RESEARCH ARTICLE

Prevalence of breakthrough COVID-19 infection among healthcare workers in Baghdad

Alaa Ali Salih, Mayasah Abdulelaah Sadiq, Waleed Arif Tawfeeq Al-Ani, Rusul AbdulKareem Mohammed, Hamzah Abdulleh Mohammed

Abstract

Objective: To determine the prevalence and severity of breakthrough coronavirus disease-2019 infection among health workers, and to assess health workers' post-vaccination adherence to preventive guidelines.

Method: The cross-sectional study was conducted from December 2021 to March 2022 at 2 major hospitals in Baghdad, Iraq, and comprised physicians, pharmacists, dentists and paramedical staff present at time of data collection. The participants were classified according to vaccination status with history of infection. Unvaccinated meant infected before vaccination; partially vaccinated meant infected after the first dose; and fully vaccinated meant breakthrough infection after the second dose. Data was analysed using SPSS 28.

Results: Of the 506 participants aged 20-59 years, 327(64.6%) were females, 247(48.8%) were physicians, 72(14.2%) were smokers, and 21(4.1%) had asthma. All the 506(100%) participants had been infected after vaccination; 430(85%) after the second dose, and 76(15%) after the first dose. In 445(88.6%) cases, the infection was mild to moderate, while admission was required in 21(4.1%). With respect to adherence to preventive guidelines, 229(45.3%) subjects were always wearing masks before the vaccination, but 119(23.7%) continued doing that after receiving the second dose of the vaccine.

Conclusion: The majority of the participants had fallen victim to breakthrough coronavirus disease-2019 infection. Adherence to preventive guidelines was found to be reduced after the second dose of the vaccination.

Key Words: COVID-19, Masks, Pharmacists, Prevalence, Smokers, Vaccination, Physicians, Dentists, Asthma

(JPMA 74: S56 (Supple-8); 2024) **DOI: https://doi.org/10.47391/JPMA-BAGH-16-14**

Introduction

The coronavirus disease-2019 (COVID-19) pandemic was recognised as a physical and mental burden, especially on healthcare workers (HCWs).[1] A large number of HCWs were at a high risk of acquiring infection in different settings, and healthcare systems needed strong strategies to strengthen infection control measures.[2,3] The World Health Organisation (WHO) made concerted efforts to protect this frontline group through vaccination campaigns.[4]

Regardless of vaccination, however, breakthrough infections were detected among HCWs.[5]

A breakthrough infection, also known as a breakthrough case, was a term used to describe a COVID-19 infection that occurred in a fully vaccinated person.

The Centres for Disease Control and Prevention (CDC) defined a person with a breakthrough infection as someone who with a positive COVID-19 test 14 or more days after receiving a full course of a COVID-19 vaccine. [6]

Department of Family and Community Medicine, Mustansiriyah University, Baghdad, Iraq.

Correspondence: Alaa Ali Salih.

Email: draasalih@yahoo.com

One of the main measures of prevention of COVID-19 transmission was preventive measures, like handwashing, using face masks, and social distancing.[7] However, reluctance to practise such measures was registered everywhere.[8] HCWs also showed such laxity, and that included even those working in dedicated COVID-19 wards.[9]

There was a limitation to the vaccines in protecting people as newer variants of the virus kept emerging.[10]

The current study was planned to determine the prevalence and severity of breakthrough infections among HCWs, and to assess HCWs' post-vaccination adherence to preventive guidelines.

Subjects and Methods

The cross-sectional study was conducted from December 2021 to March 2022 at Al-Yarmouk Teaching Hospital and Central Paediatric Teaching Hospital, Baghdad, Iraq. The sample was raised using convenience sampling technique. Those included were physicians, pharmacists, dentists and paramedical staff present at time of data collection who were willing to participate. Those not willing to participate were excluded.

Data was collected using a structured questionnaire that

had 4 parts; demographic, vaccination, infection, adherence to preventive guidelines.

Data collection was done through direct interviews that took around 15-20 minutes to complete. The participants were classified according to vaccination status with history of infection. Unvaccinated meant infected before vaccination; partially vaccinated meant infected after the first dose; and fully vaccinated meant breakthrough infection after the second dose.

Data was analysed using SPSS 28. Data was presented as frequencies and percentages.

Results

Of the 506 participants aged 20-59 years, 327(64.6%) were females, 247(48.8%) were physicians, 72(14.2%) were smokers, and 21(4.1%) had asthma (Table 1).

Overall, 296(58.5%) subjects had received Pfizer vaccine, 136(26.9%) Astrazenica and 74(14.6%) Sinopharm. In

Table-1: Characteristics of the participants (N=506).

Characteristics	No.	%
Age (years)		
20---29	298	58.9
30---39	132	26.1
40---49	57	11.3
50---59	19	3.8
Gender		
Male	179	35.4
Female	327	64.6
Marital status		
Single	230	45.5
Married	272	53.8
Divorced/Widowed	4	0.8
Qualification		
Physician	247	48.8
Dentist	32	6.3
Pharmacist	129	25.5
Paramedical staff	98	19.4
Smoking		
Yes	72	14.2
No	434	85.8
Comorbidities		
Asthma	21	4.1
Hypertension	11	2.1
Diabetes	5	0.98
Pregnancy	3	0.58
COPD	1	0.19
Ankylosing spondylitis	1	0.19
Hyperthyroidism	1	0.19
Multiple sclerosis	1	0.19

COPD: Chronic obstructive pulmonary disease.

Table-2: Vaccination status and type of vaccine used.

Characteristics	No.	%
Type of vaccine received		
Pfizer BioNTech	296	58.5
Oxford/AstraZeneca	136	26.9
Sinopharm	74	14.6
Doses received		
First & Second dose	438	86.6
First, Second & Booster dose	68	13.4
Duration in between doses		
<8 weeks	306	60.5
=>8 weeks	200	39.5

Table-3: Prevalence of breakthrough infection among participants N=506)

Characteristics	No.	%
Infected after vaccination		
Yes	506	100
No	-	-
Timing of infection after vaccination		
First dose	76	15.0
Second dose	430	85.0
2---3 weeks	89	17.6
4---8 weeks	98	19.4
>8 weeks	319	63.0
Symptoms of infection after vaccination		
Symptomatic	476	94.5
Asymptomatic	28	5.5
Symptoms		
Malaise	300	62.8
Headache	362	75.7
Fever	396	82.8
Sore throat	421	67.2
Hoarseness of voice	44	9.2
Sneezing/Rhinorrhoea	56	11.7
Palpitation	85	17.8
Symptoms* (overlapping more than one choice was selected)		
Dyspnoea/ Chest pain	124	25.9
Cough	300	62.8
Loss of taste and/or smell	132	27.6
Diarrhoea	41	8.6
Dizziness	14	2.9
Insomnia	1	0.2
Diagnosis of infection after vaccination done by		
Clinical	134	26.5
CXR	24	4.7
CBC	35	7.0
PCR	283	55.9
COVID-19 IgM, IgG	30	5.9
Received treatment* (overlapping more than one drug was received)		
Antipyretic	481	94.2
Antibiotic	417	81.7
Vitamin C, D, Zinc	132	25.8
Steroid	88	17.2

Continued on next page...

Continued from previous page...

Cough suppressant	59	11.5
Analgesia	55	10.8
Anticoagulant	42	8.2
Decongestants	36	7 .0
Antihistamine	7	1.3
Immune Booster	4	0.78
Montelukast and ketotifen	3	0.58
Ivermectin tab	2	0.39
Antispasmodic	1	1.9
No treatment	25	4.9
Duration of illness		
<1 week	360	71.1
1-3	139	27.5
>3 weeks	7	1.4
Need hospitalisation		
Yes	22	4.3
No	484	95.7

CXR: Chest X-ray, CBC: Complete blood count, PCR: Polymerase chain reaction, COVID-19: Coronavirus disease-2019, IgM: Immunoglobulin M.

addition to the two doses, 68(13.4%) subjects had also received a booster dose (Table 3).

All the 506(100%) participants had been infected despite vaccination; 430(85%) after the second dose, and 76(15%) after the first dose. In 445(88.6%) cases, the infection was mild to moderate, while admission was required in 21(4.1%) Almost all the subjects were symptomatic 476(94.5%), and the most common symptoms were fever 396(82.8%) and headache 362(75.7%). Diagnosis relied mainly on polymerase chain reaction (PCR) test 283(55.9%) and clinical findings 134(26.5%), while antipyretic was the main treatment in 481(94.2%) cases (Table 3).

Table-4: Adherences to preventive guidelines.

Adherence to protective equipment	No.	%
Mask wearing (before vaccination)		
In work (hospital/Clinic)	164	32.4
Only in crowded spaces	28	5.5
In public	85	16.8
Always	229	45.3
Mask wearing (after first dose)		
In work (hospital/Clinic)	210	41.5
Only in crowded spaces	141	27.8
In public	21	4.2
Always	134	26.5
Mask wearing (after second dose)		
In work (hospital/Clinic)	157	31.0
Only in crowded spaces	215	42.5
In public	14	2.8
Always	120	23.7
Gown wearing		
Before vaccination	266	52.6
After first dose	90	17.8
After second dose	63	12.5
Gloves wearing		
Before vaccination	316	62.5
After first dose	160	31.6
After second dose	123	24.3
Face-shield wearing		
Before vaccination	197	38.9
After first dose	28	5.5
After second dose	8	1.6

With respect to adherence to preventive guidelines, 229(45.3%) subjects were always wearing masks before the vaccination, but 119(23.7%) continued doing that after receiving the second dose of the vaccine (Table 4).

Discussion

The COVID-19 pandemic caused significant morbidity and mortality throughout the world. HCWs were a priority category for vaccination against COVID-19 since they were the frontline workers in the fight against the pandemic. However, breakthrough infections depite the vaccination were registered.[10- 12]

A breakthrough case was defined as person in whom the virus was detected on a respiratory specimen collected ≥14 days after completing the primary series of an authorised vaccine.[13]

In the current study, post-vaccine infection was registered among all participants, but PCR was positive in only half of them, and the diagnosis in the rest depended on clinical examination, chest X-ray (CXR), complete blood count (CBC) immunoglobulin M (IgM), and IgG.

In the current study, infection after the second dose was higher than after the first dose. IN contrast, a study in South Korea showed that out of the 761 diagnosed patients, 587(77%) had an unvaccinated status at the time of diagnosis, and 127(17%) had been partially vaccinated, with only 47(6.2%) having a fully vaccinated status.[14] The difference may be explained by the fact that the other study had been done among the general public, and not among HCWs.

In a study done at a tertiary dental hospital in New Delhi, India, symptomatic breakthrough infection >14 days after the second dose occurred and was seen in 16(4.5%) HCWs, and all but 1 cases had a mild infection.[15]

In a study in Qatar, only 164 out of 22,247 HCWs contracted the infection despite having received both doses of the vaccine.[16]

In Italy, of the 3720 HCWs studied, breakthrough infection was registered in 33.[17]

In a similar study on 1497 fully-vaccinated HCWs, breakthrough infection was registered in 39, and most of them were either asymptomatic or had mild symptoms.[18]

The current study noticed a dramatic reduction in adherence to preventive guidelines in the post-vaccination phase (Table 4).

A study comprising HCWs in southern Ethiopia reported 30.5% reduction after the 1st round of COVID-19 vaccine.[19] In contrast, HCWs in Taizhou, China, showed no difference in adehenrence.[20]

According to the CDC, HCWs could afford to unmask during resting time or dining with colleagues to reduce fatigue, burnout and exhaustion, but they had to continue using the face mask during working hours.[21]

Limitation: The current study has limitations as the sample size was not calculated which could have affected the power of the study.

Conclusion

Majority of the participants showed COVID-19 breakthrough infection, and most of them were of mild to moderate severity. Post-vaccination, the HCWs showed a lax attitude towards following preventive guidelines.

Disclaimer: None.
Conflict of Interest: None.
Source of Funding: None.

References

1. Cabarkapa S, Nadjidai SE, Murgier J, Ng CH. The psychological impact of COVID-19 and other viral epidemics on frontline healthcare workers and ways to address it: A rapid systematic review. Brain Behav Immun Health 2020;8:100144. doi: 10.1016/j.bbih.2020.100144.
2. Alserehi HA, Alqunaibet AM, Al-Tawfiq JA, Alharbi NK, Alshukairi AN, Alanazi KH, et al. Seroprevalence of SARS-CoV-2 (COVID-19) among healthcare work ers in Saudi Arabia: comparing case and control hospitals. Diagn Microbiol Infect Dis 2021;99:115273. doi: 10.1016/j.diagmicrobio.2020. 115273.
3. Wei JT, Liu ZD, Fan ZW, Zhao L, Cao WC. Epidemiology of and Risk Factors for COVID-19 Infection among Health Care Workers: A Multi-Centre Comparative Study. Int J Environ Res Public Health 2020;17:7149. doi: 10.3390/ijerph17197149.
4. World Health Organization. WHO sage roadmap for prioritizing uses of Covid-19 vaccines in the context of limited supply [Online] 2020 [Cited 2024 July 29]. Available from URL: https://www.who.int/docs/default-source/immunization/sage/covid/sage-prioritization-roadmap-covid19-vaccines.pdf
5. Alshamrani MM, Farahat FM, El-Saed A, Alzunitan M, Alsaedi A, El Gammal A, et al. Post-vaccination SARS-CoV-2 infection among healthcare workers in tertiary care hospitals in Saudi Arabia: A case series. J Infect Public Health 2022;15:10-2.
6. Montgomery E. Arkansas Center for Health Improvement. Defining COVID-19 Terms: Breakthrough Infection. [Online] 2021 [Cited 2022 April 03]. Available from URL: https://achi.net/newsroom/defining-covid-19-terms-breakthrough-infection-2/
7. Smith LE, Serfioti D, Weston D, Greenberg N, Rubin GJ. Adherence to protective measures among healthcare workers in the UK: a cross-sectional study. Emerg Med J 2022;39:100-5.
8. Abeya SG, Barkesa SB, Sadi CG, Gemeda DD, Muleta FY, Tolera AF, et al. Adherence to COVID-19 preventive measures and associated factors in Oromia regional state of Ethiopia. PLoS One 2021;16:e0257373. doi: 10.1371/journal.pone.0257373.
9. Neuwirth MM, Mattner F, Otchwemah R. Adherence to personal protective equipment use among healthcare workers caring for confirmed COVID-19 and alleged non-COVID-19 patients. Antimicrob Resist Infect Control 2020;9:199. doi: 10.1186/s13756-020-00864-w.
10. World Health Organization (WHO). WHO Sage Roadmap for Prioritizing Use of COVID-19 vaccines. [Online] 2022 [Cited 2022 March 28]. Available from URL: chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/immunization/sage/2022/january/who-2019-ncov-vaccines-sage-prioritization-2022.1-eng.pdf?sfvrsn=97633cf_5
11. Schieffelin JS, Norton EB, Kolls JK. What should define a SARS-CoV-2 "breakthrough" infection? J Clin Invest 2021;131:e151186.
12. UNICEF, Iraq. UNICEF, in partnership with the Ministry of Health, launched a campaign to support the delivery of COVID-19 vaccines and routine immunization services in all districts of Iraq. News release. UNICEF press centre. [Online] 2022 [Cited 2022 March 28]. Available from URL: https://www.unicef.org/iraq/press-releases/unicef-partnership-ministry-health-launched-campaign-support-delivery-covid-19
13. Centers for Disease Control and Prevention (CDC). Public health investigations of COVID-19 vaccine breakthrough cases: case investigation protocol. [Online] 2021 [Cited 2022 March 30]. Available from URL: file:///C:/Users/kca/Downloads/cdc_142747_DS1.pdf
14. Maurya D, Kaur A, Faraz F, Tandon S, Rana A, Grover S. Assessment of breakthrough infections among post-vaccinated healthcare workers in a Tertiary Dental Hospital in New Delhi, India. medRxiv 2021;2021:21266333. doi: 10.1101/2021.11.15.21266333. [Preprint].
15. Lee JE, Hwang M, Kim YH, Chung MJ, Sim BH, Chae KJ, et al. Imaging and Clinical Features of COVID-19 Breakthrough Infections: A Multicenter Study. Radiology 2022;303:682-92. doi: 10.1148/radiol.213072.
16. Alishaq M, Nafady-Hego H, Jeremijenko A, Al Ajmi JA, Elgendy M, Vinoy S, et al. Risk factors for breakthrough SARS-CoV-2 infection in vaccinated healthcare workers. PLoS One 2021;16:e0258820. doi: 10.1371/journal.pone.0258820.
17. Rovida F, Cassaniti I, Paolucci S, Percivalle E, Sarasini A, Piralla A, et al. SARS-CoV-2 vaccine breakthrough infections with the alpha variant are asymptomatic or mildly symptomatic among health care workers. Nat Commun 2021;12:6032.
18. Bergwerk M, Gonen T, Lustig Y, Amit S, Lipsitch M, Cohen C, et al. Covid-19 Breakthrough Infections in Vaccinated Health Care Workers. N Engl J Med 2021;385:1474-84.
19. Zewude B, Melese B, Addis E, Solomon W. Changing Patterns of Compliance with Protective Behavioral Recommendations in the Post First-Round COVID-19 Vaccine Period Among Healthcare Workers in Southern Ethiopia. Risk Manag Healthc Policy 2021;14:3575-87. doi: 10.2147/RMHP.S325699.
20. Sun LX, Chen LL, Chen WY, Zhang MX, Yang MG, Mo LC, et al. Association between health behaviours and the COVID-19 vaccination: risk compensation among healthcare workers in Taizhou, China. Hum Vaccin Immunother 2022;18:2029257.
21. Centers for Disease Control and Prevention (CDC). Updated healthcare infection prevention and control recommendations in response to COVID-19 vaccination [Online] 2021 [Cited 2022 April 01]. Available from URL: https://stacks.cdc.gov/view/cdc/105524