Predictive factors of Quality of Life in older adults during the COVID-19 pandemic

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Abstract

Background: Given the vulnerability of older people to COVID-19, it is important to consider their physical and mental wellbeing and quality of life (QoL) in the COVID-19 pandemic. Therefore, the present study was aimed to identify the QoL and its predictive factors among a sample of Iranian older adults during the COVID-19 pandemic.

Methods: This descriptive and cross-sectional study was conducted on 500 older people residing in Qazvin, Iran, from May 22th to November 21rd, 2021. Multistage cluster sampling method was used for selecting the eligible older adults. Data were collected using the demographic checklist, fear of COVID-19 scale, and Elderly Quality of Life Questionnaire (LIPAD). The multivariate regression model was used for determining the predictive factors of QoL in older people.

Results: The mean age of older participants was 69.17 ± 6.75 years old. The results of multivariate regression model showed that fear of COVID-19, age, marital status, level of education, living arrangement, and economic situation were the significant predictors of QoL in the older adults during the COVID-19 pandemic.

Conclusions: It is recommended to pay close attention to divorced, lonely, and illiterate older people and those with low economic situation during the COVID-19 pandemic.

Keywords: Aged, Quality of life, COVID-19, Fear

Background

China reported the emergence of a new influenza-like virus that infected many people in Wuhan in December 2019 [1]. Despite efforts to control the virus across the city, the disease has spread rapidly in China and other countries worldwide [2]. The virus was very similar to the coronavirus that appeared in China from 2002 to 2003, and it was known as a severe acute respiratory syndrome (SARS). For this reason, the World Health Organization (WHO) named the virus SARS COVID-2 and the resulting disease COVID-19 in February 2020 [3]. COVID-19 is a warning shot for the world [4, 5]. According to the WHO report, in June 2021, three million Iranian patients infected with COVID-19 have been identified, of which more than 83,000 deaths were recorded [6].

Older adults are more susceptible to COVID-19 infection, caused by a defective immune system response to infectious diseases [7]. In this regard, Liu et al. showed that the prevalence of COVID-19-related deaths was higher among people 60 years and older than in other population groups [8]. U.S. Centers for Disease Control and Prevention also reported that although people aged 65 years and older make up 17% of the total population, 31% of people infected with the virus, 45% of inpatients, 53% of ICU inpatients, and 80% of COVID-19-related deaths occur among the older adults [9]. Older adults are more likely to get severe illnesses and death from COVID-19 [10]. Factors that can cause poor health outcomes in older adults include age-related physiological changes, chronic diseases such as cardiopulmonary...
disease, diabetes, dementia, and concomitant medicine use [11]. Older adults are the first to be quarantined due to their physical conditions and greater vulnerability to COVID-19 disease [12]. During the pandemic, long-term social distancing can increase unnecessary fear, stress, and worries about the future [13]. Similarly, Ferreira et al. reported a higher level of anxiety and lower QoL during home quarantine of COVID-19 [14]. QoL is a continuous multifaceted concept that refers to physical, social, functional, and psychological well-being [15]. Previous studies have reported increased mental disorders such as fear, anxiety, and depression during the COVID-19 pandemic. In a recent study conducted in China (2020) on 1556 older people, 37.1% suffered from depression and anxiety [16]. Furthermore, Negarestani et al. reported that more than three-quarters of the older adults did not have good mental health during the COVID-19 pandemic [17].

One common feature of infectious disease compared with other conditions is fear. Fear is directly related to its transmission, morbidity, and mortality rates. Older people are also faced with psychological stress resulting in fear and anxiety [18] due to the high transmission and mortality rate of the disease, social isolation, economic problems, and difficulties in reaching health services [19, 20]. On the other hand, spreading COVID-19 and misinformation can increase public fear and affect the QoL [12]. Correspondingly, Nguyen et al. reported that older adults were more likely to have higher depression and a more inadequate QoL than their younger counterparts [21]. This fear further resulted in other psychosocial issues, including stigmatization, discrimination, and loss [22].

To the best of our knowledge, few studies have been recently conducted on the QoL of older adults and its related factors during the COVID-19 pandemic. Considering the high prevalence of COVID-19 among the older adults, as a vulnerable age group, and the importance of improving their QoL, the present study aimed to determine the predictive factors of QoL among a sample of Iranian older adults during the COVID-19 pandemic.

Methods
This descriptive and cross-sectional study was performed on 500 older adults aged 60 years and over residing in Qazvin, Iran. The multistage cluster sampling method was used for selecting older people. First, Qazvin city was divided into five regions, including North, South, East, West, and Center based on the city map. Then, the researchers identified the locations where the older people usually gather including mosques, parks, and daycare centers in each region. Ten parks and twenty masques were randomly selected from these five geographic areas. Furthermore, the samples were selected from two daily care centers with members from all five regions. Then questionnaires were distributed among those who attended in the selected locations. During the data collection, 43 older people refused to participate. The analysis was conducted on 500 older adults at the end and the responding rate was 92.1%. Inclusion criteria included age 60 years old and over and the willingness to participate in the study. The older people who suffered from mental or cognitive conditions and severe physical illnesses that inhibit effective communication were excluded from the study.

Taking into account, type I error rate = 0.01, test power = 0.95, and the correlation coefficient between fear of COVID-19 and QoL ($r = -0.188$) [23], the sufficient sample size based on the following formula was determined at 500.

$$n = \frac{(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta})^2}{\sigma^2} + 3$$

Instruments
A demographic information checklist, fear of COVID-19 scale [18], and Elderly Quality of Life Questionnaire (LIPAD) [24] were used for collecting the data.

Demographic information checklist includes age, gender, marital status, number of children, level of education, job, economic situation, living arrangement, insurance status, history of infection or death of family members, friends, or neighbors due to COVID-19 as well as the number of physical illnesses.

Fear of COVID-19 Scale: This scale was developed by Ahorsu et al. [18] to assess the level of fear of COVID-19 among the Iranian population in 2020. The answers are scored based on a five-point Likert ranging from strongly disagree to strongly agree. The possible score range is 7 to 35 with a higher score indicating greater fear of COVID-19. Internal consistency and test–retest reliability of this scale was reported to be 0.82 and 0.72, respectively. In this study, the value of Cronbach alpha was calculated to be 0.965 (95% confidence interval (CI) 0.960–0.970) for all seven items.

LIPAD: LIPAD was designed by De Leo et al. [24], and it was used in three cities of Leiden in the Netherlands, Padua in Italy, and Helsinki in Finland. This questionnaire consists of 31 questions that measure seven dimensions of QoL including physical dimensions (5 questions), self-care (6 questions), depression and anxiety (4 questions), cognitive (5 questions), social (3 questions), life satisfaction (6 questions), and sexual issues (2 questions). A higher score means a better QoL. This questionnaire is scored on a four-point Likert scale ranging from 0 (worst case) to 3 (best case). The possible score range is
also 0 and 93. Hesamzadeh et al. calculated the validity and reliability of this questionnaire among Iranian older adults and reported that its Cronbach alpha reliability coefficient is 0.831 [25]. In the present study, the value of Cronbach alpha was calculated at 0.953 (95% CI 0.946–0.958) for all 31 items.

Questionnaires were completed through face-to-face interviews by the first author from May 22th to November 21rd, 2021.

Data analysis
The data were analyzed by the Statistical Package for the Social Sciences, version 20.0 (SPSS Inc., Chicago, Illinois, USA). Quantitative variables were described using means and standard deviations (SD) and qualitative variables by frequencies and percentages. To determine the predictors of QoL, first, univariate regression was run and then the variables which were significantly associated with QoL (p ≤ 0.2) [26] were entered in the multivariate regression model.

QQ-plot and box-plot confirmed that there was a normal distribution of the QoL data. The skewness (−0.579) and the kurtosis (−0.430) values were also in the acceptable ranges. As Byrne [27] stated that if the skewness value is between −2 to +2 and the kurtosis value is between −7 to +7, normality of the data could be assumed. To assess multicollinearity issues, the variance inflation factor (VIF) of QoL was computed (1.01) which was in the acceptable range. The homoscedasticity was also evaluated and confirmed.

Results
In the present study, the mean (SD) of the participants’ age was 69.17 (6.75) years and the possible age range was 60 to 89 years. The demographic characteristics of the study participants are presented in Table 1.

According to the results, the mean (SD) score of fear of COVID-19 was 21.05 (8.92) and the mean (SD) of QoL was 59.31 (14.80).

The results of multivariate regression model showed that fear of COVID-19, age, marital status, level of education, living arrangement, and economic situation were the most significant predictors of QoL in the older adults during the COVID-19 pandemic. QoL had a negative association with age (β = −0.49, p < 0.001) and fear of COVID-19 (β = −0.44, p < 0.001). Participants who had higher QoL, if they had secondary (β = 4.45, p = 0.008) or academic (β: 6.25, p = 0.10) educational level, average (β = 9.18, p < 0.001), and good (β = 12.68, p < 0.001) or excellent (β = 14.64, p < 0.001) economic situations. Those who lived alone (β = −8.44, p = 0.009) or with others (β = −13.28, p = 0.005) reported lower QoL compared with those who were single. Furthermore, divorced older adults reported lower QoL (β = −5.79, p = 0.029) compared with those who were single (Table 2).

Discussion
The present study aimed to determine QoL predictors in a sample of Iranian older adults during the COVID-19 pandemic. The results of the current study showed a high and negative association between age and QoL, which is consistent with the results of national [28] and international studies [29–31]. In this regard, it can be stated that the high prevalence of chronic physical and mental diseases and the decline in physical activity can be practical factors in reducing the QoL of older adults [32]. However, Brown and Roose reported that age was not associated with QoL [33]. This discrepancy may be attributed to socio-cultural differences, the type of instrument used, or the average age of the study participants.

Fear of COVID-19 was another predictor of QoL in older adults during the pandemic. In this regard, Fahad et al. showed that people who experienced a history of fear, anxiety, depression, and stress reported lower QoL during the pandemic [34]. Hosseini-Moghaddam et al. also reported that fear of COVID-19 infection, death anxiety, and misinformation on social media could increase depression and reduce the QoL among older adults [35]. Furthermore, Korsi Dorene et al. showed that the perceived fear of COVID-19 infection was negatively associated with QoL [36]. In other words, fear of COVID-19 infection is associated with an increased feeling of insecurity [37], fear of losing loved ones, increasing psychological distress, and a decrease in QoL [36, 37]. Bluma et al. also reported that older adults at higher risk for COVID-19 infection, and approximately, 37% of them experienced depression and anxiety, had a better QoL than other age groups [38]. This discrepancy could be attributed to the cultural differences, the target study population, and the QoL level before the COVID-19 outbreak.

The present study results showed that divorced older adults reported lower QoL compared with those who were single. These findings are in accordance with Gutierrez-Vega et al., which showed that single older adults reported higher QoL than divorced adults [39]. In fact, divorced people lose a feeling of belongingness and emotional support [40], which can negatively affect their QoL [41]. Divorced people can also experience higher pressure and stress than married or single people, as Conversano et al. reported that living with a spouse resulted in lower distress during the COVID-19 pandemic [42]. However, the impact of marital status on the QoL in different societies is partly influenced by their cultural and social conditions, as Seangpraw et al. [43] could not find this result among the rural older adults in Northern Thailand.
Education level was found to be a significant predictor of QoL. Specifically, older adults with higher education levels (secondary and academic education compared with illiterate individuals) were more likely to have higher QoL. This finding is consistent with the results of previous studies [44–47]. It may be that well-educated people, particularly those with academic education, are generally linked to better occupational prospects, higher income, and greater health literacy and health-related information that improves their QoL.

The present study results revealed that living alone is an influential factor in reducing the QoL of older adults during the COVID-19 pandemic. Living alone is a risk factor for emotional problems, such as loneliness and depression, decreasing the QoL. [48–50]. Wu reported that social isolation and loneliness are the main risk factors associated with poor physical and mental health status among older adults in the context of COVID-19 [51]. Rumas et al. also found that during the pandemic, loneliness was associated with reduced in all domains of

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**Table 1 Demographic characteristics of the study participants**

| Demographic characteristics                        | Numbers | Percentage |
|----------------------------------------------------|---------|------------|
| Gender                                             |         |            |
| Female                                             | 236     | 47.2       |
| Male                                               | 264     | 52.8       |
| Marital status                                     |         |            |
| Single                                             | 29      | 5.8        |
| Married                                            | 271     | 54.2       |
| Divorced                                           | 51      | 10.2       |
| Widowed                                            | 149     | 29.8       |
| Level of educational attainment                    |         |            |
| Illiterate                                         | 72      | 14.4       |
| Elementary                                         | 160     | 32.0       |
| Secondary                                          | 218     | 43.6       |
| Academic                                           | 50      | 10.0       |
| Economic situation                                 |         |            |
| Low                                                | 51      | 10.2       |
| Average                                            | 251     | 50.2       |
| Good                                               | 159     | 31.8       |
| Excellent                                          | 39      | 7.8        |
| Insurance                                          |         |            |
| No                                                 | 75      | 15.0       |
| Yes                                                | 425     | 85.0       |
| Job                                                |         |            |
| Housewife/Unemployed                               | 184     | 36.8       |
| Retired                                            | 263     | 52.6       |
| Employed                                           | 53      | 10.6       |
| Living arrangement                                 |         |            |
| With spouse                                        | 188     | 37.6       |
| With spouse and children                           | 75      | 15.0       |
| With children                                      | 82      | 16.4       |
| Alone                                              | 146     | 29.2       |
| Others                                             | 9       | 1.8        |
| Number of children                                 |         |            |
| 0                                                  | 35      | 7.0        |
| 1–3                                                | 107     | 21.4       |
| 4–5                                                | 131     | 26.2       |
| > 5                                                | 227     | 45.4       |
| COVID-19 infection in family, friends, or neighbors|         |            |
| No                                                 | 126     | 25.2       |
| Yes                                                | 374     | 74.8       |
| COVID-19 death in family, friends, or neighbors    |         |            |
| No                                                 | 331     | 66.2       |
| Yes                                                | 169     | 33.8       |
| Number of physical disease                         |         |            |
| 0                                                  | 45      | 9.0        |
| 1–2                                                | 226     | 45.2       |
| ≥ 3                                                | 229     | 45.8       |

| Variable       | Mean | SD  |
|----------------|------|-----|
| Age (years)    | 69.17| 6.75|
Living alone, especially during the COVID-19 pandemic can lead to anxiety, fear, and distress among older adults. Furthermore, living alone can limit access to health care services among older adults during this pandemic.

Moreover, results showed that older adults with low economic status were more likely to report lower QoL.
In this regard, El-Hage et al. stated that financial worries and employment during the COVID-19 pandemic could significantly reduce the QoL of individuals [53]. Ping et al. also reported that low income and economic status played an important role in reducing the health-related QoL of older adults by increasing health concerns during the pandemic [54].

Limitations
The present study was performed on the community-dwelling older adults, so, it is difficult to generalize the results to the institutionalized older adults. Furthermore, due to the self-report method for filling out questionnaires that some seniors may not have given a real answer. By giving the necessary explanations about the objectives of the study, an attempt was made to reduce this limitation. Finally, only older adults who could be present in public places participated in this study, so the results may not generalize to older people with physical disabilities.

Conclusion
In general, findings showed that several factors could impact the QoL of older adults. In this regard, age, marital status, fear of COVID-19, living alone, being illiterate, and low economic situation were found as predictive factors of QoL in this group of people. Therefore, considering demographic characteristics and providing a theoretical and practical approach for reducing the fear of COVID-19 is essential for improving the QoL of this vulnerable population.

Abbreviations
QoL: Quality of Life; WHO: World Health Organization; SARS: Severe Acute Respiratory Syndrome; US: United State; ICU: Intensive Care Unit.

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Author contributions
HKH, SAM, FM conceived and designed the research method and helped to draft the manuscript. HKH collected the data. ZH performed the statistical analysis. HKH, SAM, and FM revised the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials
All data generated or analyzed during this study are included in this published article [supplementary file:SPSS file].

Declarations

Ethics approval and consent to participate
The study was approved by the by the Ethics Committee of Qazvin University of Medical Sciences, Qazvin, Iran (IR.QUMS.REC.1399.286). All methods were carried out in accordance with relevant guidelines and regulations. Prior to filling up the questionnaires, informed consent obtained from older adults or their legally authorized representative (LAR). The participants were assured of the confidentiality of personal information.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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References
1. Ren L-L, Wang Y-M, Wu Z-Q, Xiang Z-C, Guo L, Xu T, et al. Identification of a novel coronavirus causing severe pneumonia in human: a descriptive study. Chin Med J (Engl). 2020;133(9):1015–24.
2. Porcheddu R, Serra C, Kelvin D, Kelvin N, Rubino S. Similarity in Case Fatality Rates (CFR) of COVID-19/SARS-COV-2 in Italy and China. J Infect Develop Count. 2020;14(02):125–8.
3. Velavan TP, Meyer CG. The COVID-19 epidemic Trop Med Int Health. 2020;25(3):279–80.
4. Danesh F, Ghashid S. Coronavirus: scientometrics of 50 years of Global Scientific Productions. Iran J Med Microbiol. 2020;14(1):1–16.
5. Zhao S, Musa SS, Lin Q, Ran J, Yang G, Wang W, et al. Estimating the unreported number of Novel Coronavirus (2019-nCoV) cases in China in the first half of January 2020: a data-driven modelling analysis of the early outbreak. J Clin Med. 2020;9(2):388.
6. World Health Organization. Coronavirus disease (COVID-2019) situation reports. 2021 [updated 13 June 2021; cited 2021 14 June 2021]. [Available from: https://www.who.int/countries/irn/.
7. Levkovitch I, Shinan-Alman S, Essar Schwartz N, Alperin M. Depression and health-related Quality of life among elderly patients during the COVID-19 pandemic in Israel: a cross-sectional study. J Prim Care Community Health. 2021;12:2150132721995448.
8. Liu K, Chen Y, Lin R, Han K. Clinical features of COVID-19 in elderly patients: a comparison with young and middle-aged patients. J Infect. 2020;80(6):e14–8.
9. Shahid Z, Kalayanamitra R, McClaflerty B, Kepko D, Ramgobin D, Panel R, et al. COVID-19 and older adults: what we know. J Am Geriatr Soc. 2020;68(5):926–9.
10. Kunz R, Minder M. COVID-19 pandemic: palliative care for elderly and frail patients at home and in residential and nursing homes. Swiss Medical Weekly. 2020.
11. Nikolic-Zugich J, Knox KS, Rios CT, Natt B, Bhattacharya D, Fain MJ. SARS-CoV-2 and COVID-19 in older adults: what we may expect regarding pathogenesis, immune responses, and outcomes. Geroscience. 2020;42(2):505–14.
12. Armitage R, Nellums LB. COVID-19 and the consequences of isolating the elderly. Lancet Public Health. 2020;5(5):e256-e.
13. Lu X, Lin Z. COVID-19, Economic impact, Mental health, and coping behaviors: a conceptual framework and future research directions. Front Psychol. 2021;12:1–9.
14. Ferreira LN, Pereira LN, da Fé BM, Ichikhu K. Quality of life under the COVID-19 quarantine. Qual Life Res. 2021;30(5):1389–405.

15. Soleimani MA, Zarabadi-Pour S, Motalebi SA, Allen K-A. Predictors of quality of life in patients with heart disease. J Relig Health. 2020;59(4):2135–48.

16. Meng H, Xu Y, Dai J, Zhang Y, Liu B, Yang HJPr. Analyze the psychological impact of COVID-19 among the elderly population in China and make corresponding suggestions. 2020;289:112983.

17. Negarestani M, Rashedi V, Mohammadzadeh M, Borhannejad V. Psychological effect of media use on mental health of older adults during the COVID-19 pandemic. J Salmard. 2021;16(1):74–85.

18. Ahorsu DK, Lin C-Y, Alateh M, Sadegh Moghadam L, Kameli F, Algahtani F, Hassan S-U-N, Alsaif B, Zrieq R. Assessment of the Quality of Life of older adults in Turkey. Arch Gerontol Geriatr. 2020;1–9.

19. García-Fernández L, Romero-Ferreiro V, López-Roldán PD, Padilla S, Rodríguez-Jiménez RTAJoGP. Mental health in elderly Spanish people in times of COVID-19 outbreak. 2020;28(10):1040–5.

20. Lee K, Jeong G-C, Yim J. Consideration of the Psychological and Mental Health of the Elderly during COVID-19: a theoretical review. 2020;17(21):8098.

21. Nguyen HC, Nguyen MH, Do BN, Tran CG, Nguyen TTP, Pham KM, et al. People with suspected COVID-19 symptoms were more likely depressed and had lower health-related Quality of Life: The Potential Benefit of Health Literacy. J Clin Med. 2020;9(4):965–76.

22. Pappas G, Kiriaze I, Giannakis P, Falagas M. Psychosocial consequences of the COVID-19 pandemic. Int J Geriatr Psychiatry. 2021;26(12):1260–6.

23. Aksoy A, Abiç A, Değirmenci F, Yılmaz DV. The relationship between quality of life and fear of COVID-19 among the elderly: a cross-sectional study. Arch Psychiatr Nurs. 2021;35(5):472–8.

24. De Leo D, Diekstra RFW, Lonnqvist J, Lonnqvist J, Cleiren MHPD, Frisoni GB, et al. LEIPAD, an internationally applicable instrument to assess Quality of Life in the elderly. Behav Med. 1998;24(1):17–27.

25. Hosseini Moghaddam F, Ameri Delia M, Sadegh Moghadam L, Kameli F, Algahtani F, Hassan S-U-N, Alsaif B, Zrieq R. Psychological well-being of individuals after divorce: the role of social support. 2016;4(4):206–16.

26. Doran P, Burden S, Shryane N. Older people living well beyond cancer: the relationship between emotional support and quality of life. J Aging Health. 2019;31(10):1850–71.

27. Conversano C, Di Giuseppe M, Miccoli M, Ciacciini R, Gemignani A, Otrü M. Mindfulness, age and gender as protective factors against psychological distress during COVID-19 pandemic. Front Psychol. 2020;10:201–9.

28. Seangpraw K, Ratanasiripong NT, Ratanasiripong P. Predictors of quality of life of the rural older adults in Northern Thailand. J Health Res. 2019;33(16):450–9.

29. Schwartz RM, Beilacqua KG, Alpert N, Liu B, Shahmoradi M, Nyinoo MA, et al. Psychological and associated factors amongst older adults in a remote community Nepal. J Health Res. 2021.

30. Xiu-Ying H, Qian C, Xiao-Dong P, Xue-Mei Z, Chang-Quan H. Living arrangements and risk for late life depression: a meta-analysis of published literature. J Psychiatr Med. 2021;43(1):19–34.

31. You KS, Lee H. The physical, mental, and emotional health of older people who live alone or with relatives. Arch Psychiatr Nurs. 2020;34(4):193–201.

32. Ahadi B, Hassani B. Loneliness and Quality of Life in Older adults: the mediating role of depression. Aging. 2021;46:1–14.

33. Wu B. Social isolation and loneliness amongst older adults in the context of COVID-19: a global challenge. Glob Health Res Policy. 2020;5(2):7–3.

34. Ruma RS, Shambhul AL, Jagtap S, Best MWJPR. Predictors and consequences of loneliness during the COVID-19 Pandemic. 2021;30(1):113934.

35. El-Hage W, Hingray C, Lemogne C, Yrondi A, Brunault P, Bienvenu T, et al. Health professionals facing the coronavirus disease 2019 (COVID-19) pandemic: What are the mental health risks? Encephale. 2020;46(3):573–80.

36. Ping W, Zheng J, Niu X, Guo C, Zhang J, Yang H, et al. Evaluation of health-related quality of life using EQ-5D in China during the COVID-19 pandemic. PLoS ONE. 2020;15(6):e0234850-e.