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A population-based and symptom-based COVID-19 prevalence survey

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Abstract:

The current study aimed to determine the community-based COVID-19 prevalence and compare the symptom-based and test-based prevalence rates in the Omicron peak (February 20 to March 20, 2022) to assess community involvement and provide effective healthcare. This cross-sectional and population-based study examined the prevalence of COVID-19 from February 20 to March 20, 2022, in the city of Khomein in Markazi Province (located in central Iran) through random cluster sampling. The period prevalence of recurrent Omicron symptoms was 37.69%. Factors such as residence in urban areas (OR = 1.25, 95% CI: 0.95–1.66), number of COVID-19 vaccine doses (OR = 0.80, 95% CI: 0.67–0.95), the interval of last vaccination dose (OR = 1.04, 95% CI: 0.97–1.11) and a history of COVID-19 (OR = 1.20, 95% CI: 1.04–1.39) were among the most important risk factors for Omicron. Ongoing efforts to vaccinate high-risk populations as well as stronger actions to diminish the Omicron consequences are fundamental obligations of the health system.

Keywords:

Community-based, Omicron, Prevalence, SARS-COV-2, Symptom-based, Test-based

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Introduction

Omicron is a variant of COVID-19 with a high mutation potential (over 30 mutations) that can rapidly target young adults due to its poor diagnosis by polymerase chain reaction (PCR) test.[1,2]

Growing evidence has demonstrated a high rate of Omicron transmission during the COVID-19 pandemic.[3-5] Moreover, estimates have shown that approximately 70% of Omicron cases have asymptomatic or mild cold-like symptoms.[6] Due to the limited availability of COVID-19 diagnostic tests in developing countries, the number of Omicron cases may be underestimated by up to 10 times. Therefore, the COVID-19 mortality burden is likely underestimated.[7] Despite the reduced fatality rate of Omicron cases compared to previous coronavirus strains, the SARS-CoV-2 burden is still high due to high pathogenic potential and escape from the immune response.[2,8]

The ongoing emergence of new SARS-CoV-2 variants has made disease control more difficult. Some limitations of Omicron, diagnosis/treatment, such as the limited availability and low sensitivity of COVID-19 diagnostic tests (rapid tests and PCR) for identifying Omicron patients and less effective vaccination/treatment strategies cause the Omicron virus to spread faster than other variants.[2,8,9] Therefore, the current study sought to determine the population-based COVID-19 prevalence and compare the symptom-based and test-based prevalence rates in the population covered by the Khomein University of Medical Sciences during the Omicron peak in Iran (February 20 to March 20, 2022) to assess community involvement and provide effective health care.

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Materials and Methods

This cross-sectional and population-based study was conducted to determine the prevalence of COVID-19 from February 20 to March 20, 2022, in the city of Khomein, Markazi Province (located in central Iran). The required (demographic, diagnostic and vaccination) data were collected through telephone interviews (April 1 to May 1, 2022). Khomein has 33,250 households, hosting 108,000 individuals.

In this study, the sampling procedure was performed using a proportion-to-size method for all households that met the eligibility criteria. After approving the study and receiving the code of ethics from the Khomein University of Medical Sciences, the list/contact numbers of all heads of family living in Khomein were obtained from the health department. Subsequently, using the information registered in the Integrated Health System (IHS) of the health department, the residences of the individuals (city/village) were identified. Second, the sample size for the population covered by each comprehensive urban/rural health center was estimated, and eligible households were randomly selected from the population covered by that center using a random number table. Finally, 1199 households hosting 3128 individuals participated in the study.

Due to limited access to diagnostic tests (PCR and rapid tests) to identify Omicron cases,[2] the clinical signs (e.g., runny or stuffy nose and sore throat, lethargy, headache, body aches, muscle aches, cough, fever, general myalgia and severe fatigue) were considered as suspected Omicron clinical signs during the Omicron peak (February 20 to March 20, 2022)) in the head of household or other family members.

Figure 1 shows that participants were divided into three groups based on the presence/absence of COVID-19 symptoms and diagnostic tests, as follows:

- Had no coronavirus symptoms (COVID-19 not-suspected cohort)
- Had coronavirus symptoms and received a diagnostic test (COVID-19 suspected cohort):
  - Had COVID-19 symptoms and tested positive (Positive cohort)
  - Had COVID-19 symptoms and tested negative (Negative cohort)
- Had COVID-19 symptoms without test confirmation (Untested cohort)

A researcher-developed checklist was used to collect the required data in two phases. In the first phase, the participants' characteristics were extracted from the IHS. In the second phase, to ensure that the participants' personal information would be kept confidential, the items in the checklist were completed by the members of the research team for each head of the households by telephone (4030 call center). The 4030-call center was established after the COVID-19 outbreak to provide the necessary training to manage the pandemic.

A simple logistic regression model (survey and cluster analysis) was used to determine if the baseline characteristics, history of COVID-19 infections and number of COVID-19 vaccine doses were correlated with COVID-19 suspected cases.

Results

In this study, 1199 households with 3128 individuals were examined. The symptom-based prevalence was 37.69% (1179 persons) [Figure 1 and Table 1]. Table 2 shows the baseline characteristics of the participants and their relationships with the COVID-19 suspected cases.

Discussion

The results indicated that most participants (62.31%) reported no COVID-19 symptoms. Of the 1179 subjects (37.69%) who reported COVID-19 symptoms, 246 (20.9%) had taken diagnostic tests and 153 (12.97%) had positive COVID-19 test results, accounting for only 4.89% of all participants. Consistent with this finding, Morlock *et al*.[7] demonstrated that 1.7% of the entire

Table 1: Prevalence of symptoms, diagnostics tests, and referral to medical centers in suspected COVID-19 cases

Features			Number (%)
Omicron symptoms	Runny nose	No	500 (42.6)
		Yes	673 (57.4)
	Sore throat	No	466 (39.8)
		Yes	706 (60.2)
	Cramps and swelling throat	No	924 (79)
		Yes	246 (21)
	Weakness and lethargy	No	740 (63)
		Yes	435 (37)
	Headache	No	812 (69)
		Yes	364 (31)
	Body aches and muscle aches	No	522 (44.5)
		Yes	652 (55.5)
	Hoarseness	No	636 (54.3)
		Yes	535 (45.7)
	Cough	No	789 (67.3)
		Yes	383 (32.7)
	Fever	No	796 (68.2)
		Yes	372 (31.8)
	Severe fatigue	No	1052 (90.2)
		Yes	114 (9.8)
COVID-19 diagnostic tests	Negative		93 (37.8)
	Positive		153 (62.2)
Referral to a physician or other medical centers	No		377 (32.1)
	Yes		798 (67.9)

Table 2: Baseline characteristics of the participants and their relationship with the COVID-19 suspected cases

Variables		Number (%)	OR (95%CI*)	*P***
Place of living	Rural	1008 (32.2)	Reference	0.013
	Urban	2120 (67.8)	1.38 (1.07,1.78)	
Gender	Female	1515 (48.5)	Reference	0.494
	Male	1611 (51.5)	0.95 (0.83,1.09)	
Variables		**Mean±sd*** **	**OR (95%CI*)**	***P****
Age (years)		37.01±20.27	0.99 (0.99,1)	0.133
Family size (number)		3.19±1.31	1.05 (0.96,1.15)	0.235
Number of COVID-19 vaccine doses		2.01±1.15	0.93 (0.87, 0.99)	0.049
Previous infections of coronavirus		0.66±0.81	1.25 (1.09, 1.43)	0.001
The interval between the last dose of the vaccine and the time of contact (month)		2.55±1.73	1.07 (1.01,1.14)	0.016
The interval between the last COVID-19 infection and the time of contact (month)		8.92±5.27	0.99 (0.97,1.02)	0.944

*Confidence interval. **Simple logistic regression in survey analysis. ***Standard deviation

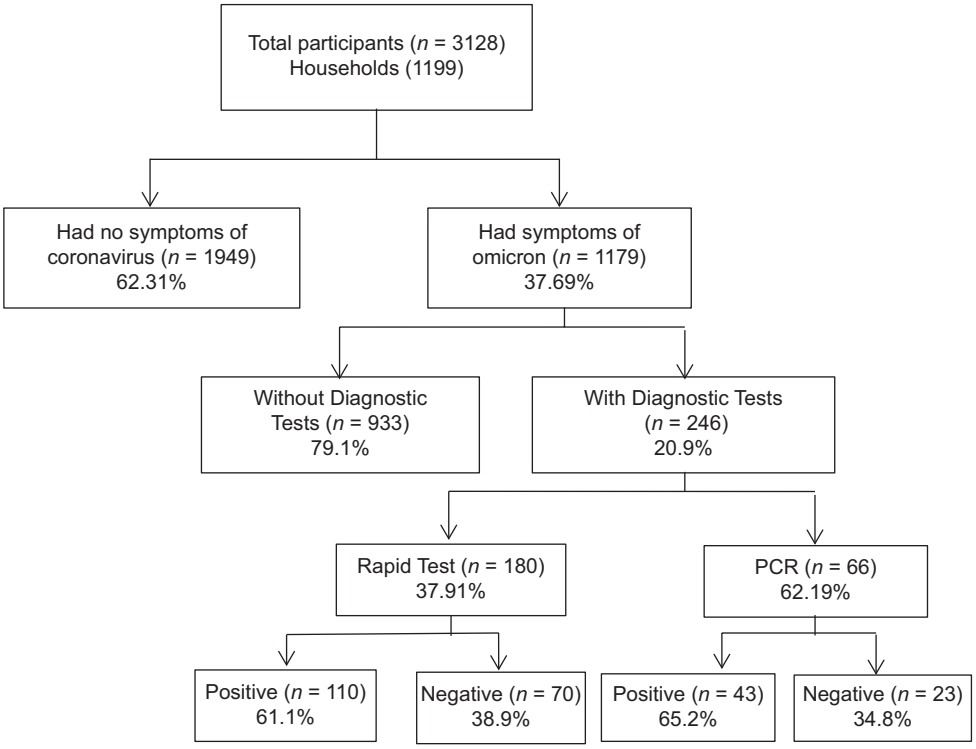

Figure 1: Flowchart of study participants

American population had positive COVID-19 test results and had limited access to diagnostic tests. Accordingly, the actual mortality rates are underestimated with more diagnostic tests, and the mortality rate reports are more precise.

The data in the present study confirmed a significant relationship between urban residence and symptom-based prevalence, possibly because people living in urban areas have access to more information about COVID-19 symptoms than their rural counterparts do. Additionally, people in rural areas generally pay less attention to their symptoms and are reluctant to report them. These findings reflect the differences between rural and urban populations in terms of perceived health and healthcare cultures.

The findings of the present study also indicated that the risk of developing Omicron declined by approximately 20% in individuals who received higher vaccination doses. Similarly, Buchan *et al*.[1] found that two doses of the COVID-19 vaccine brought only average short-term protection against symptomatic Omicron infection, while the third dose improved protection against symptomatic infection and prevented severe consequences of the disease. Although previous studies reported much decrease in the antibody-neutralizing Omicron after getting the second dose (2 mRNA vaccine doses) compared to COVID vaccination types (strong neutralization after the third dose), CD8+ cytotoxic T cells were less affected by the Omicron variant and, subsequently, they would probably keep protection

against severe symptoms.[10-13] Vaccine effectiveness (VE) against the omicron variant has a marked potential distribution of immunity compared to the immunity from infection.[14,15] Overall, previous studies have confirmed the escape of Omicron-infected cells from the immune system.[16-21] A considerable decline in hospitalization risk (about 80%) was observed after receiving the third dose in A. Maisa *et al*.[22]

The data in the present study showed that any previous COVID-19 would increase the risk of developing Omicron by more than 20%, possibly because of the following reasons: (1) having false confidence about body immunity against new infections and the failure to follow healthcare protocols after recovery; (2) consequent exposure to Omicron due to a high risk of contact; and (3) the possibility of Omicron escaping from immunity. Taken together, compliance with general healthcare protocols, including wearing masks, maintaining physical distance and good air conditioning, can significantly prevent the risk of Omicron infections.[1]

This study had some limitations. First, it was not possible to conduct face-to-face interviews with participants due to the large sample size. Second, similar studies with larger samples should be replicated to generalize these findings to larger populations.

Conclusion

SARS-COV-2 is still considered a burden on the healthcare system. Accordingly, ongoing efforts to vaccinate high-risk populations, as well as stronger actions to diminish the Omicron consequences, are fundamental obligations of the health system. Although initial investigations indicated a decline in the severity of Omicron symptoms compared to other varieties, high prevalence and evasion from human immunity are two main concerns. Reliance on national official statistics in countries with limited access to SARS-COV-2 diagnostic tests would lead to an underestimation of COVID-19 mortality rates. Consequently, the disease burden increased. Vaccination is the most reliable method for preventing SARS-COV-2 infection.

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Conflicts of interest

There are no conflicts of interest.

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