International Journal of Community Medicine and Public Health
Gebili SA et al. Int J Community Med Public Health. 2024 Apr;11(4):1410-1416
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20240872

Original Research Article

The impact of COVID-19 vaccination on the risk of hospitalization in Fayoum healthcare workers

Shaimaa Abdallah Gebili[1], Amal Ali Abu El Hassab[2], Ashraf Ibrahim Mohammed[3], Asmaa Rohym[4], Hatem Gamal El-Din[4], Mohamed Abdelhamed Fathy[5], Ahmed Mohamed Ahmed Abdelhafez[6], Asmaa Younis Elsary[7]*

[1]Fayoum Clinical Research Unit, Fayoum Directorate of Health Affairs, The Ministry of Health and Population, Egypt
[2]Fayoum Directorate of Health Affairs, Health IT Manager Fayoum Fever Hospital, Egypt
[3]Fayoum Directorate of Health Affairs, Surveillance Coordinator Fayoum Fever Hospital, Egypt
[4]Fayoum Directorate of Health Affairs, The Ministry of Health and Population, Egypt
[5]Technical Office, The Ministry of Health and Population, Egypt
[6]Fayoum Health Council, Fayoum Directorate of Health Affairs, The Ministry of Health and Population, Egypt
[7]Public Health and Community Medicine, Faculty of Medicine, Fayoum University, Egypt

Received: 01 July 2023
Accepted: 04 March 2024

***Correspondence:**
Dr. Asmaa Younis Elsary,
E-mail: ays00@fayoum.edu.eg

ABSTRACT

Background: Healthcare workers (HCWs) face several challenges including treating COVID-19 patients. The immunization of the population through vaccination is recognized as a public health priority. The aim of the study is to assess the impact of vaccination on the risk of hospitalization and mortality in HCWs due to COVID-19 infection.
Methods: This study was conducted in Egypt in El Fayoum governorate on the HCWs from April 2021 to the end of the year 2021. A cohort retrospective approach was carried out using (the national electronic disease surveillance system) NEDSS and COVID-19 vaccine registration system. Hospitalization is determined by assessment of the cases according to the protocol of COVID-19 management of MOHP November 2020.
Results: There was no association between hospitalization and both sex and residence (p=0.1, and 0.06 respectively). There was no statistical significant association between hospitalization and vaccination (time, status, or type). The p=0.2, 0.6, and 0.07 respectively. Age and the presence of comorbidities were statistically significant predictors with p=0.004 and 0.04, respectively, as increasing age and the presence of comorbidities will increase the likelihood of hospitalization by 1.04 and 1.9 folds, respectively.
Conclusions: This study shows no significant association between vaccination and hospitalization of HCWs.

Keywords: Vaccination, COVID-19, HCWs, Hospitalization, Egypt

INTRODUCTION

COVID-19 infection is illness caused by a novel coronavirus called the severe acute respiratory syndrome coronavirus (SARS-Cov2), first identified amid an outbreak of respiratory illness cases in Wuhan city, Hubei Province, China.[1] It was initially reported to the world health organization (WHO) on December 31, 2019. On January 30, 2020, the WHO declared the COVID-19 outbreak a global health emergency.[2,3] On March 11, 2020, the WHO declared COVID-19 a global pandemic and initiated the WHO global clinical platform to mitigate the COVID-19 outbreak through global data sharing.[4] However, 20% of people need to be hospitalized, and (5% of cases) have symptoms that quickly advance to severe pneumonia/acute respiratory distress syndrome (ARDS),

necessitating invasive mechanical ventilation and the leading cause of death.[5,6] In specific individuals (particularly in the young), hypo/anosmia (loss of sense of smell) and hypo/dysgeusia (alteration of the sense of taste) have been described as early signs. There are also cases with gastrointestinal indications, especially diarrhea.[7,8] Old age and specific comorbidities, such as coronary heart disease, diabetes mellitus, chronic obstructive pulmonary disease, and hypertension, are risk factors for the development of severe COVID-19 and a poor prognosis.[9-11] In many severe cases, ARDS accrues to respiratory failure, multi-organ failure, and mortality. COVID-19-related deaths reached 6,773,425 worldwide while 24,613 in Egypt by February 7, 2023, according to the last update of world meters' COVID-19 data.[12]

The COVID-19 pandemic has increased the number of hospitalized patients significantly and increased the healthcare system's costs.[13,14] Unfortunately, HCWs are more prone to risk for hospitalization due to COVID-19 than non-HCWs.[14,15] Hospitalization of HCWs leads to human resource losses that increase the healthcare system's socioeconomic burden.[15]

The six major types of the current vaccines for coronavirus disease 2019 (COVID-19) are (live attenuated virus, recombinant viral vector, inactivated virus, protein subunit, virus-like particles, and nucleic acid-based.[16] A large-scale vaccine production facility will need to be established in order to address the current COVID-19 pandemic, which is being brought on by the SARS-CoV-2 virus. A platform for manufacturing vaccines that offers scalability, technological flexibility, and adaptability is necessary. The knowledge gained from earlier coronavirus outbreaks revealed a high level of virus diversity, so these vaccinations must meet high efficacy, safety, and tolerability standards. A large-scale production followed by a vaccination campaign aimed at millions of people in various regions is also necessary for the practical application of SARS-CoV-2 vaccines and the development of the production technique. Only a strategy this intricate will make it possible to stop the coronavirus pandemic.[17]

The WHO's COVID-19 vaccines global access (COVAX) initiative is a worldwide effort aimed at providing equitable access to vaccines raising the quote. While giving the relevance of COVID-19 vaccines to global health and the growing number of vaccine candidates now being tested in phase 2 and phase 3 trials, there is a need to create and maintain a dynamic synthesis of their efficacy and safety. Thus, The COVID national medical association COVID-NMA initiative, a living mapping and living systematic review of COVID-19 trials, is an international research initiative supported by the WHO and Cochrane.[18]

HCW hesitation to get the COVID-19 vaccine varied from 4.3% to 72% worldwide. Most research identified vaccine safety, efficacy, and potential adverse effects as leading causes of HCWs' hesitation to receive the COVID-19 vaccine.[19]

Vaccine uptake can be influenced by several factors, including a person's risk tolerance, fear of adverse events, media availability, level of trust in the healthcare system, and other social factors.[20]

The WHO has emphasized that it is necessary to assess COVID-19 VE against important outcomes, including COVID-19 symptoms, severe conditions, and COVID-19-related deaths. The ministry of health and population in Egypt led scaling up vaccination campaigns across the country as Egypt faced sequential waves of COVID-19 by using nine types of vaccination. We do not have enough studies on post vaccines).

The study's objective is to measure the effect of vaccination on the risk of hospitalization among El-Fayoum HCWs using documented COVID-19 cases extracted from the (NEDSS). COVID-19 cases are registered through the (NEDSS), a routine method started in 2002 in Egypt. The technology provides computerized reports on COVID-19 and 41 infectious illnesses. All Egyptian governorates, districts, public hospitals for infectious diseases, and basic healthcare facilities are reporting locations. During the pandemic, surveillance is crucial for early case detection, describing the epidemiology of health issues, assisting in priority setting, and planning and evaluating public health policies and tactics.[21]

METHODS

This study was conducted in El Fayoum governorate-Egypt on the HCW in 2021 to reveal the impact of COVID-19 vaccination on the risk of hospitalization and mortality in HCWs. COVID-19 cases are registered through NEDSS. While the confirmation of positive cases of COVID-19 was done by COVID-19 PCR test or COVID-19 ID NOW tests.

A cohort retrospective approach was carried out using NEDSS. The study begins from April 2021 till the end of the year 2021. The study sample was the convenience of HCWs working in healthcare facilities during the period of the study, and any participants who had any contraindication to the vaccines were excluded, and the personal characteristics and comorbidities were considered.

The vaccines used are Sinopharm, Sinovac, AstraZeneca, Moderna, Pfizer, Johnson and Johnson, and Sputnik; these vaccines are permitted by the ministry of health and population MOHP in Egypt. The site of isolation of participants is determined according to the COVID-19 protocol of MOHP version November 2020 Figure 1.[22] The critically severe and moderate cases with risk factors are isolated at hospitals, while mild and moderate cases without risk factors are isolated at home.

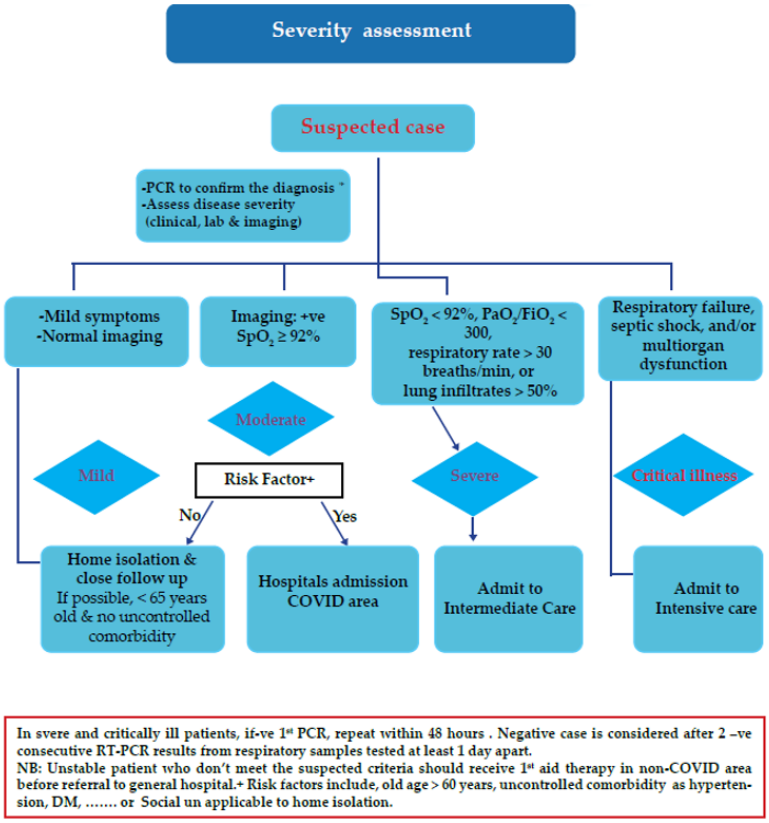

Figure 1: Triage criteria to determine home and hospital isolation according to COVID-19 protocol in November 2020.[22]

The collected data is in a pre-designed excel sheet containing personal characteristics such as age, gender, job site, job title, and home address. The diseased status also is collected as the date of COVID-19 infection, site of detection, comorbidities, site of isolation, date of hospitalization, and final clinical condition. Also, the vaccination status is collected as the type of vaccine and date of vaccination, whether first/second dose of vaccine.

Statistical analysis

Data analysis was performed using the statistical package of social science (SPSS) software version 22 in Windows 7 (SPSS Inc., Chicago, IL, USA). Simple descriptive analysis in form of numbers and percentages of qualitative data, and arithmetic means as central tendency measurement, SD as measure of dispersion of quantitative parametric data. Independent samples t test was used to compare quantitative measures between two independent groups. Chi square test is used to compare two of more than two qualitative groups. The logistic regression testis used to test association between categorical dependent and independent variables and detection of risk factors. $P<0.05$ considered statistically significant.

Ethical approval

All the necessary approvals for carrying out the research were obtained. The ethical committee of the MOHP approved the research and approval of the undersecretary of ministry of health, Fayoum governorate, was obtained. (Approval number (17-2021\31) on 1/9/2021).

RESULTS

Table 1 showed that study group's mean age was (38.5±10.9 and varied from 20 to 85 years. 69.7% of study group's members were men compared to 30.3% of women, 60.3% were from Fayoum city, where most of study population resides, followed by 19% from Senoris.

Table 1: Description of demographic characteristics among the study group (n=726).

Variables	N	Percentages (%)
Age (in years)		
Mean±SD	38.5±10.9	
Sex		
Male	506	69.7
Female	220	30.3
Residence		
Fayoum	438	60.3
Senoris	138	19
Itsa	59	8.1
Ibshway	43	5
Tamiyya	28	3.9
YousifSedik	10	1.4
Other governorates	10	1.4

Table 2 illustrated that mean duration between vaccination doses among study group was (36.2±24.2) days ranging between (20 and 126) days, with 10.7% being vaccinated before infection versus 88.8% being vaccinated after infection, 95.7% were fully vaccinated, versus 3.9% were partially vaccinated regarding the type of vaccination, 33.1% were vaccinated with AstraZeneca, 23.2% were vaccinated with Sinovac, and (23.1%) with Sinopharm, and 11.1% were vaccinated with Pfizer type.

Table 2: Description of vaccination characteristics among the study group (n=726).

Variables	N	Percentages (%)
The duration between vaccination doses (days)		
Mean±SD	36.2±24.2	
Range	20-126	
Time of vaccination		
Before infection	78	10.7
After infection	645	88.8
Not vaccine	3	0.4
Vaccine status		
Fully vaccine	695	95.7
Partially vaccine	28	3.9
Not vaccine	3	0.4
Type of vaccine (n=723)		
AstraZeneca	239	33.1
Sinovac	168	23.2
Sinopharm	167	23.1
Pfizer	80	11.1
Johnson	57	7.9
Moderna	8	1.1
Sputnik	3	0.4
Mixed	1	0.1

Among study group, 11.4% had comorbidities, with 33.7% having hypertension, 22.9% having DM, 12% being pregnant, and 10.8% being hypertensive and diabetic. As opposed to 93.1% of cases who were home-isolated, 6.9% of patients isolated at hospital. All cases eventually treated and cured, except only 1 case died.

Hospitalized cases were statistically significantly older, with a mean (of 44.02±13.01) years old versus (38.1±10.6) years old in home-isolated cases with p<0.001; in addition, they had a higher percentage of comorbidities in comparison to home-isolated cases (38% versus 17.9% respectively) p=0.001. On the other hand, there was no association between hospitalization and both sex and residence (p=0.1 and 0.06, respectively).

Table 3: Description of COVID-19 infection outcomes among the study group (n=726).

Variables	N	Percentages (%)
Comorbidities		
No	586	80.7
Yes	83	11.4
Unknown	57	7.9
Types of comorbidities (n=83)		
HTN	28	33.7
DM	19	22.9
Pregnancy	10	12
HTN and DM	9	10.8
Chest	6	7.2
Thyroid dysfunction	5	6
Cardiac	4	4.8
Renal	2	2.4
Rheumatoid	2	2.4
Prostate	1	1.2
Tumors	1	1.2
Place of isolation		
Home isolation	676	93.1
Hospital isolation	50	6.9
Outcome		
Cure	725	99.9
Death	1	0.1

Table 4: Comparison of vaccination characteristics in different isolation places.

Variables	Home isolation		Hospitalized		P value
	N	%	N	%	
Age (in years)	38.1 (mean)	10.6 (SD)	44.02 (mean)	13.01 (SD)	<0.001*
Sex					
Male	466	68.9	40	80	0.1
Female	210	31.1	10	20	
Residence					
Fayoum	418	61.8	20	40	0.06
Ibshway	38	5.6	5	10	
Tamiyya	24	3.6	4	8	
Senoris	127	18.8	11	22	
YousifSedik	7	1	3	3	
Itsa	53	7.8	6	6	
Other governorates	9	1.3	1	2	
Comorbidities					
No	555	82.1	31	62	0.001*
Yes	121	17.9	19	38	

*Statistical significance with p<0.05.

Table 5: Comparison of vaccination characteristics in different isolation places.

Variables	Home isolation		Hospitalized		P value
	N	%	N	%	
Time of vaccination					
Before infection	76	11.3	2	4	0.2
Not vaccinated before the infection	597	88.7	48	96	
Vaccine status					
Fully vaccinated	648	95.9	47	94	0.6
Partially vaccinated	25	3.7	3	6	
Not vaccine	3	0.4	0	0	
Type of vaccine, (n=723)					
AstraZeneca	230	34.2	9	18	0.07
Sinovac	150	22.3	18	36	
Sinopharm	154	22.9	13	26	
Pfizer	73	10.8	7	14	
Johnson and Johnson	55	8.2	2	4	
Moderna	8	1.2	0	0	
Sputnik	2	0.3	1	2	
Mixed	1	0.1	0	0	

Table 6: Logistic regression analysis to determine the risk factors of hospitalization among study group.

Variables	B	SE	Sig.	Exp (B)	CI (95%)
Constant	-5.1	0.9	<0.001	----	-----
Sex (Female)	-0.57	0.37	0.12	0.56	0.27-1.17
Age (in years)	0.04	0.01	0.004*	1.04	1.01-1.06
Comorbidities	0.67	0.33	0.04*	1.9	1.02-3.7
Time of vaccination (before infection)					
After infection	0.87	0.74	0.24	2.4	0.56-10.2
No vaccine	-17.5	22603.4	0.99	0.0	00
Status of vaccination (fully vaccinated)					
Partially vaccine	0.51	0.64	0.43	1.7	0.47-5.8

*Statistical significance with p<0.05.

No statistically significant association between hospitalization and vaccination (time, status, or type) existed. P=0.2, 0.6, and 0.07, respectively.

By analyzing the study group, we found that 10.7% (78/726) were vaccinated before infection, two of them were hospitalized (2.5%), and one of them died (1.2%). While 89.26% (648/726) were unvaccinated before infection, 48 were hospitalized 7.4% with no deaths.

This study used a multivariate logistic regression model to examine the explanatory power of various risk factors of hospitalization of COVID cases. Age and co-morbidities were statistically significant predictors with p=0.004 and 0.04, respectively, as increasing age and comorbidities will increase the likelihood of hospitalization by 1.04 as well as the 1.9 folds, respectively.

DISCUSSION

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) a new virus detected in Wuhan City in China in December 2019.[23] On March 12, 2020, the WHO announced that COVID-19 is considered a pandemic.[24] The transmission is through droplets, coughing, or sneezing.[25]

In Egypt, 515,698 confirmed cases of COVID-19, with 24,809 fatalities, have been reported to WHO between January 3, 2020, and 4:24 PM on February 21, 2023, 104,508,139 vaccine doses have been given as of February 18, 2023.[26] The new virus is still affecting humans and not only affects the healthcare system but also puts a socioeconomic burden.[27]

To limit the spread of the infection, most countries applied restriction measures, such as staying one meter away from others. When social distancing was not enough to encounter the pandemic, wearing masks, washing hands regularly with soap or swabbing with alcohol, covering mouth and nose while coughing or sneezing, and restriction on public gatherings were a must; however, the most essential measure is to get vaccinated.[28]

HCWs are at the frontline of COVID-19 being at high risk of infection. In this study, we compare the impact of

different types of vaccines available in Egypt during the study on the risk of hospitalization of HCWs; the types used were: Oxford\AstraZeneca, which is a recombinant vaccine (ChAdOx1-S) has an efficacy of 72%, against symptomatic SARS-CoV-2 infection.[29] Sinovac-Corona-Vac is an inactivated whole virus vaccine that shows 51% efficacy against symptoms. Pfizer-BioNTech (BNT162b2) vaccine which is an m-RNA vaccine that has very high efficacy against severe disease and moderate efficacy against symptomatic SARS-CoV-2 infection.[30,31] Moderna is an mRNA-1273 vaccine, and, after two doses, a first booster dose, has been shown to have very high effectiveness against severe disease, hospitalization, and death and modest effectiveness against symptomatic illness.[32] Sputnik V vaccine, which is a viral vector vaccine.[33] Johnson and Johnson vaccine, is a viral vector vaccine with 72% efficacy after 1 shot.[34]

The highest percentage of vaccination is in Fayoum district, representing 60%, due to its largest population compared to other districts, easy access to vaccination centers, presence of all travelers' centers in Fayoum district, and high education level. Also, this may be due to the presence of the most trustable vaccination center.

According to the study, only 11% (n 78) of HCWs were vaccinated before infection because vaccines became available after two waves of COVID-19, so many people were already infected. While 89% (n=648) were vaccinated after infection as vaccination became obligatory and vaccines became more popular and trusted worldwide. It was sending alarming messages as reminders for the first and the second doses resulted in about 95.5% being fully vaccinated. AstraZeneca was the primary type of vaccine taken by HCWs, 33.1% (n=239), as it was recommended for people not suffering from comorbidities and those aged less than 60 years.

From the study, it was observed that hospitalized HCWs represented 6.9% (n=50) of the study sample. Unvaccinated hospitalized HCWs before infection were 96% (n=48), while only 4% (n=2) get hospitalized from the vaccinated group. We also found that according to the vaccination status, about 95.9% (n=648) were fully vaccinated from the study sample at the end of the study as the government has set laws to prevent the entry of unvaccinated HCWs into the MOHP facilities.

People were more inclined to receive COVID-19 vaccines if they were male, older in age, and doctoral degree holders.[34]

Limitations

The sample size is small in comparison with the number of vaccinated HCWs in Fayoum. Some data extracted from NEEDS are incomplete and the authors had to contact participants personally to complete them.

CONCLUSION

This study proves that there is no significant difference in the hospitalization of COVID-19 cases between vaccinated and non-vaccinated HCWs. Overall, this renders as increasing age and the presence of comorbidities will increase the likelihood of hospitalization. Hospital physicians should be aware of these differences to guide the diagnosis and subsequent management of cases, especially the decision of hospitalization for cases with comorbidities and old patients. These results would help in developing specific and effective management strategies.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Coronavirus Disease 2019 (COVID-19). CDC. Available at: https://www.cdc.gov/coronavirus/2019-ncov/index.html. Accessed on 12 January, 2024.
2. Shrestha UK. Adaptive immunity against COVID-19. J Adv Internal Med. 2020;9(2):44-6.
3. Coronavirus Disease 2019 (COVID-19): Practice Essentials, Background, Route of Transmission. Available at: https://emedicine.medscape.com/article/2500114-overview. Accessed on 12 January, 2024.
4. Mitigating the COVID-19 outbreak through global data sharing. Available at: https://www.who.int/teams/health-care-readiness/COVID-19/data-platform/mitigating-the-covid-19-outbreak-through-global-data-sharing. Accessed on 12 January, 2024.
5. Cai Q, Feng H, Huang J, Wang M, Wang Q, Lu X, et al. The mental health of frontline and non-frontline medical workers during the coronavirus disease 2019 (COVID-19) outbreak in China: A case-control study. J Affect Disord. 2020;275:210–5.
6. 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. Lancet (London, England). 2020;395(10223):497-506.
7. Chen Y, Liu Q, Guo D. Emerging coronaviruses: Genome structure, replication, and pathogenesis. J Med Virol. 2020;92(4):418-23.
8. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. JAMA, 2020;323(11):1061-9.
9. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. China Medical Treatment Expert Group for COVID-19. Clinical Characteristics of Coronavirus Disease 2019 in China. N Eng J Med. 2020;382(18):1708-20.
10. 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. JAMA. 2020;323(13):1239-42.

11. Lopes-Pacheco M, Silva PL, Cruz FF, Battaglini D, Robba C, Pelosi P, et al. Pathogenesis of Multiple Organ Injury in COVID-19 and Potential Therapeutic Strategies. Frontiers Physiol. 2021;12:593223.
12. COVID-Coronavirus Statistics-Worldometer. 2023. Available at: https://www.worldometers.info/coronavirus/. Accessed on 12 January, 2024.
13. Buchegger S. Analyzing the economic burden of COVID-19 patient hospitalization and testing: A comparison between the Netherlands and Germany. J Heal Social Studies. 2020;9(57):e67-78.
14. Ferland L, Carvalho C, Gomes Dias J, Lamb F, Adlhoch C, Suetens C, et al. Risk of hospitalization and death for healthcare workers with COVID-19 in nine European countries. J Hospital Infection. 2022;119:170-74.
15. An X, Xiao L, Yang X, Tang X, Lai F, Liang XH. Economic burden of public health care and hospitalisation associated with COVID-19 in China. Public Health. 2022;*203*:65-74.
16. Jeyanathan M, Afkhami S, Smaill F, Miller MS, Lichty BD, Xing Z. Immunological considerations for COVID-19 vaccine strategies. Nature Rev Immunol. 2020;20(10):615-32.
17. Calina D, Docea AO, Petrakis D, Egorov AM, Ishmukhametov AA, Gabibov AG, et al. Towards effective COVID-19 vaccines: Updates, perspectives and challenges (Review). Int J Mol Med. 2020;46(1):3-16.
18. Juul S, Nielsen EE, Feinberg J, Siddiqui F, Jørgensen CK, Barot E, et al. Interventions for treatment of COVID-19: A living systematic review with meta-analyses and trial sequential analyses (The LIVING Project). PLoS Med. 2020;17(9):e1003293.
19. Biswas N, Mustapha T, Khubchandani J, Price JH. The Nature and Extent of COVID-19 Vaccination Hesitancy in Healthcare Workers. J Community Heal. 2021;46(6):1244-51.
20. Abdullahi LH, Kagina BM, Ndze VN, Hussey GD, Wiysonge CS. Improving vaccination uptake among adolescents. Cochrane Database Systematic Rev. 2020;1(1):CD011895.
21. Girgis N, Elnahry W, Afifi S, El Shourbagy S, Abu Elsood H, Eid A. Evaluation of the National Electronic Disease Surveillance System Amid the COVID-19 Pandemic in Elsahel District, Cairo Governorate, Egypt. 2020 Proc. 2022;8(1):e36514.
22. Management Protocol for COVID-19 Patients MoHP Protocol for COVID19. 2020. Available at: https://micrositesstorge.blob.core.windows.net/product/Guideline_39. Accessed on 12 January, 2024.
23. Dhar J, Samanta J, Kochhar R. Corona Virus Disease-19 pandemic: The gastroenterologists' perspective. Indian J Gastroenterol. 2020;*39*(3):220-31.
24. WHO announces COVID-19 outbreak a pandemic. Available at: https://reliefweb.int/report/world/who-announces-covid-19-outbreak-pandemic?gclid=EAIaIQobChMI-MK95bbx_AIVhYXVCh1JtweKEAAYAiAAEgL0wvD_BwE. Accessed on 12 January, 2024.
25. Reddy V, Sharma D. COVID 19 in neonates. J Maternal Fetal Neonatal Med. 2022;35:8:1610-18.
26. Egypt: WHO Coronavirus Disease (COVID-19) Dashboard with Vaccination Data | WHO Coronavirus (COVID-19) Dashboard with Vaccination Data. Available at: https://covid19.who.int/region/emro/country/eg. Accessed on 12 January, 2024.
27. Chilamakuri R, Agarwal S. COVID-19: Characteristics and Therapeutics. Cells. 2021;10(2):206.
28. WHO. Coronavirus disease (COVID-19). Available at: https://www.who.int/health-topics/coronavirus#tab=tab_2. Accessed on 12 January, 2024.
29. WHO. COVID-19 vaccines: everything you need to know. Available at: https://www.who.int/news-room/feature-stories/detail/the-oxford-astrazeneca-covid-19-vaccine-what-you-need-to-. Accessed on 12 January, 2024.
30. WHO. The Sinovac-CoronaVac COVID-19 vaccine: What you need to know. 2022. Available at: https://www.who.int/news-room/feature-stories/detail/the-sinovac-covid-19-vaccine-what-you-need-to-know?gclid=Cj0KCQjwnf-kBhCnARIsAFlg491XtKnMZPK8D-6YDAWotKiiwQUrbCOeIeiHmL8mFSjATJNa2RxexYQaAn7-EALw_wcB. Accessed on 12 January, 2024.
31. WHO. The Pfizer BioNTech (BNT162b2) COVID-19 vaccine: What you need to know. 2022. Available at: https://www.who.int/news-room/feature-stories/detail/who-can-take-the-pfizer-biontech-covid-19--vaccine-what-you-need-to-know. Accessed on 12 January, 2024.
32. WHO. The Moderna COVID-19 (mRNA-1273) vaccine: what you need to know. 2022. Available at: https://www.who.int/news-room/feature-stories/detail/the-moderna-covid-19-mrna-1273-vaccine-what-you-need-to-know?gclid=EAIaIQobChMIhM-hNCr_QIV-I9oCR3PjQHjEAAYASAAEgLVD_D_BwE. Accessed on 12 January, 2024.
33. Morón-Duarte LS, Chacón KR, Gutiérrez MP, De La Hoz IH, Yomayusa N. Efficacy and safety of four COVID-19 vaccines in preventing SARS-CoV-2 infection: A rapid review. Eficacia y seguridad de cuatro COVID-19 vacunasparaprevenir la infecciónpor SARS-CoV-2: unarevisión-rápida. Biomedica: Revista del Instituto Nacional de Salud. 2022;42(2):19-31.
34. Vaccines work. Everything we know about Johnson and Johnson's single-dose COVID-19 vaccine (Feb.2021). Available at: https://www.gavi.org/vaccineswork/everything-we-know-about-johnson-johnsons-single-dose-covid-19-vaccine?gclid=EAIaIQobChMIic6notOr_QIVloXVCh1VGwXaEAAYASAAEgI8t_D_BwE. Accessed on 12 January, 2024.

Cite this article as: Gebili SA, El Hassab AAA, Mohammed AI, Rohym A, El-Din HG, Fathy MA et al. The impact of COVID-19 vaccination on the risk of hospitalization in Fayoum healthcare workers. Int J Community Med Public Health 2024;11:1410-6.