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Navigating the COVID-19 Pandemic: An Investigation of Migrant Health in Iran

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Abstract: Background: The COVID-19 pandemic has raised concerns about its disproportionate impact on individuals and communities facing disadvantage. This study aims to examine whether there is a disproportionate impact on immigrant patients with COVID-19 in Iran and to present their characteristics.
Methods: This cross-sectional study analyzed data from 589,146 patients who were diagnosed with COVID-19 in Iran. Descriptive analyses were conducted to summarize the study population's characteristics. Chi-squared test and logistic regression were used to examine the association between immigrant status and COVID-19 outcomes.
Results: After adjusting for potential confounding factors, the study found that being an immigrant was significantly associated with an increased risk of death due to COVID-19 (OR 1.64, CI 1.568-1.727). Immigrant patients were more likely to present with low blood oxygen levels upon admission compared to Iranian-born patients (53.9% versus 47.7%, P value < 0.001). A higher proportion of immigrant patients diagnosed with COVID-19 were admitted to an intensive care unit (17% versus 15.8%, P value < 0.001). The study also found a significant difference in the age profiles of patients, with children under the age of eighteen accounting for 16% of immigrant patients versus 6.6% of Iranian-born patients (P value < 0.001). While both groups had a higher prevalence of COVID-19 cases among men than women, the gender bias was more pronounced for immigrant patients (P value < 0.001).
Conclusion: The study suggests that immigrant patients with COVID-19 in Iran experienced more severe health outcomes than their Iranian-born counterparts.

Keywords: COVID-19; Healthcare disparities; Health equity; Social determinants of health; Transients and migrants

1. Introduction

The ongoing pandemic caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) has impacted communities worldwide, affecting both their lives and mental health [1]. This novel disease was first identified in China in late 2019 and was named coronavirus disease 2019 (COVID-19) by the World Health Organization (WHO) in early 2020 [2]. As of writing, there have been over 500 million confirmed cases of COVID-19 globally, with over six million reported deaths [3]. In February 2020, the outbreak was detected in a north-central province of Iran, and by early March, the virus had spread to all regions of the country, making it one of the first countries significantly affected by the virus. Iran has reported over seven million confirmed cases of COVID-19 and over 140,000 confirmed deaths to date [4,5].

The COVID-19 pandemic has had unprecedented health and social consequences for almost all populations. However, there is a growing concern about how people in disadvantaged positions may be disproportionately affected [6]. People who have been displaced, such as refugees, asylum seekers, migrants, or immigrants, represent one of the most important groups who are vulnerable to epidemics [7]. Generally, these populations live in overcrowded conditions and poor-quality housing, making them prone to various communicable diseases. They often face challenges in accessing healthcare services due to multiple barriers including linguistic differences, financial instability, lack of legal status, and unawareness of their rights to healthcare. In addition, chronic comorbid conditions which are not appropriately cared for, such as cardiac diseases, diabetes, and hypertension, may be more prevalent in them [8]. All these could pose a greater risk of morbidity and mortality on these populations at the time of pandemics.

Iran is home to a significant immigrant population, particularly refugees, making it one of the largest host countries worldwide [9]. The vast majority of these immigrants are from Afghanistan, comprising around 97% of the total

population, with the remaining being mainly Iraqi nationals. While about one million Afghan nationals are registered, there are estimated to be an additional 2.1 million undocumented foreign nationals (mostly Afghan) living in the country [10]. While registered immigrants have access to primary healthcare services and national health insurance plans, there remain several barriers to accessing effective healthcare for those with foreign nationalities. These barriers include cultural beliefs, low health literacy, and concerns about immigration enforcement, which may make them more vulnerable to infection and negative consequences of COVID-19 [10]. Although all foreign nationals living in Iran, regardless of their documentation status, were provided with free COVID-19 testing and hospital services, there is still a need to examine the impact of the pandemic on immigrant populations residing in Iran [11].

Given the limited number of studies that have evaluated the impact of the COVID-19 pandemic on displaced populations, this paper aims to investigate whether COVID-19 has disproportionately affected immigrant patients residing in Iran by examining their characteristics.

2. Methods

A cross-sectional study was conducted using the Coronavirus Control Operations Headquarter of Tehran's registry database, which is the most populous province in Iran. This province is considered a crucial epicenter of the COVID-19 epidemic in the country, with over thirteen million residents. The integrated COVID-19 registry was established in March 2020, and all patients diagnosed with COVID-19 have been documented ever since, following the WHO case definition guidance [12]. This descriptive multi-center study included all patients (589,146 individuals) who were diagnosed with SARS-CoV-2 infection and received healthcare services from healthcare facilities throughout the Tehran province from March 2020 up to November 2021. Out of these, 256,359 (43%) patients had positive PCR test results for SARS-CoV-2, while the remaining patients were diagnosed based on chest CT findings and clinical epidemiological criteria. The extracted data from the records included demographic characteristics, clinical manifestations, underlying diseases, paraclinical findings, and health outcomes of the patients, and was anonymized for analysis.

2.1. Variables

The study collected data on several variables including age, sex, smoking history, opioids history, underlying diseases such as diabetes, hypertension, CVD, cancer, asthma, chronic liver diseases, chronic kidney diseases, chronic neurological diseases, chronic hematological diseases, and chronic immune deficiency diseases, clinical manifestations like fever, cough, muscle ache, difficulty breathing, chest pain, loss of smell, loss of taste, loss of appetite, nausea, diarrhea, headache, vertigo, seizure, paraplegia, and skin lesions, para-clinical findings such as blood oxygen saturation level, PCR test result, and chest CT scan report, ICU admission, and disease outcome. The age variable was categorized into 9 groups ranging from 0-4 years to 65 years or more. Sex was classified as male or female. The blood oxygen saturation level was defined as being higher than 93% or 93% and lower. PCR test result was defined as negative, inconclusive, or positive. The chest CT scan report was divided into reports with positive COVID-19-related findings and those with no COVID-19 findings. The disease outcome was described as survived or deceased. All other variables were dichotomized as yes or no.

2.2. Statistical Analysis

The study population's characteristics were summarized using descriptive analyses. Differences in patients' characteristics, clinical and para-clinical findings, and health outcome between immigrant and Iranian-born patients were assessed using the chi-squared test. The logistic regression model was used to adjust for potential confounding factors such as demographic and existing comorbidities on the health outcome of patients. Statistical analyses were performed using IBM SPSS Statistics, version 27 (IBM Corp., Armonk, N.Y., USA). A significant difference was considered at a P value < 0.05. Missing values were minimal across all variables documented by trained healthcare personnel, so the impact of missing information on the study's statistical inferences was deemed insignificant [13].

3. Results

In this study, a total of 589,146 patients diagnosed with COVID-19 were included, comprising 20,992 immigrant patients and 568,154 Iranian patients. The mean age for immigrant patients was 42± 23.4 years, while for Iranian patients, it was 51± 20.9 years. Patients aged 65 and above were the largest age group in both populations, but immigrant patients had a higher proportion of children under 18 (16%) compared to Iranian patients (6.6%). Men were more affected by COVID-19 than women in both groups, but the sex bias was more prominent in immigrant patients. The

prevalence of smoking was similar in both populations, while opioid use was more common among immigrant patients. Immigrant patients had a lower prevalence of comorbidities such as diabetes, hypertension, CVD, cancers, and chronic neurological disorders, but no significant difference was found in the prevalence of other comorbidities. There were significant differences in the distribution of clinical manifestations between the two groups, except for difficulty breathing and paraplegia. Blood oxygen saturation levels were lower in more than half of the immigrant patients than in Iranian patients. PCR test results for SARS-CoV-2 were positive in a third of the immigrant patients and in almost half of the Iranian patients. ICU admission rates and death rates due to COVID-19 were higher among immigrant patients than Iranian patients. After adjusting for possible confounding covariates, including age, sex, smoking history, opioids history, and underlying diseases, the logistic regression model revealed that being an immigrant was significantly associated with an increased risk of death with COVID-19 (OR 1.64, CI 1.568-1.727) compared to Iranian patients. Chi-squared tests were used to assess the differences in patients' characteristics, clinical and para-clinical findings, and the health outcome between the immigrant and Iranian-born patients. The logistic regression model was applied to adjust for possible confounding effects, and the estimates were examined with P value < 0.05 indicating a significant difference. IBM SPSS Statistics, version 27 (IBM Corp., Armonk, N.Y., USA) was used for the analysis. Low rates of missing values were observed across all variables used in this study, and their impact on statistical inferences was considered insignificant [14].

4. Discussion

According to a study, immigrant patients with COVID-19 in Iran had more severe health outcomes compared to Iranian-born patients. The study found that being an immigrant was significantly associated with an increased risk of dying from COVID-19. More immigrant patients had low blood oxygen levels on admission and required ICU care compared to Iranian patients [15]. This disparity in health outcomes between the two groups may be attributed to multiple barriers that hinder access to healthcare, such as differences in language and cultural beliefs, lack of entitlement to healthcare, and reluctance to use health services due to fears about legal status [16]. Despite all foreign nationals being entitled to free COVID-19 testing and hospital services in Iran, immigrants in Iran could generally be characterized as low-income communities with poor overall health status. They often suffer from chronic conditions that are either not diagnosed or not properly managed, which could result in delayed diagnosis of SARS-CoV-2 infection, exacerbate the severity of the disease, and increase the risk of morbidity and mortality in the migrant population. This study's findings confirm results reported from other countries that migrants have a disproportionate burden of COVID-19 [17].

Table 1. Characteristics and clinical presentations of patients infected with COVID-19, Iran, 2020-2021

	n	%	n	%	
Age (years)					
0-4	25,262	4.4	2200	10.5	<0.001
5-11	7408	1.3	717	3.4	
12-17	4918	0.9	448	2.1	
18-24	13,442	2.4	1359	6.5	
25-34	56,466	9.9	2758	13.1	
35-44	94,617	16.7	3106	14.8	
45-54	95,896	16.9	3198	15.2	
55-64	105,851	18.6	3139	15.0	
65 and over					
	164,294	28.9	4067	19.4	
Sex					
Female	270,578	47.6	9636	45.9	<0.001
Male	297,576	52.4	11,356	54.1	
Positive history of smoking	8618	1.5	290	1.4	0.11
Positive history of opioids					
	4434	0.8	268	1.3	<0.001
Underlying diseases					
Diabetes	56,119	9.9	1224	5.8	<0.001
Hypertension	64,053	11.3	1431	6.8	<0.001
CVD	52,465	9.2	1031	4.9	<0.001
Cancer	8891	1.6	225	1.1	<0.001
Asthma	5927	1.0	215	1.0	0.79
Chronic liver diseases	2435	0.4	105	0.5	0.12
Chronic kidney diseases	9012	1.6	293	1.4	0.03
Chronic neurological diseases	4059	0.7	112	0.5	0.002
Chronic immune deficiency diseases	1547	0.3	43	0.2	0.06
Chronic hematological diseases					
	2562	0.5	95	0.5	0.97
Clinical presentations					
Fever	210,294	37.0	7267	34.6	<0.001
Cough	295,532	52.0	9020	43.0	<0.001
Muscle ache	191,694	33.7	5608	26.7	<0.001
Difficulty breathing	240,796	42.4	8828	42.1	0.34
Chest pain	16,363	3.1	507	2.6	<0.001
Loss of smell	14,365	2.5	257	1.2	<0.001
Loss of taste	8393	1.5	182	0.9	<0.001
Loss of appetite	45,292	8.4	1216	6.2	<0.001
Nausea	36,046	6.7	1090	5.6	<0.001
Diarrhea	19,052	3.5	785	4.0	<0.001
Headache	48,991	9.1	1032	5.4	<0.001
Vertigo	15,810	2.9	420	2.2	<0.001
Seizure	1920	0.3	241	0.1	<0.001
Paraplegia	717	0.1	21	0.1	0.36
Skin lesions	635	0.1	41	0.2	<0.001

It was found that non-Iranian patients infected with COVID-19 in Iran were younger on average than Iranian patients. This finding is consistent with similar studies conducted in Kuwait, Italy, and the United States involving immigrant populations [18]. It is not surprising since most foreign nationals in Iran are migrant workers. Both Iranian and non-Iranian patients were less likely to be women, which is consistent with reports from around the world [19]. However, the difference was more pronounced among non-Iranian patients, which could be attributed to the higher proportion of male labor migrants. Differences in biological factors and behavioral habits between men and women have been cited in literature to explain the observed sex bias in COVID-19 pandemic [20].

Table 2. Para-clinical findings and health outcome of patients infected with COVID-19, Iran, 2020-2021

	n	%	n	%	
PaO2 sat <93%	270,811	47.7	11,314	53.9	<0.001
Positive PCR test result	250,649	44.1	5710	27.2	<0.001
Chest CT with positive findings	375,468	66.1	11,369	54.2	<0.001
ICU admitted	90,044	15.8	3576	17.0	<0.001
Deceased	48,765	8.6	2127	10.1	<0.001

Table 3. Logistic regression model of independent variables associ- ated with COVID-19-related death, Iran, 2020-2021

	Variable	Lower	Upper	
Age group				
0-4	1			
5-11	0.38	0.316	0.469	<0.001
12-17	0.71	0.595	0.858	<0.001
18-24	0.53	0.466	0.612	<0.001
25-34	0.50	0.461	0.552	<0.001
35-44	0.84	0.786	0.914	<0.001
45-54	1.49	1.387	1.600	<0.001
55-64	2.68	2.509	2.879	<0.001
65+				
	6.20	5.799	6.630	<0.001
Sex				
Female	1			
Male				
	1.31	1.288	1.338	<0.001
Nationality				
Iranian patients	1			
Immigrant patients	1.64	1.568	1.727	<0.001
Positive history of smoking	0.80	0.740	0.865	<0.001
Positive history of opioids	1.31	1.205	1.443	<0.001
Diabetes	1.16	1.129	1.195	<0.001
Hypertension	1.04	1.012	1.068	0.004
CVD	1.15	1.126	1.190	<0.001
Cancer	2.21	2.097	2.339	<0.001
Asthma	0.91	0.842	1.001	0.05
Chronic liver diseases	1.63	1.458	1.824	<0.001
Chronic kidney diseases	2.02	1.916	2.129	<0.001
Chronic neurological diseases	1.78	1.646	1.941	<0.001
Chronic immune deficiency diseases	1.28	1.084	1.527	0.004
Chronic hematological diseases	1.40	1.248	1.579	<0.001
Constant	0.28			

The study found that hypertension and diabetes were the most common underlying diseases in both Iranian and immigrant patients infected with COVID-19, which aligns with findings in other countries and suggests the potential involvement of ACE2 receptors in the virus entry into human cells. However, the prevalence of these conditions was higher in Iranian patients. This could be attributed to the relatively older age of Iranian patients or the underdiagnosis of chronic conditions in the immigrant population. Respiratory symptoms such as cough and difficulty breathing were the most common complaints in both groups, but it is unclear why these symptoms were more prevalent in Iranian patients.

It is important to note that this study may have limitations. The researchers did not have access to data on determinants such as reason for relocation, migration status, and length of stay in Iran that could influence the health outcomes of immigrant patients infected with COVID-19. Additionally, socio-economic status may have impacted the health outcomes of patients with COVID-19, but the study did not have information on the socio-economic status of the patients. The study compared immigrant patients, who are mostly from a low socio-economic status, with the general population of Iran, which has socio-economic diversity. As more comprehensive data become available, further research is needed to test this hypothesis. However, the use of real-time and consistent data on a large multi-center cohort of

COVID-19 patients is a major strength of this study, which makes it of great importance for policy-makers. The references have been kept unchanged.

5. Conclusion

Based on the findings of this study, it was observed that COVID-19-infected immigrant patients had worse health outcomes compared to those who were Iranian-born. These outcomes included higher rates of ICU admission and death due to COVID-19. The study further revealed that being an immigrant was significantly associated with increased risk of dying with COVID-19. These findings are consistent with the results reported from other countries.

The disparities in health outcomes between immigrant and Iranian patients could be attributed to multiple socio-economic determinants of health, including differences in language and cultural beliefs, lack of entitlement to health care, and reluctance to use health services due to fears about their legal status. These barriers hinder immigrants' access to health care, resulting in delayed diagnosis of SARS-CoV-2 infection, exacerbating the severity of the disease, and increasing the risk of morbidity and mortality in the migrant population.

Furthermore, immigrants in Iran are mostly from Afghanistan and are characterized as low-income communities with poor overall health status. Many of them send most of their earnings to their home country to support their families, which leaves them unable to afford non-COVID-19 health services, and they often suffer from chronic conditions that are either not diagnosed or not properly managed. Most labor migrants are day workers who would lose the day's pay if they left work to get tested or see physicians. All these could result in delayed diagnosis of SARS-CoV-2 infection, exacerbate the severity of the disease, and increase the risk of morbidity and mortality in the migrant population.

Inclusive policies that ensure immigrants' entitlement to COVID-19 healthcare and their inclusion in the national surveillance systems are crucial. However, it is particularly important to address the socio-economic health determinants that affect the overall health status of this population with social services that are tailored to their needs. Targeted public health interventions are needed to reduce the health inequalities and ensure that vulnerable populations, including immigrants, receive the appropriate care and support they need during the COVID-19 pandemic.

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