Research Paper

# Managed Care After Discharge of COVID-19 Patients in North Iran

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## ABSTRACT

**Background and Purpose:** After-discharge follow-up is one of the branches of managed care used for information exchange, health education, early diagnosis of symptoms, symptom management, and high-quality aftercare services. The present study aims to elucidate the managed care of COVID-19 patients after discharge from hospitals affiliated with Mazandaran University of Medical Sciences, Mazandaran Province, Iran.

**Materials and Methods:** The present cross-sectional study was conducted in 2019. The study sample included all COVID-19 patients discharged from public, private, and social security hospitals affiliated with Mazandaran University of Medical Sciences. The census method was used to recruit 14625 discharged patients. The data collection tool was based on the information registration form "Follow-up of the treatment process of discharged COVID-19 patients," which was prepared in three sections (demographic, clinical characteristics, and follow-up of the treatment process) based on the opinions of 15 experts. Data analysis was carried out via the chi-square test in SPSS software, version 21.

**Results:** The findings of the demographic section showed that 35.8% of COVID-19-related admissions were over 65 years old. Intensive care unit (ICU) admissions were necessary for 13% of cases, with the highest ICU admission rates among those aged 65 and above. Based on the findings of the clinical characteristics section, the most common underlying disease (46.7%) was diabetes, and the most common symptom upon admission was fever (higher than 38°C) (44.8%). Also, according to the findings of the "treatment follow-up" section, 7.04% of the discharged patients were readmitted, and 14.5% of patients infected their family members with COVID-19. Also, 57.82% adhered to the health and safety protocols and self-quarantine at home, which varied in different months.

**Conclusion:** Follow-up after the discharge of COVID-19 patients as one of the branches of managed care increased the compliance with health principles and decreased the rate of COVID-19 infection of the patient's family members and the readmission of patients. Therefore, appropriate follow-up after discharge is suggested as a low-cost method to shorten the recovery period of patients, prevent other family members from contracting this disease, and detect the worsening of disease symptoms among discharged patients.

**Keywords:** Coronavirus, COVID-19, Patient discharge, Coronavirus infections, Managed care programs

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## Introduction

On December 29, 2019, hospital physicians in Wuhan, China, noticed unusual cases of pneumonia [1]. An unusual pneumonia outbreak was reported to the World Health Organization (WHO) on December 31, 2019. After widespread speculations, a novel coronavirus (2019-nCoV) was declared the cause of the disease on January 9, 2020 [2]. Due to an increase in the incidence rate and the global virus outbreak, WHO recognized the 2019-nCoV as the sixth leading cause of public health emergency worldwide on January 30, 2020, threatening China and all countries [3]. COVID-19 belongs to a large family of viruses that can cause respiratory infections ranging from the common cold to more severe illnesses such as MERS (Middle East respiratory syndrome) and SARS (severe acute respiratory syndrome) [4]. The symptoms include fever, cough, and shortness of breath, ranging from mild to severe. Many of these patients require follow-up and post-discharge care [5].

Nakayama et al. (2022) retrieved data from 565 patients (43.7% female) with a mean age of 61.1 years. About 18.2% had at least one hospital readmission. The most common symptoms were pulmonary and neuropsychiatric sequelae. This study emphasizes the need for follow-up after recovering from the initial illness [6]. In the post-discharge follow-up of 143 COVID-19 patients by Carfi et al. (2020) in Italy, it was found that 87.4% of patients who had recovered from COVID-19, reported the persistence of at least one symptom, particularly fatigue and shortness of breath [7]. Also, studies from the United Kingdom [8, 9], France [10, 11], the United States [12], Spain [13], and China [14] analyzed more than 3000 COVID-19 patients after hospital discharge with different severity and follow-up duration after hospital discharge. However, all of them emphasized the necessity of follow-up after the discharge of recovered patients of COVID-19 and identified its effects. Also, long-term illness and prevention of secondary acute symptoms were considered useful.

Discharge is a period of transfer from hospital to home in which the care needs are transferred to the patients and their caregivers and may cause new problems for the patients and their families [15]. Nowadays, the readmission of patients, which is not pre-planned, indicates the health system's poor performance [16]. A previous study showed that readmission (19.6%) within 30 days after discharge resulted in an estimated loss of 17.4 billion dollars [17]. Therefore, it is necessary to manage and pay attention to the care of patients after discharge. The most important measures include informing patients about the disease status and aggravating factors, emphasizing the correct and timely use of prescribed drugs after discharge, different aspects of self-care, knowledge, and awareness of risk factors, and a timely visit to a physician for the treatment follow-up [18].

Various studies report that telemedicine significantly affected patients' lives, along with Orem-based self-care training programs, counseling, and telephone follow-ups [19-23]. Telephone follow-up is one of the branches of managed care used for information exchange, health education, prompt diagnosis of symptoms, symptom management, and high-quality aftercare services. This low-cost method can be employed to follow the status of the underlying disease or psychological factors of the disease after discharge. Despite the ease and low cost of follow-up after discharge and remote care, which is possible through telephone, this method is not used in Iran, and the positive effects of telephone follow-up in patients have not been given serious attention so far [24]. Hospitals are under severe pressure due to a lack of beds and resources for patient care [25]. Many patients can recover at home by receiving medication instructions and self-care training.

Therefore, it seems necessary to care for and follow up on the recovery process of the discharged patients. Identifying sequelae after acute infection by COVID-19 is essential to understand the disease's pathophysiology better, which goes beyond the initial presentation. Understanding the post-COVID-19 syndrome is crucial for remodeling the health system for multidisciplinary treatment and rehabilitation. Therefore, this study was designed to explain the care management of COVID-19 patients after discharge from hospitals affiliated with Mazandaran University of Medical Sciences. The results of this study help the policymakers of the country's health system formulate managed care protocols with an emphasis on follow-up after discharge of patients to manage secondary symptoms of the disease and provide quality care after discharge.

## Materials and Methods

### Study design and population

The present research was carried out with a cross-sectional analytical approach in 2020. The research environment included all hospitals affiliated with Mazandaran University of Medical Sciences, with 25 public hospitals (therapeutic-educational), 5 social security hospitals, and 10 private hospitals. The study population included

all COVID-19 patients who were discharged from these hospitals. The total number of COVID-19 patients discharged from the hospital between February 20 and May 20, 2020, was 14542, and the number of patients who participated in the study was 11689. The sampling method was census.

### Inclusion and exclusion criteria

The inclusion criteria were COVID-19 patients discharged from hospitals affiliated with Mazandaran University of Medical Sciences and residents of Mazandaran Province from February 2020 to May 2020. The exclusion criteria were COVID-19 outpatients, patients diagnosed with other diseases, and patients reluctant to participate in the study.

### Instruments and data collection

The data collection tool was based on the information registration checklist, "treatment follow-up of the discharged COVID-19 patients".

After reviewing the research literature, a list of cases was compiled according to the instructions and checklist approved by the Ministry of Health and Treatment of Iran to identify the questions of the checklist, which was then evaluated by 15 specialists (5 infectious disease specialists, 2 anesthesiologists, 3 epidemiologists, and 5 heads and managers of hospitals affiliated to Mazandaran University of Medical Sciences). The final checklist was prepared in three sections, apropos their viewpoints. The face validity of the checklist was checked and confirmed by 10 discharged COVID-19 patients. Also, the content validity was checked by 10 experts who are members of the university's scientific committee, and the content validity ratio (0.62) and content validity index (0.79) were confirmed in all items. Its reliability was confirmed with a Cronbach α coefficient of 0.73. The first section comprised the demographic characteristics (age, sex, and occupation). The second section included clinical characteristics (including a history of underlying disease, type of hospitalization, duration of hospitalization, and mode of referral to hospital), and the third section included managed care (quarantine at home status, infection in other family members with COVID-19, and readmission or returning to the hospital). The patients were taught how to take medicines, monitor the symptoms of the disease, and how to quarantine, and the effect of the training was evaluated by asking the above three questions.

Demographic and clinical characteristics data were collected from the "COVID-19 patient information registration" electronic system. Information related to COVID-19 patients of all hospitals under the affiliation of Mazandaran University of Medical Sciences is recorded in this system. Managed care data was collected in the checklist "treatment follow-up of the discharged COVID-19 patients" and through phone calls and questions from COVID-19 patients discharged from the hospital.

### Study procedure

Data were collected for three months by the health education nurses (educational supervisors) at each hospital, who had adequate knowledge and experience regarding COVID-19. Before starting the research, two webinar sessions were held for 4 hours for the health education nurses of the studied hospitals (due to the COVID-19 disease, face-to-face meetings were not possible). Also, the provincial nursing office prepared an educational video related to the purpose of the study with the cooperation of infectious disease experts. They were trained to follow up with discharged COVID-19 patients via phone calls. Thus, patients discharged from February 2020 to May 2020 received phone call follow-ups every other day for 14 days. Each phone call lasted about 15 minutes, covering medication use, symptoms, and quarantine.

### Data management and statistical analysis

Data analysis was done by the SPSS software, version 21. Descriptive analyses were performed to test the characteristics of the participants. Data analysis was carried out using the chi-square test.

## Results

A total of 14625 patients were admitted to hospitals affiliated with Mazandaran University of Medical Sciences diagnosed with COVID-19 from February 20 to May 20, 2020. Of them, 81 patients died during hospitalization, and 14542 of those hospitalized were discharged. The mean age of discharged patients was 56.78±17.77 years, and almost half were male (n=7388, 50.5%). Approximately 13% of the patients had an exposure history and contact with a person infected with COVID-19. The distribution of the underlying disease in the patients was as follows: Nearly half of the patients had diabetes (46.7%) and coronary heart disease (41.3%), around 38% of the patients had hypertension, and almost 32% had a history of a blood disease. The most common symptoms on admission were fever and cough,

**Table 1.** Demographics and clinical characteristics of discharged patients with COVID-19

| Demographics and Clinical Characteristics | | No. (%) | | | P |
|---|---|---|---|---|---|
| | | Total (n=14625) | Survivor (14542) | Non-survivor (81) | |
| Age (y) | ≤19 | 205(1.4) | 204(1.4) | 1(0.0) | <0.0001* |
| | 20-44 | 3625(24.8) | 3619(24.7) | 6(0.0) | |
| | 45-54 | 2675(18.3) | 2664(18.2) | 11(0.1) | |
| | 55-64 | 2881(19.7) | 2869(19.6) | 12(0.1) | |
| | 65-74 | 2583(17.7) | 2557(17.5) | 26(0.2) | |
| | 75-84 | 1891(12.9) | 1869(12.8) | 22(0.2) | |
| | ≥85 | 763(5.2) | 760(5.2) | 3(0.0) | |
| Gender | Female | 7237(49.5) | 7206(49.3) | 31(0.2) | 0.028* |
| | Male | 7388(50.5) | 7338(50.2) | 50(0.3) | |
| Exposure history | Yes | 1873(13.1) | 1867(13) | 6(0.1) | 0.116* |
| | No | 12450(86.9) | 12380(86.4) | 70(0.5) | |
| Current smoker | Yes | 174(1.4) | 174(1.4) | 0(0.0) | 0.373* |
| | No | 14368(98.8) | 14298(98.3) | 70(0.5) | |
| Drug user | Yes | 227(1.6) | 225(1.54) | 2(0.06) | 0.365* |
| | No | 14315(98.4) | 14247(97.9) | 68(0.5) | |
| Carcinoma | Yes | 234(1.6) | 233(1.59) | 1(0.01) | 0.627* |
| | No | 14389(98.4) | 14309(97.9) | 80(0.5) | |
| Hypertension | Yes | 5479(38.2) | 5479(38.1) | 3(0.1) | 0.201* |
| | No | 6872(61.8) | 6851(61.5) | 21(0.3) | |
| | Noanswer/Reported | | 277 | | |
| Diabetes | Yes | 6825(46.7) | 6771(46.3) | 54(0.4) | 0.001* |
| | No | 7798(53.3) | 7771(53.1) | 27(0.2) | |
| | Noanswer/Reported | | 2 | | |
| Coronary heart disease | Yes | 5716(41.3) | 5671(41.0) | 45(0.3) | <0.0001* |
| | No | 8122(58.7) | 8096(58.5) | 26(0.2) | |
| | Noanswer/Reported | | 787 | | |
| Chronic obstructive lung disease | Yes | 172(1.9) | 171(1.87) | 1(0.03) | 0.483* |
| | No | 9057(98.1) | 9023(97.8) | 34(0.4) | |
| | Noanswer/Reported | | 5396 | | |

| Demographics and Clinical Characteristics | | No. (%) | | | P |
|---|---|---|---|---|---|
| | | Total (n=14625) | Survivor (14542) | Non-survivor (81) | |
| Chronic kidney disease | Yes | 209(2.3) | 207(2.28) | 2(0.02) | 0.188 |
| | No | 9020(97.7) | 8987(97.4) | 33(0.4) | |
| | Noanswer/Reported | | 5396 | | |
| Asthma | Yes | 256(2.8) | 255(2.79) | 1(0.01) | 0.627 |
| | No | 8973(97.2) | 8939(96.9) | 34(0.4) | |
| | Noanswer/Reported | | 5396 | | |
| Chronic liver disease | Yes | 477(3.3) | 475(3.28) | 2(0.02) | 0.533 |
| | No | 13846(96.7) | 13772(96.2) | 74(0.5) | |
| | Noanswer/Reported | | 302 | | |
| Blood disease | Yes | 4738(32.4) | 4697(32.1) | 41(0.3) | <0.0001 |
| | No | 9885(67.6) | 9845(67.3) | 40(0.3) | |
| | Noanswer/Reported | | 2 | | |
| Chronic neurological disorder | Yes | 101(1.1) | 101(1.1) | 0(0.0) | 0.680 |
| | No | 9128(98.9) | 9093(98.5) | 35(.04) | |
| | Noanswer/Reported | | 5396 | | |
| Fever (temperature ≥37·3°C) | Yes | 6548(44.8) | 6516(44.6) | 32(0.2) | 0.199 |
| | No | 8074(55.2) | 8025(54.9) | 49(0.3) | |
| | Noanswer/Reported | | 3 | | |
| Cough | Yes | 4949(33.8) | 4929(33.7) | 20(0.1) | 0.05 |
| | No | 9673(66.2) | 9612(65.7) | 61(0.4) | |
| | Noanswer/Reported | | 3 | | |
| Muscular pain | Yes | 2092(14.3) | 2084(14.3) | 8(0.1) | 0.168 |
| | No | 12530(85.7) | 12457(85.2) | 73(0.5) | |
| | Noanswer/Reported | | 3 | | |
| Respiratory distress | Yes | 4119(28.2) | 4103(28.1) | 16(0.1) | 0.05 |
| | No | 10503(71.8) | 10438(71.4) | 65(0.4) | |
| | Noanswer/Reported | | 3 | | |
| Decreased consciousness | Yes | 437(3) | 435(2.98) | 2(0.02) | 0.562 |
| | No | 14185(97) | 14106(96.5) | 79(0.5) | |
| | Noanswer/Reported | | 3 | | |
| Oxygen level | <93% | 2951(20.2) | 2940(20.1) | 11(0.1) | 0.08 |
| | >93% | 11674(79.8) | 11604(79.3) | 70(0.5) | |

*The chi-square test.

**Table 2.** Emergency department, ICU admission, and isolation room for reported COVID–19 cases, by age group, Mazandaran (north of Iran), February 20–May 20, 2020 (P<0.0001)

| Age Group (y) (No. of Cases) | No. (%) | | | Total |
|---|---|---|---|---|
| | Inpatient Department | ICU Admission | Isolation Room | |
| 0-19 | 132(0.9) | 17(0.1) | 56(0.4) | 205(1.4) |
| 20-44 | 2363(16.2) | 246(1.7) | 1016(6.9) | 3625(24.8) |
| 45-54 | 1669(11.4) | 234(1.6) | 772(5.3) | 2675(18.3) |
| 55-64 | 1674(11.4) | 394(2.7) | 814(5.6) | 2882(19.7) |
| 65-74 | 1459(10) | 440(3) | 685(4.7) | 2584(17.7) |
| 75-84 | 986(6.7) | 441(3) | 464(3.2) | 1891(12.9) |
| ≥85 | 397(2.7) | 201(1.4) | 165(1.1) | 763(5.2) |
| Total | 8680(59.4) | 1973(13.5) | 3972(27.2) | 14625(100) |

followed by respiratory distress and myalgia (Table 1). Out of 14542 discharged patients, 11689 patients participated in the follow-up after discharge until the end of the study (14 days of follow-up after discharge). The response rate was 80.38%.

The chi-square test showed that most patients (59.4%) were hospitalized in the Inpatient Department. The least were aged ≤19 years (0.9%), and that most were aged 44-20 years (7.4%). Only 0.1% of Intensive Care Unit (ICU) admissions were reported among persons aged ≤19 years, and highest belonged to adults aged 65–84 years (6%). Among 14625 patients, 27.2% were hospitalized in the isolation room. The lowest of them (1.1 %) were aged ≥85 years, and most were aged 20–44 years (6.9 %) (Table 2).

In February 20-March 20, 2020, readmission occurred among 9.3% of discharged patients. A total of 1016 (15%) of them infected their family members with COVID-19. Moreover, hygiene compliance during self-quarantine was observed in 34.47% of cases.

The readmission rate among patients discharged on March 20- April 20 and April 20 -May 20, 2020 respectively, was 8.4% and 8.2%, respectively. A total of 521(11.72%) and 159(10%) of patients discharged infected their family members with COVID-19, respectively. A total of 77% and 87% of them followed hygiene compliance during self-quarantine, respectively. Also, the above patients also suffered from exacerbated COVID-19 symptoms in 9.23% and 9.10% of cases, respectively (Table 3).

## Discussion

Based on the results of the current study, approximately 35.8% of patients were 65 years and older. About 13% of inpatients were transferred to the ICU; the highest ICU admission rate was for patients 65 years and older. The results also revealed that approximately 0.5% of the

**Table 3.** Follow-up treatment of discharged COVID-19 hospitals in Mazandaran Province

| Variables / Time | No. (%) | | |
|---|---|---|---|
| | February 20-March 20, 2020 | March 20-April 20, 2020 | April 20-May 20, 2020 |
| Readmission of discharged patients | 359(6.3) | 376(8.4) | 136(8.2) |
| Infection of other family members | 1016(15) | 521(11.72) | 159(10) |
| Hygiene compliance during self-quarantine | 1920(34.47) | 3459(77) | 1380(87) |
| Patients with exacerbated COVID-19 symptoms after discharge | 791(14) | 411(9.23) | 174(10.9) |

inpatients died, and this rate was higher among people aged 65 to 85 years than other age groups. The results of a study in the United States showed that COVID-19 accounted for 45% of hospital admissions, 53% of ICU admissions, and 80% of deaths in adults aged 65 years and older [23]. These findings are similar to a Chinese study, which presented that more than 80% of deaths occurred among people aged 60 years and older [26]. The number of hospitalizations and deaths caused by COVID-19 in different age groups among 44219 infected patients in China revealed that about 31.1% of hospitalizations and more than 80% of deaths were over 60 years old [5], consistent with the findings of the present study. The difference in the admission rate of patients in the ICU in different studies with the present study can be due to the differences in the study time, race, and severity of the disease, as well as due to the availability of appropriate facilities and the number of beds in the special department in those countries, which makes it possible to admit more patients in the ICU. The high percentage of death in older patients can be due to the presence of an underlying disease and a decrease in the level of immunity of people of this age. The findings of the study by Sun et al. showed a 4.3% mortality rate for COVID-19 [27], which is inconsistent with the present study. However, the COVID-19 mortality rate changes over time, and the number of recovered patients increases. At the beginning of the COVID-19 disease in Iran, due to the long duration of the COVID-19 confirmation test (PCR+) and the lack of diagnostic kits in the hospital, in various studies, the mortality rate in the first months of the COVID-19 epidemic has been reported differently.

According to the results of the present study, the hospitalization rates in men and women were 50.5% and 49.5%, respectively. Similar studies have shown that men are more likely to develop COVID-19 than women [28, 29]. The coronavirus affects immunity-related genes on the X chromosome and sex hormones that influence innate and acquired immune responses, which may explain men's greater susceptibility to this infection [30, 31]. Because of their jobs, men are more socially active. As a result, the probability of encountering COVID-19 patients (with obvious and hidden symptoms) is higher among them, and as a result, the rate of infection increases.

In addition, the results of the present study stated that the most common underlying disease among inpatients was diabetes, followed by heart disease, hypertension, and blood disease. Studies by Wu have shown that people with underlying diseases are at higher risk for complications and mortality from COVID-19. Approximately 50% of inpatients with suspected COVID-19 have other chronic diseases, and around 40% of inpatients with confirmed COVID-19 have cardiovascular diseases [5]. More than two-thirds of people who died of COVID-19 in Italy had diabetes, cardiovascular diseases, cancer, or a history of previous smoking [24].

According to the results, almost half of the patients (44.8%) had a fever above 38°C, the most important symptom at admission, followed by cough, respiratory distress, chest pain, hypoxia, and loss of consciousness. In a study of 40 patients with confirmed COVID-19 admitted to Wuhan Hospital, Huang et al. found that fever, cough, shortness of breath, muscle pain, and fatigue were the most common clinical symptoms [28]. Acute respiratory distress syndrome was also observed in 14.8% of COVID-19 cases [27]. Unlike patients with typical coronavirus infections, upper respiratory tract symptoms such as sore throat and runny nose were less common in patients with 2019-nCoV [28, 29].

The results showed that post-discharge care increased the observance of hygiene compliance at home and decreased the incidence of COVID-19 in the patients' family members and their return to the hospital. To interpret these findings, it can be argued that phone call follow-up and self-care in patients can be used to perform procedures such as treatment follow-up dietary and pharmacological recommendations, thereby reducing the feeling of need and dependence on the relatives and even the physician, creating a feeling good and healthy in the person, and increasing hope among patients by boosting their self-esteem. The results of the present study are consistent with several previous studies [22, 32, 33]. The results of Nakayama's study show that COVID-19 infection overloads the healthcare system during waves of disease, and follow-up after hospital discharge is critical in these patients [11]. Also, Halpin's study results recommend planning rehabilitation services to manage these symptoms appropriately and maximize the functional return of COVID-19 survivors [8]. In his research, Nakayama states that after-discharge follow-up improves readmission and death rates and the potential severity of COVID-19 and emphasizes the need for follow-up after recovery from initial respiratory conditions [6].

It should be noted that the first days after discharge are a sensitive time for COVID-19 patients. Therefore, proper phone call follow-up shortens the recovery period and prevents other members of the patient's family from getting the disease. Considering the spread of

COVID-19 in many societies, updating current recommendations and creating new resources and guides may be necessary for patients and their caregivers. Phone follow-up is a low-cost method that can improve patients' recovery period, diagnose exacerbated disease symptoms among discharged patients, and inform patients about complications promptly for appropriate treatment.

## Conclusion

Due to the high cost of treating patients with COVID-19 (direct cost of treatment and cost of lost opportunity), the best solution is to avoid infection and prevent its spread under the current situation. One of the first measures is hygiene compliance and self-quarantine of the infected person. Phone call follow-up is a low-cost method that effectively improves patients' recovery period, diagnosing exacerbated disease symptoms among discharged patients and informing patients about complications on time for appropriate treatment. It should be noted that the first days after discharge are a sensitive time for COVID-19 patients. Therefore, proper phone call follow-up shortens the recovery period and prevents other members of the patient's family from getting the disease. Considering the spread of COVID-19 in many societies, updating current recommendations and creating new resources and guides may be necessary for patients and their caregivers.

### Study limitations

Despite the benefits that have been stated, follow-up after discharge by telephone has some limitations, such as difficulty in communicating with people with dementia or speech and learning problems, that may create overestimation bias related to reporting symptoms.

## Ethical Considerations

### Compliance with ethical guidelines

The study procedure was approved by the Medical Ethics Committee of Mazandaran University of Medical Sciences (Code: IR.MAZUMS.REC.1399.492). The ethical considerations of the research comprised obtaining permission from the head of the hospital, obtaining informed consent from participants, explaining the purpose of conducting the study, maintaining the confidentiality of information, and honesty in publishing data.

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### Authors contributions

Conceptualization: All authors; Methodology, analysis, validation, writing the original draft, review and editing: Roya Malekzadeh; Data curation and investigation: Touraj Assadi.

### Conflict of interest

The authors declared no conflict of interest.

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## References

[1] Khazaee-Pool M, Naghib SA, Pashaei T, Ponnet K. Designing and evaluating validity and reliability of the Questionnaire Concerning the Factors Affecting Person's Intention of COVID-19 Prevention (FAPI-COP). Iranian Journal of Health Sciences. 2022; 10(3):1-12. [DOI:10.18502/jhs.v10i3.10517]

[2] Kahn N. New virus discovered by Chinese scientists investigating pneumonia outbreak [Internet]. 2020 [Updated 2020 January 8]. Available from: [Link]

[3] Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coronavirus disease-2019 (COVID-19): The epidemic and the challenges. International Journal of Antimicrobial Agents. 2020; 55(3):105924. [DOI:10.1016/j.ijantimicag.2020.105924] [PMID]

[4] Tong ZD, Tang A, Li KF, Li P, Wang HL, Yi JP, et al. Potential presymptomatic transmission of SARS-CoV-2, Zhejiang province, China, 2020. Emerging Infectious Diseases. 2020; 26(5):1052-4. [DOI:10.3201/eid2605.200198] [PMID]

[5] Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: Summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. Journal of the American Medical Association. 2020; 323(13):1239-42. [DOI:10.1001/jama.2020.2648] [PMID]

[6] Nakayama LF, Urias MG, Gonçalves AS, Ribeiro RA, Macruz TA, Pardo RB. Post-discharge follow-up of patients with COVID-19: A Brazilian experience. SAGE Open Medicine. 2022; 10:20503121221096602. [DOI:10.1177/20503121221096602] [PMID]

[7] Carfì A, Bernabei R, Landi F; Gemelli Against COVID-19 Post-Acute Care Study Group. Persistent symptoms in patients after acute COVID-19. Journal of the American Medical Association. 2020; 324(6):603-5. [DOI:10.1001/jama.2020.12603] [PMID]

[8] Halpin SJ, McIvor C, Whyatt G, Adams A, Harvey O, McLean L, et al. Post-discharge symptoms and rehabilitation needs in survivors of COVID-19 infection: A cross-sectional evaluation. Journal of Medical Virology. 2021; 93(2):1013-22. [DOI:10.1002/jmv.26368] [PMID]

[9] Arnold DT, Hamilton FW, Milne A, Morley AJ, Viner J, Attwood M, et al. Patient outcomes after hospitalisation with COVID-19 and implications for follow-up: Results from a prospective UK cohort. Thorax. 2021; 76(4):399-401. [DOI:10.1136/thoraxjnl-2020-216086] [PMID]

[10] Carvalho-Schneider C, Laurent E, Lemaignen A, Beaufils E, Bourbao-Tournois C, Laribi S, et al. Follow-up of adults with noncritical COVID-19 two months after symptom onset. Clinical Microbiology and Infection. 2021; 27(2):258-63. [DOI:10.1016/j.cmi.2020.09.052] [PMID]

[11] Garrigues E, Janvier P, Kherabi Y, Le Bot A, Hamon A, Gouze H, et al. Post-discharge persistent symptoms and health-related quality of life after hospitalization for COVID-19. Journal of Infection. 2020; 81(6):4-6. [DOI:10.1016/j.jinf.2020.08.029] [PMID]

[12] Chopra V, Flanders SA, O'Malley M, Malani AN, Prescott HC. Sixty-day outcomes among patients hospitalized with COVID-19. Annals of Internal Medicine. 2021; 174(4):576-8. [DOI:10.7326/M20-5661] [PMID]

[13] Moreno-Pérez O, Merino E, Leon-Ramirez JM, Andres M, Ramos JM, Arenas-Jiménez J, et al. Post-acute COVID-19 syndrome. Incidence and risk factors: A Mediterranean cohort study. Journal of Infection. 2021; 82(3):378-83. [DOI:10.1016/j.jinf.2021.01.004] [PMID]

[14] Huang C, Huang L, Wang Y, Li X, Ren L, Gu X, et al. 6-month consequences of COVID-19 in patients discharged from hospital: A cohort study. The Lancet. 2021; 397(10270):220-32. [DOI:10.1016/S0140-6736(20)32656-8] [PMID]

[15] Coleman EA, Smith JD, Frank JC, Min SJ, Parry C, Kramer AM. Preparing patients and caregivers to participate in care delivered across settings: The care transitions intervention. Journal of the American Geriatrics Society. 2004; 52(11):1817-25. [DOI:10.1111/j.1532-5415.2004.52504.x] [PMID]

[16] Ali-Akbari F, Khalifehzadeh A, Parvin N. [The effect of short time telephone follow-up on physical conditions and quality of life in patients after pacemaker implantation (Persian)]. Journal of Shahrekord University of Medical Sciences. 2009; 11(3):23-8. [Link]

[17] Shahrokhi A, Mohammadi Alamouti A, Fallah L, Mohamadpour A. [Effect of body change positions on endotracheal tube cuff pressure in patients with head injury treated with mechanical ventilation (Persian)]. The Journal of Qazvin University of Medical Sciences. 2016; 20(5):26-33. [Link]

[18] Karbaschi K, Zareiyan A, Dadgari F, Siydati S. [The effect of self-care program based on Orem's theory on quality of life of cancer patients undergoing chemotherapy in military personnel (Persian)]. J ournal of Military Caring Sciences. 2015; 2(2):69-77. [DOI:10.18869/acadpub.mcs.2.2.69]

[19] Ahn S, Song R, Choi SW. Effects of self-care health behaviors on quality of life mediated by cardiovascular risk factors among individuals with coronary artery disease: A structural equation modeling approach. Asian Nursing Research. 2016; 10(2):158-63. [DOI:10.1016/j.anr.2016.03.004] [PMID]

[20] Cajanding RJ. The effectiveness of a Nurse-Led cognitive-behavioral therapy on the quality of life, self-esteem and mood among Filipino patients living with heart failure: A randomized controlled trial. Applied Nursing Research. 2016; 31:86-93. [DOI:10.1016/j.apnr.2016.01.002] [PMID]

[21] Yu M, Chair SY, Chan CW, Choi KC. A health education booklet and telephone follow-ups can improve medication adherence, health-related quality of life, and psychological status of patients with heart failure. Heart & Lung. 2015; 44(5):400-7. [DOI:10.1016/j.hrtlng.2015.05.004] [PMID]

[22] Farazmand J, Nasiripour A, Raeissi P. The effect of telephone follow-up programs after hospital discharge on hope and the quality of life in patients admitted to the coronary care unit (CCU). Journal of Babol University of Medical Sciences. 2017; 19(2):41-6. [DOI:10.22088/jbums.19.2.41]

[23] CDC COVID-19 Response Team. Severe outcomes among patients with coronavirus disease 2019 (COVID-19)-United States, February 12-March 16, 2020. Morbidity and Mortality Weekly Report. 2020; 69(12):343-6. [DOI:10.15585/mmwr.mm6912e2] [PMID]

[24] Remuzzi A, Remuzzi G. COVID-19 and Italy: What next? The Lancet. 2020; 395(10231):1225-8. [DOI:10.1016/S0140-6736(20)30627-9] [PMID]

[25] Hadinezhad P, Setareh J, Moosazadeh M. Investigating the factors affecting the length of stay of patients admitted to psychiatry hospital at North of Iran. Iranian Journal of Health Sciences. 2019; 7(4):19-25. 4. [DOI:10.18502/jhs.v7i4.2204]

[26] Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. The Lancet. 2020; 395(10229):1054-62. [PMID]

[27] Sun P, Qie S, Liu Z, Ren J, Xi JJ. Clinical characteristics of 50466 patients with 2019-nCoV infection. medRxiv. 2020; 92(6):612-7. [Link]

[28] Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. The Lancet. 2020; 395(10223):497-506. [DOI:10.1016/S0140-6736(20)30183-5] [PMID]

[29] Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: A descriptive study. The Lancet. 2020; 395(10223):507-13. [DOI:10.1016/S0140-6736(20)30211-7] [PMID]

[30] Jaillon S, Berthenet K, Garlanda C. Sexual dimorphism in innate immunity. Clinical Reviews in Allergy & Immunology. 2019; 56(3):308-21. [DOI:10.1007/s12016-017-8648-x] [PMID]

[31] Libert C, Dejager L, Pinheiro I. The X chromosome in immune functions: When a chromosome makes the difference. Nature Reviews Immunology. 2010; 10(8):594-604. [DOI:10.1038/nri2815] [PMID]

[32] Shojaee A, Tahrir B, Naderi N, Zareian A. [Effect of patient education and telephone follow up by the nurse on the level of hope in patients suffering from heart failure (Persian)]. Journal of Nursing Education. 2013; 2(1):16-26. [Link]

[33] Choobdari M, Dastgerdi R, Sharifzadeh G. [The impact of self-care education on life expectancy in acute coronary syndrome patients (Persian)]. Journal of Birjand University of Medical Sciences. 2015; 22(1).19-26. [Link]

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