



The Burden of COVID-19 Vaccine Side Effects on Nursing Staff in Palestine

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ABSTRACT

This study investigates the impact of various COVID-19 vaccine side effects on nursing staff in Palestine. A quantitative cross-sectional study design was used, and 355 nurses participated by completing a self-administered questionnaire via Google Forms. These nurses worked in private and governmental hospitals and health centres in Palestine. The study showed that 55.2% of participants were hesitant to receive the vaccine. The majority of participants received the Pfizer vaccine (46.5%). Moreover, 50.7% reported experiencing post-vaccination side effects, with 37.5% describing them as mild. The most common side effects included fatigue (48.4%), pain at the injection site (46.2%), fever (46.2%), and headache (39.1%). The impact of different types of COVID-19 vaccines on missed work due to side effects was most notable after the first dose (21.7%), and the side effects were mainly mild and disappeared after one day (34.6%). Participants expressed concerns about safety, effectiveness, and short- and long-term side effects of vaccines.

Keywords: COVID-19, Immunity, Nursing, Hesitancy, Vaccines, Side effects.

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1. Introduction

The COVID-19 pandemic originated in Wuhan, China, in December 2019 (Platto et al., 2020) and rapidly spread globally, causing widespread morbidity and mortality (Amer et al., 2024; Naqid et al., 2024; Orebi et al., 2022). The infection has resulted in more than two million deaths and over 107 million cases worldwide, including over 3,000 deaths and over 300,000 cases in Palestine (Shouli et al., 2022). As nurses play a crucial role in combating the pandemic, the number of COVID-19 cases among them was proportionately high (Maraqa et al., 2021; Naqid et al., 2024).

Vaccination offers a safer path to adaptive immunity than contracting the virus itself (Shouli et al., 2022). Although no vaccine is without potential side effects, COVID-19 vaccines utilise acquired artificial active immunity, relying on the adaptive immune response and immune memory. Their primary effect is reducing severe illness and death. However, vaccine effectiveness wanes over time and with the emergence of new variants (Barouch, 2022; Feikin et al., 2022.; Sette & Crotty, 2021). Despite the proven life-saving benefits of vaccines, some regions have experienced low acceptance rates (Eterafi et al., 2024). Nurses' attitudes toward vaccination, shaped by various factors such as their understanding of its importance, are critical, as they are considered a trusted source of information for others (Orebi et al., 2022).

There are different vaccine technologies in existence, including mRNA vaccines (Pfizer-BioNTech, Moderna), viral vector vaccines (Janssen, Sputnik, AstraZeneca), and inactivated vaccines (Sinopharm, Sinovac, COVAXIN) (Desai et al., 2023). Due to the rapid development of these vaccines, vaccine hesitancy has become a significant public health concern, driven by misinformation and rumours regarding vaccine safety and efficacy (Desai et al., 2023; Nwachukwu et al., 2024; Orebi et al., 2022). Factors influencing vaccine acceptance include awareness, perceived side effects, attitudes, perceived susceptibility, social influences, and trust in the medical community (Orebi et al., 2022). Rapid vaccine development, media attention, and anti-vaccination groups have also contributed to hesitancy. Misinformation concerning infertility and other severe side effects has also fuelled vaccine hesitancy among some nurses and the public (Desai et al., 2023). Transparency and accurate information are crucial for increasing vaccine confidence and addressing concerns about side effects (Amer et al., 2024). Common side effects are generally mild to moderate (fatigue, chills, fever, myalgia, headache, diarrhea, nausea, and injection site reactions) and manageable (Abukhalil et al., 2024; Ahmed Mohamed Ibrahim et al., 2024). Serious side effects, though rarer, have been reported (Abukhalil et al., 2024). Some studies show that women report side effects more than men (Sedaghat et al., 2024).

This research aims to assess the burden of COVID-19 vaccine side effects on Palestinian nurses, examining potential contributing factors, including age and gender. Due to the limited research on this topic in Palestine, the study aims to provide databased recommendations to enhance nurse support and minimize the impact of side effects on their work. Prior research has indicated vaccine hesitancy and fear of side effects among healthcare workers (Maraqa et al., 2021; Shouli et al., 2022). This study also investigates the relationship between vaccine hesitancy among nurses and the burden of COVID-19 vaccine side effects. Additionally, it aims to provide insights into future vaccination efforts in the event of a COVID-19 resurgence or the reuse of similar vaccine technologies in future epidemics.

2. Methods

A cross-sectional quantitative study was conducted using a convenience sampling method. The sample size was determined with a 95% confidence level and a 5% margin of error. The calculated sample size was 374, and the final response rate was around 95%, resulting in a final sample of 355 nurses. Data were collected using a structured, pretested questionnaire administered via Google Forms and distributed through visits and social media groups for nurses. The study included an appropriate sample of nurses from primary health care centres and governmental and non-governmental hospitals and centres in Palestine. The data were collected after obtaining approval from the Ethical Review Committee at Modern University College (Ref: muc006/2024), between October 15, 2024, and December 1, 2024. Approximately 13,000 nurses work in governmental and private hospitals, centres, and outpatient clinics in Palestine (West Bank), according to the Palestinian Nursing Syndicate.

Nurses from northern (Jenin, Tubas, Nablus, Qalqilya, Tulkarem), central (Jerusalem, Ramallah, Salfit, Jericho), and southern (Hebron, Bethlehem) cities were included. Participants were selected from various departments, including intensive care, emergency, neonatal, gynaecology, and surgery.

The survey was adjusted and adapted from previous research to test nurses' experiences with the vaccination process and to collect data on related side effects (Ahmed Mohamed Ibrahim et al., 2024; Al-Hatamleh et al., 2022; Chrissian et al., 2022; Dejen Tilahun et al., 2024; Elhadi et al., 2021; Maraqa et al., 2021; Naqid et al., 2024; Shouli et al., 2022; Zare et al., 2022).

The questionnaire consists of four sections: Demographic data: (age, gender, marital status, profession, place of work, years of experience). General knowledge: includes chronic medical problems, a healthy lifestyle, and the annual flu vaccination before the COVID-19 vaccine. COVID-19 information: about the type of vaccine and the number of doses, about vaccine hesitancy and refusal, about infection with this virus after vaccination, and admission to hospital after vaccination. Side effects of vaccines, including serious complications of the vaccine, the severity of side effects after vaccination, the nature of symptoms, the time required for vaccination symptoms to disappear, if there is a need to miss work after receiving the doses, concerns about the safety and effectiveness of the vaccine, and concerns about short- and long-term side effects.

Some of the questionnaire's items were improved after it was piloted with 40 respondents to assess its comprehensibility, face validity, and expected time to complete. Certain things were eliminated and merged with other subjects in response to the feedback received. To avoid possible bias. The reliability was indicated by the trend data's determined Cronbach's alpha of 79%.

2. 1. Data Analysis

The collected data were analysed by the Statistical Package for Social Sciences (SPSS), Version 27. Data entry was performed and double-checked for outliers or errors. Both descriptive and inferential statistical analyses were conducted. Descriptive statistics, including frequencies, percentages, mean scores, and Standard Deviation (SD), were used to describe the study variables. Regarding inferential statistics, an independent t-test and a One-Way ANOVA, and a chi-square test were conducted to assess the differences between variables.

3. Results

3. 1. Demographic Variables

The study included 355 participants. Most were female (62.0%), compared to males (38.0%). The majority were aged 20–29 years (67.3%), followed by those aged 30–39 years (13.5%), 40–49 years (15.5%), and those aged 50 years or older (3.7%). Regarding marital status, 52.1% were married, 46.8% were single, and 1.1% were divorced. In terms of education, 66.5% held a Bachelor's degree, 19.7% had a diploma, and 13.8% pursued higher education (Master's or PhD). Participants were almost evenly distributed between governmental (48.7%) and private (51.3%) sectors. Regionally, 43.1% worked in the central region (Jerusalem, Ramallah, Salfit, Jericho), 38.9% in the southern region (Hebron, Bethlehem), and 18.0% in the northern region (Jenin, Tubas, Nablus, Qalqilya, Tulkarem). Most participants had 1–5 years of experience (60.8%), while 11.5% had 6–10 years, and 27.6% had more than 10 years of experience.

Table 1. Demographic Variables of the Participants (n=355)

Demographic variables		n	%
Gender	Male	135	38.0%
	Female	220	62.0%
Age group	20-29 years old	239	67.3%
	30-39 years old	48	13.5%
	40-49 years old	55	15.5%
	>49 years old	13	3.7%
Marital status	Single	166	46.8%

Level of education	Married	185	52.1%
	Divorced	4	1.1%
	Diploma Degree	70	19.7%
	Bachelor's Degree	236	66.5%
	Higher Education (Master's or PhD)	49	13.8%
Working sector	Governmental	173	48.7%
	Private	182	51.3%
Working region	North (Jenin, Tubas, Nablus, Qalqilya, Tulkarem)	64	18.0%
	Middle (Jerusalem, Ramallah, Salfit, Jericho)	153	43.1%
	South (Hebron, Bethlehem)	138	38.9%
Experience	1-5 years	216	60.8%
	6-10 years	41	11.5%
	>10 years	98	27.6%

3. 2. Assessing Health Practices, COVID-19 Vaccination Attitudes, and Post-Vaccination Experience

The assessment of health practices, COVID-19 vaccination attitudes, and post-vaccination experiences revealed that 58.0% maintained a healthy lifestyle, while 42.3% reported receiving annual flu vaccinations prior to the COVID-19 pandemic. A majority (79.4%) did not have chronic medical problems. The primary source of COVID-19 information was the WHO (50.4%), followed by multiple sources (28.2%). Vaccine hesitancy was observed in 55.2% of participants, and 42.5% had previously refused the COVID-19 vaccine. About 52.1% encouraged others to get vaccinated. Regarding vaccine types, 46.5% received the Pfizer/BioNTech vaccine, followed by Sputnik (19.7%) and Moderna (17.7%). Most participants (47.0%) received two doses, and 35.2% were willing to receive a booster if recommended. Post-vaccination, 36.6% reported contracting COVID-19, and 13.5% required hospitalisation. 41.1% reported feeling safer post-vaccination, while 32.1% did not feel safer, and 26.8% were uncertain.

3. 3. Side Effects of Vaccines

The analysis of vaccine side effects revealed that 55.5% expressed concern about serious complications, while 50.7% reported experiencing side effects post-vaccination. Regarding the severity of symptoms, 37.5% described them as mild, 31.0% as moderate, and 7.6% as severe, while 23.9% reported no symptoms. The most common side effects included fatigue (48.4%), pain at the injection site (46.2%), fever (46.2%), and headache (39.1%). Injection site reactions involved pain (54.9%), redness (7.6%), and swelling (8.5%). Side effects were most commonly reported after the first dose (32.7%), followed by the second dose (14.1%) and the third dose (4.2%), while 20.3% experienced side effects after each dose. Symptoms resolved after one day in 34.6% of cases, within 48 hours in 22.0%, and within 72 hours in 11.8%. Missing work due to side effects was reported by 21.7% after the first dose, 14.1% after the second, and 10.4% after all doses, while 47.9% did not need to miss work.

3. 4. Concerns Regarding COVID-19 Vaccines

The analysis of concerns regarding COVID-19 vaccines shows that participants generally exhibited "good concern" across all assessed aspects, with a total mean score of 3.13 (SD = 0.918). Specifically, concerns about vaccine safety had a mean score of 3.08 (SD = 1.142), effectiveness scored 3.14 (SD = 1.146), short-term side effects scored 3.10 (SD = 1.082), and long-term side effects scored 3.18 (SD = 1.190). Based on the cutoff point (<3 indicating "bad concern" and ≥3 indicating "good concern"), all items reflected a good level of concern.

Table 2. Concerns Regarding COVID-19 Vaccines

Item	Mean	SD	%	Status
1. I have concerns about the COVID-19 vaccine's safety	3.08	1.142	61.6%	Good Concern
2. I have concerns about the COVID-19 vaccine's effectiveness	3.14	1.146	62.8%	Good Concern
3. I have concerns about the short-term side effects	3.10	1.082	62%	Good Concern
4. I have concerns about the long-term side effects	3.18	1.190	63.6%	Good Concern
Total Mean Score (4 items)	3.13	.918	62.6%	Good Concern

Cutt of point: <3 bad concern, ≥3 good concern

3. 5. Factors Associated with the Severity of COVID-19 Side Effects

As shown in [Table 3](#), participants in the study were hesitant about vaccination, and those who previously refused vaccines reported more severe side effects. Those who did not advise others to be vaccinated also experienced more severe side effects. Participants receiving the Pfizer/BioNTech vaccine reported more severe side effects compared to those receiving the AstraZeneca/Oxford vaccine. Unwillingness to receive a booster dose was associated with higher side effect severity, as was contracting COVID-19 after vaccination. Conversely, those who felt safer dealing with COVID-19 patients after vaccination reported less severe side effects.

Table 3. Factors Associated with the Severity of COVID-19 Side Effects (n=355)

Factors	N	Mean	SD	P-value
Do you have COVID–19 vaccine hesitancy?	Yes	196	2.37	.003*
	No	103	2.05	
	Maybe	56	2.04	
Did you refuse to receive COVID-19 vaccine in the past?	Yes	151	2.39	.002*
	No	204	2.10	
Did you advise other people to get vaccinated for COVID–19?	Yes	185	2.13	.043*
	No	170	2.32	
What is the type of vaccine you received?	Moderna	63	2.19	.043*
	Sputnik	70	2.19	
	Sinopharm	20	2.15	
	Pfizer/BioNTech	165	2.33	
	AstraZeneca/Oxford	30	1.77	
	J&J/Janssen	7	2.57	
Are you willing to receive a booster dose if recommended by health authorities?	Yes	125	2.10	.009*
	No	154	2.39	
	Maybe	76	2.08	
Did you get infected with COVID-19 after vaccination?	Yes	130	2.51	<.001*
	No	186	2.03	
	Maybe	39	2.18	
Do you think getting vaccinated made you feel safer while dealing with Corona patients?	Yes	146	2.08	.035*
	No	114	2.33	
	Maybe	95	2.32	

A higher mean score means higher severity of side effects (Min=1, Max=4)

Independent t-test and One-Way ANOVA; *Significant at $p < 0.05$

3. 6. Associated Factors that Affect COVID-19 Vaccine Hesitancy

COVID-19 vaccine hesitancy was significantly associated with the working sector. Participants working in the governmental sector were more likely to report vaccine hesitancy (56.6%) compared to those in the private sector (43.4%), while individuals without hesitancy were more prevalent in the private sector (65.0%) compared to the governmental sector (35.0%). Those who were uncertain ("Maybe") were more evenly distributed but leaned slightly toward the private sector (53.6%). The association was statistically significant ($X^2 = 12.8$, $p = .002$). Years of experience showed a statistically significant relationship with vaccine hesitancy ($X^2 = 13.6$, $p = .009$). The majority of hesitant individuals had 1-5 years of experience (61.7%), followed by those with >10 years (30.6%), while the 6-10 years group had the lowest proportion (7.7%). A similar trend was observed among non-hesitant individuals, where the 1-5 years group also dominated (64.1%), followed by 6-10 years (18.4%) and >10 years groups (17.5%). Among those who were uncertain ("Maybe"), most had 1-5 years of experience (51.8%), followed by >10 years (35.7%), with the 6-10 years group again being the least represented (12.5%). Although a significant association was found, the predominance of the 1-5 years group across all categories suggests that other factors may also contribute to vaccine hesitancy. Post-vaccination side effects were strongly associated with hesitancy. Among those with hesitancy, 61.7% reported experiencing side effects, compared to 37.9% in the "No" group and 35.7% in the "Maybe" group. Those without hesitancy were more likely to report no side effects (54.4%), compared to 26.0% in the hesitant group and 37.5% in the "Maybe" group. The "Maybe" group had the highest proportion of individuals uncertain about side effects (26.8%), compared to 12.2% in the hesitant group and 7.8% in the "No" group. The association was highly significant ($X^2 = 35.8$, $p = .001$).

Table 4. Associated Factors that Affect COVID-19 Vaccine Hesitancy (n=355)

		Do you have COVID–19 vaccine hesitancy?						X ²	P-value
		Yes		No		Maybe			
		n	%	n	%	n	%		
Working sector	Governmental	111	56.6%	36	35.0%	26	46.4%	12.8	.002*
	Private	85	43.4%	67	65.0%	30	53.6%		
Experience	1-5 years	121	61.7%	66	64.1%	29	51.8%	13.6	.009*
	6-10 years	15	7.7%	19	18.4%	7	12.5%		
	>10 years	60	30.6%	18	17.5%	20	35.7%		
Have you suffered from any side effects post-vaccination?	Yes	121	61.7%	39	37.9%	20	35.7%	35.8	.001*
	No	51	26.0%	56	54.4%	21	37.5%		
	Maybe	24	12.2%	8	7.8%	15	26.8%		

Chi-square test; *Significant at $p < 0.05$

3. 7. Association Between the Need to Miss Work After Which Dose and Type of Vaccine

Table 5 shows that Pfizer/BioNTech recipients were the most likely to report missing work, particularly after the second dose (62%), although 50% of Pfizer recipients reported no missed work. Moderna recipients most commonly missed work after the first dose (29.9%). Sputnik recipients frequently missed work after all doses (27%). Sinopharm recipients missed work most often after the first dose (5.2%) and third dose (14.3%), but a high proportion (4.7%) reported no missed work. AstraZeneca/Oxford recipients reported the lowest need to miss work, with only 12.4% missing any work. J&J/Janssen recipients also largely didn't miss work, with only small percentages missing work after the second dose (4%) or all doses (2.7%). The study concludes that vaccine type influences missed work, with Pfizer/BioNTech having the highest impact, especially after the second dose.

Table 5. Association Between Needed to Miss Work after which Dose and Type of Vaccine (n=355)

Variable		Needed to miss work after which dose?										X ²	P-value
		1 st		2 nd		3 rd		All doses		No need			
		dose		dose		dose							
		n	%	n	%	n	%	n	%	N	%		
What is the type of vaccine you received?	Moderna	23	29.9%	5	10.0%	3	14.3%	8	21.6%	24	14.1%	32.7	.036*
	Sputnik	18	23.4%	8	16.0%	6	28.6%	10	27.0%	28	16.5%		
	Sinopharm	4	5.2%	3	6.0%	3	14.3%	2	5.4%	8	4.7%		
	Pfizer/BioNTech	28	36.4%	31	62.0%	7	33.3%	14	37.8%	85	50.0%		
	AstraZeneca/Oxford	4	5.2%	1	2.0%	2	9.5%	2	5.4%	21	12.4%		
	J&J/Janssen	0	0.0%	2	4.0%	0	0.0%	1	2.7%	4	2.4%		

Chi-square test

*Significant at $p < 0.05$

4. Discussion

The burden of COVID-19 vaccines among nurses in Palestine was measured, focusing on two aspects: vaccine hesitancy and the incidence and severity of post-vaccination side effects. The results presented above shed light on the complex interplay of factors contributing to this burden. Our findings demonstrate a clear link between vaccine hesitancy and the perception of side effect severity, suggesting that concerns about adverse reactions may play a significant role in vaccine uptake. Furthermore, the observed differences in side effect profiles across vaccine types, along with the association between specific vaccines and time off work, underscore the practical impact of vaccination on healthcare personnel. The significant link between hesitancy and reported side effect severity among participants can be explained by the fact that individuals who were hesitant, had previously refused vaccination, or did not advise others to get vaccinated reported more severe side effects. This aligns with the idea that individuals with less knowledge or reliable information about vaccines may experience more fear and perceived side effects. Other studies have shown varying levels of vaccine acceptance, with one finding 63% of Palestinians willing to be vaccinated, particularly women, married individuals, and those with more knowledge about the vaccine (Maraqa et al., 2021; Zawahrah et al., 2021). Another study highlighted the role of misinformation and mistrust in vaccine hesitancy (Alalawi et al., 2024; Al-Hatamleh et al., 2022; Biswas et al., 2021). Regarding side effects, fatigue, fever, injection site pain, and headache were the most commonly reported symptoms on the first day of vaccination, with most resolving the same day. The varying percentages of reported side effects across doses may be attributed to participants perceiving them as a normal physiological response. This contrasts with a study on Birzeit University staff, where approximately one-third of participants reported no adverse effects after any dose of the Pfizer-BioNTech vaccine. The most commonly reported side effects in that study were fever, chills, headache, fatigue, pain at the injection site, muscle pain, joint pain, and some allergic reactions (Abukhalil et al., 2024). Other studies have also reported similar common side effects, with varying frequencies (Alhazmi et al., 2021; Colleran et al., 2024; Zare et al., 2022). Our study found greater vaccine hesitancy among nurses in governmental hospitals compared to those in private hospitals, potentially due to rumours, lower confidence in vaccine quality, and a lack of awareness campaigns. This finding is partially supported by some studies suggesting that vaccine acceptance varies by work sector (Alhazmi et al., 2021; Eterafi et al., 2024; Park & Ahn, 2023), although others found no such influence. We also found that less experienced nurses were more hesitant, which is consistent with other studies (Mohammed et al., 2021; Odejinmi et al., 2022). Post-vaccination side effects were strongly associated with hesitancy, aligning with other research highlighting concerns about short-term and long-term side effects as major drivers of hesitancy (Ahmed Mohamed Ibrahim et al., 2024; Azimi-nezhad et al., 2022; Odejinmi et al., 2022; Perrone et al., 2023). Nurses who didn't experience side effects were less hesitant, supporting the idea that the severity of side effects correlates with vaccine hesitancy (Aloweidi et al., 2021; Desai et al., 2023; Hoffman et al., 2022). Finally, our study showed a

significant association between missing work and the type of vaccine, with Pfizer/BioNTech recipients more likely to miss work, particularly after the second dose. While some studies have reported similar findings regarding Pfizer side effects and missed work (Abukhalil et al., 2024), others have not found a significant correlation between vaccine type and missed work due to side effects (Alguraini et al., 2024; Al-Matouq et al., 2022). AstraZeneca/Oxford recipients in our study were least likely to miss work, which aligns with some studies showing milder side effects (Darraj & Al-Mekhlafi, 2022; Eterafi et al., 2024). J&J/Janssen recipients in our study also reported low rates of missed work, which is consistent with other findings (Okpani et al., 2023).

5. Conclusion

A significant association was found between vaccine hesitancy and the perceived severity of side effects. Additionally, a correlation was observed between the number of doses received and the incidence of reported side effects. Nurses in governmental hospitals and less experienced nurses showed higher vaccine hesitancy than others. The study strongly reinforces the link between post-vaccination side effects and hesitancy. Receiving the Pfizer/BioNTech vaccine, especially the second dose, was associated with a higher likelihood of missing work due to side effects. This study is not without limitations. First, the reliance on self-reported questionnaires introduces the potential for recall bias, particularly given that the data collection occurred several years after the initial vaccination campaigns. Participants' memories of side effects may be incomplete or influenced by other factors. Second, the study's data collection period coincided with a time of restricted access to health facilities due to political circumstances and military barriers, which likely impacted the response rate and may have introduced selection bias. Finally, the study's focus on nurses working in Palestine limits the generalisability of the findings to other healthcare providers or populations in different settings. Further investigation into the long-term effectiveness of different COVID-19 vaccine types is warranted. Measuring antibody titres in vaccinated nurses could provide valuable data on vaccine efficacy over time and inform decisions regarding the need for and timing of booster doses. Additionally, research exploring vaccine hesitancy and side effects among other healthcare provider groups, both within Palestine and in other countries, would broaden our understanding of the challenges and inform targeted interventions to improve vaccine confidence and uptake.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request. The datasets generated and analysed during the current study are not publicly available due to privacy and ethical restrictions but are available from the corresponding author on reasonable request. For further enquiries or access to the data, please contact:

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Conflicts of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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