants is reported in Table 1. The results showed that the total life expectancy score of the participants was high (39.21 ± 5.93). The mean scores in strategic and agency domains were 14.45 ± 3.08 and 15.83 ± 2.35, respectively. However, the mean life expectancy total score was lower in the COVID-19 recovered group compared to the no COVID-19 history group. There was also a statistically significant difference in the mean total and subscale scores of life expectancy between the groups (Table 2).

Table 3 displays the results of linear regression analysis to examine the relationship between socio-demographic factors and life expectancy. Based on the simple linear regression model, the p value for the relationship between life expectancy and age, income, presence of high-risk individuals at home, marriage, underlying diseases, smoking, job, and history of COVID-19 was less than 0.15; therefore, these variables were entered into multiple linear regression model. Based on the standardized regression coefficients (β) in the multiple linear regression model, no history of with COVID-19 was the most important determinant of life expectancy (β=0.24), followed by more than sufficient income (β=0.22). This finding indicated that life expectancy score increased 2.95 folds in participants without the history of COVID-19 compared to those with the history of COVID-19 (B=2.95, P<0.001). Moreover, having more than sufficient income level was associated with 4.86 time increase in life expectancy score compared to other income level categories, which was statistically significant (B=4.86, P<0.001). In addition, an underlying disease was associated with 3.47 times reduced life expectancy score compared to those who did not have an underlying disease (B= -3.47, P<0.001). Furthermore in smoking was associated with 2.85 times reduced life expectancy score compared to non-smokers (B= -2.85, P=0.022).

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Table 1. Characteristics of the study participants

Characteristics	Level	Frequency (%) N=300
Gender	Female	160 (53.3)
	Male	140(46.7)
History of COVID-19	Yes	147 (49)
	No	153 (51)
History of hospital admission due to covid-19	Yes	10 (3.3)
	No	290 (96.7)
Education level	Primary	28 (9.3)
	Secondary	51 (17)
	University degree	221 (73.7)
Income level	Below sufficient level	51 (17)
	Sufficient level	224 (74.7)
	More than sufficient level	25 (8.3)
Occupation	Employee	98 (32.7)
	Student	97 (32.3)
	Other (housewife- unemployment- retired)	105 (35)
Presence of high-risk individuals at home	Child	82 (27.3)
	Elderly	51 (17)
	Individuals with underlying diseases	53 (17.7)
	None	114 (38)
Marital status	Married	192 (64)
	Single	108 (36)
Underlying diseases	No	241 (80.3)
	Yes	59 (19.7)
Smoking	No	227 (92.3)
	Yes	23 (7.7)
Age (year)		Mean ± SD
		32.45 ± 10.42

Table 2. Comparison of the mean total and subscale scores of life expectancy between study groups

Life expectancy Domains	Mean± SD (n=300)	Group		Independent T-test
		COVID-19 recovered (n=152)	No COVID-19 history (n=148)	
Strategic	14.45 ± 3.08	13.49 ± 3.19	15.44 ± 2.62	p<0.001
Agency	15.83 ± 2.35	15.42 ± 2.59	16.25 ± 2.00	P= 0.002
Total score	39.21 ± 5.93	37.1753 ± 5.91	40.94 ± 5.45	p<0.001

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Table 3. Result of linear regression model on the factors associated with life expectancy

Predictors	Levels	Simple regression					Multiple regression				
		B	S.E.	Beta	t	P-value	B	S.E.	Beta	t	P-value
age		-0.12	0.03	-0.21	-3.67	<0.001*	-0.26	0.04	-0.04	-0.53	0.59
Sex	male	*					-				
	female	-0.59	0.68	-0.5	-0.87	0.38					
Education	Primary	*					-				
	Secondary	-1.86	1.39	-0.92	-1.34	0.18					
	University degree	0.37	0.92	0.02	0.40	0.68					
Income	sufficient level	*					*				
	Below Sufficient level	-3.07	0.88	-0.19	-3.46	<0.001*	-1.27	0.89	-0.80	-1.41	0.15
	More than sufficient level	3.77	1.2	0.17	3.13	0.002*	4.86	1.21	0.22	4	<0.001
Presence of high-risk individuals at home	Child	*					*				
	Elderly	-4.62	1.01	-0.29	-4.50	<0.001*	-1.69	0.93	-0.19	-1.82	0.069
	Individuals with underlying diseases	-2.99	1.01	-0.19	-2.95	0.003*	-1.37	0.94	-0.08	-1.45	0.14
	None	-1.52	0.83	-0.12	-1.82	0.069*	1.53	0.81	0.11	1.87	0.062
Marriage	Married	*					*				
	Single	1.24	0.71	0.09	1.72	0.087*	0.42	0.97	0.03	0.43	0.66
Underlying diseases	No	*					*				
	Yes	-4.27	0.82	-0.28	-5.17	<0.001*	-3.47	0.87	-0.23	-3.96	<0.001
Smoking	No	*					*				
	Yes	-4.84	1.25	-0.21	-3.85	<0.001*	-2.85	1.23	-0.12	-2.3	0.022
job	Other (housewife-unemployment-retired)	*					*				
	Employee	-0.36	0.83	-0.02	-0.44	0.65	0.03	0.77	0.002	0.04	0.96
	Student	1.42	0.83	0.11	1.71	0.088*	-0.87	1.03	-0.06	-0.84	0.39
History of hospital admission due to covid-19	Yes	*					-				
	No	2.7	1.9	0.08	1.42	0.16					
History of COVID-19	Yes	*					*				
	No	3.41	0.65	0.28	5.19	<0.001	2.95	0.75	0.24	3.89	<0.001

Discussion

This study was conducted to assess the impact of COVID-19 on life expectancy in residents of Gonabad city. The findings of this study indicated that the life expectancy total score and its subscale scores were significantly lower among participants who recovered from COCID-19 compared to those who did not have the history of COVID-19. This finding was in line with the findings of previous studies in different countries. For instance, it was estimated that COVID-19 pandemic reduced life expectancy at birth by 1.5 to 2 years in the United States, which was more prominent among men compared to women (15, 26). Also, another study reported that life expectancy in areas with high, moderate, and low life expectancy regions decreased by 3 to 9, 2 to 7, and 1 to 4 years, respectively in 50% of the study population (15). A study compared life expectancy loss among different countries and reported that in 2021 life expectancy loss was reversed in Western Europe countries while it continues to be present in

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Eastern Europe countries and that he life expectancy loss was more prevalent among younger patients in 2021 compared to 2020 (27). These findings may also indicate the increased life expectancy scores to acceptable levels among COVID-19 recovered participants in our study.

The results of the current study showed that life expectancy had a direct relationship with age, income level, education level, and underlying disease. These findings were in line with the findings of previous studies (26, 28). While COVID-19 can reduce life expectancy directly due to the mortality and morbidity, it can lower life expectancy by reducing income level. A study showed that the indirect effects of COVID-19 on life expectancy through reduced future income, were five times higher compared to the direct effects of COVID-19 mortality (25). By reducing income and creating poverty, COVID-19 reduces people's access to health services and, as a result, decreases life expectancy. This finding shows the need to expand social assistance programs to cover not only the existing poor but also the new population of poor individuals (25). As long as the prevalence of COVID-19 is low in an area, the pandemic will not have a significant impact on life expectancy. For instance an international study on the effects of COVID-19 pandemic on life expectancy in different European countries showed that life expectancy loss was indirectly associated with vaccination rate in the countries (27). Failing to control the spread of the virus may lead to increased mortality and as a result reduces life expectancy to a significant extent (29). Many studies used excess mortality to estimate the impact of COVID-19 on life expectancy without relying on any data on the prevalence of infection. Similar to the findings of our study, some previously published studies showed that several factors, including medical expenses from families, have a negative and significant relationship with life expectancy, which can be due to the use of health services for treatment at the time of illness (17). Current life expectancy is not only affected by the past year general medical expenses but also by the general income expenses of previous years. Furthermore, a positive and significant relationship has been reported between long-term public health expenditures and life expectancy in Iran (26). The results of the present study showed a significant relationship between reduced life expectancy and age and gender in the study participants. Similarly, a study stated that decreased life expectancy during the COVID-19 pandemic was caused by a sharp increase in mortality at older ages in both sexes (27). The pandemic has overwhelmed health systems in many countries, potentially leading to increased morbidity and mortality beyond the direct impact of COVID-19 (28). This increase in mortality, either directly or indirectly, has the potential to stagnate or reduce life expectancy (27).

Considering the findings of our study and previous studies, COVID-19 effects on life expectancy is multidimensional. Therefore, any intervention to reduce the risk of COVID-19 transmission must be precisely targeted and take into account its indirect effects otherwise, measures to prevent COVID-19 mortality may do more harm than good by indirectly reducing life expectancy through reduced future income (25). Furthermore, the identified modifiable risk factors for reduced life expectancy in COVID-19 recovered participants in our study, including low income and underlying diseases, can be used to design supportive interventions in reviving the reduced life expectancy on COVID-19 patients besides COVID-19 transmission prevention. These interventions can include financial aid and health insurance coverage for infected patients and to screen and control underlying diseases that increase the risk of COVID-19 transmission or increase the risk of morbidity and mortality due to COVID-19.

Conclusion

The current study showed that participants who recovered from COVID-19 had a lower life expectancy compared to those who did not have the history of COVID-19 and that life expectancy was positively related with age, gender, education, economic status, the presence of high-risk individuals at

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home, history of underlying diseases, and smoking. These findings imply that COVID-19 as a pandemic had numerous and diverse effects in all countries and societies. On the one hand, COVID-19 reduced access to health services through decreasing patients' income, which has directly decreased life expectancy at different ages. On the other hand, with the increase in public health expenses of the society, the amount and quality of public health services have been affected by COVID-19, which can directly decrease life expectancy. Furthermore, COVID-19 can directly decrease life expectancy through increasing mortality rate among different age groups in all societies.

Therefore, it is necessary for the economic policy makers to pay special attention to the factors affecting life expectancy and adopt programs to facilitate individual's access to health services through increasing economic empowerment and facilitating appropriate expenses in the health sector. On the other hand, health policy makers should facilitate sufficient care and health service provision to patients to reduce morbidity and mortality in the society by increasing and expanding the quality and quantity of comprehensive health services, including prevention and efficient management of COVID-19, to prevent life expectancy loss in the society.

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Competing Interests

The authors declare no conflict of interest.

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