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Modeling the Impact of Factors Associated with Delay in Healthcare Seeking on the Survival of Hospitalized Patients with COVID-19

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Abstract

Background: The delay between the onset of initial symptoms and hospitalization is a critical issue in the context of COVID-19 awareness.

Objectives: This study aims to identify the factors influencing the delay in healthcare-seeking among hospitalized patients with COVID-19 in Chaharmahal and Bakhtiari province.

Methods: This cross-sectional analytical study was conducted on all patients hospitalized from 2020 to 2022 in Chaharmahal and Bakhtiari province. Chi-square tests, *t*-tests, and logistic regression were used to establish the relationship between referral delay and various variables.

Results: This study was conducted on 38,124 patients hospitalized with COVID-19 in Chaharmahal and Bakhtiari, with an average age of 25.27 ± 49.61 years. The mean duration of hospitalization and patient care was 4.67 ± 4.33 days. The average delay in seeking healthcare was 3.68 ± 3.67 days, and 75.6% of the cases with delay sought care at health and treatment centers. Those who experienced a delay in seeking care [2.09 (1.98 - 2.20, P = 0.01)] were more likely to be hospitalized. Individuals with a history of hypertension [2.46 (2.25 - 2.67, P = 0.001)] and diabetes [1.13 (1.05 - 1.22, P = 0.001)] had a higher chance of delay compared to their respective counterparts. Those with a positive lung scan [8.25 (7.59 - 8.97, P = 0.001)] had a higher chance of delay, and patients with abnormal radiological findings [3.18 (2.86 - 3.54, P = 0.001)] were more likely to experience a delay in seeking care.

Conclusions: Delay in seeking care at healthcare centers during COVID-19 infection depends on gender, place of residence, occupation, individuals' history of chronic disease, and other demographic variables, as well as the onset of initial disease symptoms.

Keywords: Infectious Diseases, COVID-19, Hospitalized, Behavioral Pattern, Care Seeking

1. Background

Timely patient referral to healthcare centers plays a crucial role in promoting rapid recovery, reducing mortality rates, and mitigating disease-related complications (1). A delay in diagnosing patients is associated with an increase in secondary complications resulting from exposure to the index case (2). Moreover, delayed diagnosis can lead to treatment complexities and, ultimately, patient mortality (3). Such delays may stem from postponed patient referral, which includes the period between the onset of symptoms and the patient's first visit to a healthcare facility or physician (4). A study conducted in Italy on children with COVID-19 who experienced delayed emergency care revealed that half of these patients were admitted to the ICU, and

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33.3% succumbed to the disease (5). Additionally, research indicates that a prolonged interval between symptom onset and hospital admission exacerbates disease severity and increases mortality rates, particularly among the elderly (6). An investigation into the causes of delayed emergency care for seven critically ill children found that a major contributing factor was parental fear of entering healthcare facilities or contracting the coronavirus during the visit, which significantly delayed the reporting of severe patient conditions (7). Early and accurate diagnosis of COVID-19 is essential for its effective management. Therefore, understanding the causes and consequences of delays in patient referral and diagnosis can aid in improving both prevention and treatment strategies.

Despite numerous studies addressing the factors influencing delays in seeking medical care, notable research gaps persist. One of the most significant is the lack of a comprehensive and systematic analysis of the social, cultural, and economic factors influencing delays in care-seeking behavior (3, 8). Furthermore, prior research has predominantly focused on developed countries or communities with adequate access to healthcare services. In contrast, there is limited data concerning underserved populations or developing nations. The impact of healthcare infrastructure, economic barriers such as treatment costs and insurance, and the influence of quarantine policies and social restrictions have also been underexplored (9-11).

2. Objectives

This study aims to examine the factors associated with delays in the referral of hospitalized COVID-19 patients and the consequent mortality.

3. Methods

This cross-sectional analytical study was conducted on 38,124 patients hospitalized in hospitals across Chaharmahal and Bakhtiari province from 2020 to 2022. Duplicate and overlapping data were removed using Excel software and patients' national identification codes. To determine the referral delay, the number of days between the onset of symptoms and the first visit to a doctor or healthcare center was calculated. In the case of asymptomatic COVID-19 patients, the delay was calculated based on the interval between the date of contact with a confirmed positive case and the date of referral to a doctor or healthcare center. Data analysis was carried out using SPSS version 16 and STATA software. Chi-square tests, *t*-tests, and logistic regression were employed to assess the relationship between referral delay and various variables.

4. Results

The mean duration of hospitalization and patient care was 4.67±4.33 days. The average delay in referral was 3.68±3.67 days, with 75.6% of patients experiencing delays in seeking care at health and treatment centers (Table 1). A total of 4,059 patients (10.6%) had abnormal radiological findings, and 21,423 patients (56.2%) had blood oxygen levels below 93. Overall, the disease outcome resulted in death for 3,209 patients (8.4%) (Table 2). After adjustment, the odds for intubated patients decreased by 27-fold, while for those who were ventilated, the odds increased by 3.07-fold. It was also observed that with an increase in the duration of hospitalization, the odds of delay increased by 1.22 in the unadjusted (raw) model and by 2.09 in the adjusted model (Table 3).

5. Discussion

Our study results showed that patients admitted to intensive care units experienced greater delays in seeking medical care. This finding is consistent with results from Italy, where children who experienced delayed medical care had higher rates of admission to intensive care units and significantly elevated mortality rates (5). Our results also demonstrated that individuals who presented with symptoms such as body aches, chills, taste disturbances, cough, diarrhea, headache, shortness of breath, sore throat, and fever were more likely to experience delays in seeking care. These symptoms are consistent with common manifestations of COVID-19, and a study conducted in Brazil found that individuals presenting with such symptoms were less likely to seek immediate healthcare services.

The findings of our study indicated that urban residents had a lower likelihood of experiencing delayed medical care compared to rural residents. This disparity could be attributed to better transportation options, increased accessibility to healthcare facilities, and potentially superior financial resources among urban populations (12). Numerous studies have consistently demonstrated that delays in seeking medical care are more prevalent in rural regions and in

Table 1. Frequency of Delay in Referral Based on Demographic Variables [a,b]

Variables	Total Frequency	Without Delay Frequency	Delayed Frequency	P-Value
Gender				0.001
Male	18731 (49.1)	4729 (25.2)	14002 (74.8)	
Female	19393 (50.9)	4570 (23.6)	14823 (76.4)	
Habitat				0.001
Urban	32489 (85.2)	8224 (25.3)	24265 (74.7)	
Rural	5635 (14.8)	1075 (19.1)	4560 (80.9)	
Job				0.001
Free	5440 (14.3)	1491 (27.4)	3949 (72.6)	
Retired	5891 (15.5)	1446 (24.5)	4445 (75.5)	
Unemployed/student/soldier	1190 (3.1)	503 (42.3)	687 (57.7)	
Housewife	8545 (22.4)	2040 (23.9)	6505 (76.1)	
Child/student	5750 (15.1)	1300 (22.6)	4450 (77.4)	
Healthcare workers/government employee	620 (1.6)	287 (46.3)	333 (53.7)	
Farmer/rancher	57 (0.1)	35 (61.4)	22 (38.6)	
Other	10631 (27.9)	2197 (20.7)	8434 (79.3)	
Age				0.001
< 18	5750 (15.1)	1300 (22.6)	4450 (77.4)	
18 - 29	2481 (6.5)	658 (26.5)	1823 (73.5)	
29 - 59	14314 (37.5)	3353 (23.4)	10961 (76.6)	
> 59	15579 (40.9)	3988 (25.6)	11591 (74.4)	
Smoking				0.001
Yes	501 (1.3)	27 (5.4)	474 (94.6)	
No	37623 (98.7)	9272 (24.6)	28351 (75.4)	
Opioid use				0.001
yes	606 (1.6)	24 (4)	582 (96)	
No	37518 (98.4)	9275 (24.7)	28243 (75.3)	
Corona vaccine injection				0.001
Yes	6221 (16.3)	596 (9.6)	5625 (90.4)	
No	31903 (83.7)	8703 (27.3)	23200 (72.7)	
Pregnancy				0.001
Yes	621 (7.7)	120 (19.3)	501(80.7)	
No	7450 (92.3)	1778 (23.9)	5672 (76.1)	
Cancer				0.3
Yes	793 (2.1)	181 (22.8)	612 (77.2)	
No	37331 (97.9)	9118 (24.4)	28213 (75.6)	
Lung disease				0.17
Yes	2801 (7.3)	713 (25.5)	2088 (74.5)	
No	35323 (92.7)	8586 (24.3)	26737 (75.7)	
Hypertension				0.001
Yes	5334 (14)	676 (12.7)	4658 (87.3)	
No	32790 (86)	8623 (26.3)	24167 (73.7)	
Diabetes				0.001
Yes	4512 (11.8)	1012 (22.4)	3500 (77.6)	
No	33612 (88.2)	8287 (24.7)	25325 (75.3)	
Cardiovascular disease				0.1
Yes	7417 (19.5)	1755 (23.7)	5662 (76.3)	
No	30707 (80.5)	7544 (24.6)	23163 (75.4)	
Other chronic diseases				0.001
Yes	4205 (11)	1389 (33)	2816 (67)	
No	33919 (89)	7910 (23.3)	26009 (76.7)	
Age (y)	49.61 ± 25.27	50.65 ± 25.21	49.27 ± 25.28	0.001
Hospitalization period (d)	4.33 ± 4.67	2.66 ± 4.69	4.49 ± 4.64	0.001
Delay in referral (d)	3.67 ± 3.68	-	-	-

[a] Values are expressed as mean ± SD or No. (%),

[b] Chronic diseases: Blood fat, nervous and mental diseases, metabolic diseases, weak immune system. Women aged 9 years and older who are of reproductive age.

areas located further from healthcare services, which aligns with the results of our study (13).

Furthermore, our study indicated that patients hospitalized in special care units experienced longer

Table 2. Frequency of Delay in Referral Based on Symptoms and Outcome of the Disease [a]

Variables	Total Frequency	Without Delay Frequency	Delayed Frequency	P-Value
Lab result				0.001
Positive	16568 (43.5)	3840 (23.2)	12728 (76.8)	
Negative	21104 (55.3)	5306 (25.1)	15798 (74.9)	
Further investigation is needed	452 (1.2)	153 (33.8)	299 (66.2)	
Disease classification				0.001
Confirmed	16150 (42.4)	3913 (24.2)	12237 (75.8)	
Suspected	21436 (56.2)	5112 (23.8)	16324 (76.2)	
Probable	538 (1.4)	274 (50.9)	264 (49.1)	
Hospitalization in ICU				0.001
Yes	2319 (6.1)	418 (18)	1901 (82)	
No	35805 (93.9)	8881 (24.8)	26924 (75.2)	
Shivering				0.001
Yes	12242 (32.1)	1079 (8.8)	11163 (91.2)	
No	25882 (67.9)	8220 (31.8)	17662 (68.2)	
Body pain				0.001
Yes	15840 (41.5)	2622 (16.6)	13218 (83.4)	
No	22284 (58.5)	6677 (30)	15607 (70)	
Test disorder				0.001
Yes	549 (1.4)	75 (13.7)	474 (86.3)	
No	37575 (98.6)	9224 (24.5)	28351 (75.5)	
Abnormal finding radiology				0.001
Yes	4059 (10.6)	405 (10)	3654 (90)	
No	34065 (89.4)	8894 (26.1)	25171 (73.9)	
Cough				0.001
Yes	21455 (56.3)	4306(20.1)	17149(79.9)	
No	16669 (43.7)	4993(30)	11676(70)	
Diarrhea				0.001
Yes	2711 (7.1)	554 (20.4)	2157 (79.6)	
No	35413 (92.9)	8745 (24.7)	26668 (75.3)	
Hard breath				0.001
Yes	23529 (61.7)	4683 (19.9)	18846 (80.1)	
No	14595 (38.3)	4616 (31.6)	9979 (68.4)	
Headache				0.001
Yes	7666 (20.1)	1441 (18.8)	6225 (81.2)	
No	30458 (79.9)	7858 (25.8)	22600 (74.2)	
Sore throat				0.001
Yes	5288 (13.9)	1192 (22.5)	4096 (77.5)	
No	32836 (86.1)	8107 (24.7)	24729 (75.3)	
Lung scan				0.001
Has symptoms	11673 (30.6)	649 (5.6)	11024 (94.4)	
No symptoms	26451 (69.4)	8650 (32.7)	17801 (67.3)	
Intubation				0.001
Yes	1590 (4.2)	108 (6.8)	1482 (93.2)	
No	36534 (95.8)	9191 (25.2)	27343 (74.8)	
Using ventilator				0.001
Yes	2096 (5.5)	414 (19.8)	1682 (80.2)	
No	36028 (94.5)	8885 (24.7)	27143 (75.3)	
Blood oxygen level				0.001
> 93	8780 (23)	432 (4.9)	8348 (95.1)	
< 93	21423 (56.2)	946 (4.4)	20477 (95.6)	
Unknown	7921 (20.8)	921 (100)	0	
Fever				0.001
No fever	14749 (38.7)	2433 (16.5)	12316 (83.5)	
Mild fever	18505 (87.2)	4056 (21.9)	14449 (78.1)	
High fever	434 (1.1)	109 (25.1)	325 (74.9)	
Unknown	4436 (11.6)	2701 (60.9)	1735 (39.1)	
Outcome				0.001
Death	3060 (8)	1004 (32.8)	2056 (67.2)	
Recovery	34915 (92)	8259 (23.7)	26656 (76.3)	

[a] Values are expressed No. (%).

delays in seeking medical care. This supports findings from Italy, where children with delayed medical attention had higher intensive care unit admission rates and a significantly increased mortality rate (5). Our findings also emphasized that individuals exhibiting symptoms such as body pain, shivering, taste disorders, cough, diarrhea, headache, shortness of breath, sore throat, and fever had a higher probability of delay. These symptoms reflect typical clinical features of COVID-19, and supporting evidence from a Brazilian study showed that individuals with these symptoms were less inclined to seek prompt healthcare services (14).

Patients with lower blood oxygen levels (below 93) also exhibited a higher likelihood of delayed medical care. Various studies have identified hypoxia as a significant factor contributing to delays in medical care and increased mortality among COVID-19 patients (12, 15, 16).

Patients with a history of hypertension and diabetes showed a higher probability of delayed medical care.

This finding aligns with other studies demonstrating that individuals with chronic conditions are more likely to hesitate in seeking medical attention, resulting in increased disease severity and higher mortality rates from COVID-19 (17-19).

The study also indicated that delays in seeking medical care were less common among middle-aged and elderly individuals compared to younger individuals. This contradicts findings from a study conducted in Tehran, which reported that delays increased with age. This discrepancy may reflect variations in healthcare-seeking behavior across different populations (7, 20).

One of the key factors influencing delays in seeking medical care is hospital capacity and the availability of hospital beds. In many regions, hospitals faced a sudden influx of COVID-19 patients, leading to capacity saturation and a reduced ability to admit new patients. This situation caused some individuals to postpone seeking care due to concerns about receiving inadequate services or facing overcrowded conditions in hospitals (21, 22).

Additionally, the availability of COVID-19 diagnostic tests plays a crucial role in patients' decisions to seek medical care. In areas where diagnostic tests are limited or where test results are delayed, patients may face uncertainty in obtaining a definitive diagnosis. This can lead to postponement in their decision to visit healthcare facilities (21, 23).

The inefficiency of healthcare systems is another significant factor contributing to delays in seeking care. Inefficient healthcare systems — characterized by a shortage of medical personnel, poor resource management, and a lack of coordination among healthcare facilities — can increase patient waiting times and discourage timely visits. Furthermore, the absence of an effective referral system may compel patients to move between different healthcare centers, thereby further delaying necessary medical attention (21, 22, 24).

In summary, enhancing hospital capacity, increasing access to diagnostic testing, and improving the efficiency of healthcare systems can play a crucial role in reducing delays in seeking care among COVID-19 patients. These improvements can ultimately lead to more effective disease management at the community level (25).

5.1. Conclusions

Delay in seeking care at healthcare centers during COVID-19 infection is influenced by gender, place of residence, occupation, history of chronic diseases, and other demographic variables, as well as the timing of initial symptom onset. This study underscores the critical importance of prompt healthcare-seeking behavior. Recommendations derived from this study include the development of awareness programs to educate the public about disease symptoms and the enhancement of equitable access to healthcare services for all segments of the population.

Footnotes

Authors' Contribution: Study concept and design: M. S. M. and A. S. H.; Acquisition of data: A. D. and M. H.; Analysis and interpretation of data: S. K. H. and A. M.; Drafting of the manuscript: A. S. H.; Critical revision of the manuscript for important intellectual content: M. S. M.; Statistical analysis: A. D. and M. H.; Administrative, technical, and material support: M. S. M.; Study supervision: M. S. M.

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Table 3. Modeling Factors Associated with Delay in Seeking Medical Care

Variables	Crude		Adjusted	
	OR (95% CI)	P-Value	OR (95% CI)	P-Value
Gender				
Female [a]	-	-	-	-
Male	0.91 (0.87 - 0.96)	0.001	0.86 (0.73 - 1)	0.06
Habitat				
Rural [a]	-	-	-	-
Urban	0.69 (0.65 - 0.75)	0.001	1.16 (0.99 - 1.36)	0.05
Job				
Free [a]	-	-	-	-
Retired	1.16 (1.07 - 1.26)	0.001	1.01 (0.79 - 1.29)	0.92
Unemployed/student/soldier	0.52 (0.45 - 0.59)	0.001	1.12 (0.84 - 1.48)	0.44
Housewife	1.20 (1.11 - 1.30)	0.001	0.80 (0.64 - 1.02)	0.07
Child/student	1.29 (1.18 - 1.41)	0.001	1.02 (0.65 - 1.59)	0.93
Healthcare workers/government employee	0.44 (0.37 - 0.52)	0.001	0.89 (0.50 - 1.60)	0.71
Farmer/rancher	0.24 (0.14 - 0.41)	0.001	0.24 (0.06 - 0.89)	0.03
Other	1.45 (1.34 - 1.56)	0.001	0.89 (0.74 - 1.09)	0.3
Age				
< 18 [a]	-	-	-	-
18 - 29	0.81 (0.73 - 0.90)	0.001	0.72 (0.53 - 0.98)	0.04
29 - 59	0.95 (0.89 - 1.03)	0.22	0.85 (0.71 - 1.02)	0.07
< 59	0.85 (0.79 - 0.91)	0.001		
Smoking				
No [a]	-	-	-	-
Yes	5.74 (3.89 - 8.47)	0.001	0.71 (0.44 - 1.16)	0.18
Opioid use				
No [a]	-	-	-	-
Yes	7.96 (5.29 - 11.99)	0.001	1.32 (0.79 - 2.17)	0.3
Corona vaccine injection				
No [a]	-	-	-	-
Yes	3.54 (3.24 - 3.87)	0.001	1.04 (0.89 - 1.21)	0.64
Pregnancy				
No [a]	-	-	-	-
Yes	1.35 (1.10 - 1.65)	0.003	1.03 (0.83 - 1.27)	0.8
Cancer				
No [a]	-	-	-	-
Yes	1.09 (0.92 - 1.29)	0.3		
Lung disease				
No [a]	-	-	-	-
Yes	0.94 (0.86 - 1.03)	0.17	0.66 (0.54 - 0.81)	0.001
Hypertension				
No [a]	-	-	-	-
Yes	2.46 (2.26 - 2.67)	0.001	0.81 (0.68 - 0.96)	0.02
Diabetic				
No [a]	-	-	-	-
Yes	1.13 (1.05 - 1.22)	0.001	0.85 (0.71 - 1.02)	0.08
Cardiovascular disease				
No [a]	-	-	-	-
Yes	1.05 (0.99 - 1.15)	0.10	1.13 (0.95 - 1.34)	0.16
Other chronic diseases				
No [a]	-	-	-	-
Yes	0.62 (0.57 - 0.66)	0.001	1.08 (0.88 - 1.33)	0.46
Lab result				
Negative [a]	-	-	-	-
Positive	1.13 (1.06 - 1.17)	0.001	0.71 (0.51 - 0.97)	0.03
Further investigation is needed	0.66 (0.54 - 0.80)	0.001	0.88 (0.51 - 1.53)	0.66
Disease classification				
Probable [a]	-	-	-	-
Suspected	3.31 (2.79 - 3.94)	0.001	0.44 (0.17 - 1.11)	0.08
Confirmed	3.24 (2.73 - 3.85)	0.001	0.55 (0.21 - 1.42)	0.21
Outcome				
Death [a]	-	-	-	-
Recovery	1.57 (1.46 - 1.71)	0.001	0.87 (0.67 - 1.13)	0.31
Hospitalization in ICU				
No [a]	-	-	-	-
Yes	1.5 (1.35 - 1.67)	0.001	0.54 (0.43 - 0.67)	0.001
Shivering				
No [a]	-	-	-	-
YES	4.81 (4.5 - 5.15)	0.001	0.9 (0.79 - 1.02)	0.1
Body pain				
No [a]	-	-	-	-
Yes	2.16 (2.05 - 2.27)	0.001	1.31 (1.16 - 1.47)	0.001
Taste disorder				
No [a]	-	-	-	-
Yes	2.06 (1.61 - 2.62)	0.001	0.86 (0.57 - 1.29)	0.46
Abnormal finding radiology				
No [a]	-	-	-	-

Variables	Crude		Adjusted	
	OR (95% CI)	P-Value	OR (95% CI)	P-Value
Yes	3.18 (2.87 - 3.54)	0.001	0.56(0.48 - 0.66)	0.001
Cough				
No [a]	-	-	-	-
Yes	1.7 (1.62 - 1.78)	0.001	1.04 (0.92 - 1.17)	0.56
Diarrhea				
No [a]	-	-	-	-
Yes	1.28 (1.16 - 1.41)	0.001	0.92 (0.73 - 1.14)	0.43
Hard breath				
No [a]	-	-	-	-
Yes	1.86 (1.77 - 1.95)	0.001	0.93 (0.82 - 1.06)	0.26
Headache				
No [a]	-	-	-	-
Yes	1.50 (1.41 - 1.59)	0.001	1.04 (0.91 - 1.19)	0.56
Sore throat				
No [a]	-	-	-	-
Yes	1.13 (1.05 - 1.21)	0.001	0.96 (0.81 - 1.13)	0.61
Lung scan				
No symptoms [a]	-	-	-	-
Have symptoms	8.25 (7.59 - 8.97)	0.001	0.82 (0.73 - 0.94)	0.003
Intubation				
No [a]	-	-	-	-
Yes	4.61 (3.78 - 5.62)	0.001	0.26 (0.16 - 0.42)	0.001
Using ventilator				
No [a]	-	-	-	-
Yes	1.33 (1.19 - 1.48)	0.001	3.18 (1.93 - 5.26)	0.001
Blood oxygen level				
> 93 [a]	-	-	-	-
< 93	1.12 (.99 - 1.26)	0.06	1.05 (0.93 - 1.19)	0.43
Unknown	0		0	
Fever				
No fever [a]	-	-	-	-
Mild fever	0.7 (0.66 - 0.74)	0.001	1.01 (0.89 - 1.14)	0.93
High fever	0.59 (0.47 - 0.73)	0.001	0.77 (0.42 - 1.41)	0.39
Unknown	0.13 (0.12 - 0.14)	0.001	0.01 (0.002 - 0.11)	0.001
Period time hospitalization				
Day [a]	1.22 (1.19 - 1.24)	0.001	2.14 (2.02 - 2.25)	0.001

[a] Reference group.