Research Paper Side Effects of COVID-19 Vaccination Among Healthcare Workers in Tehran, Iran



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Citation Yadegarynia D, Tehrani S, Hadavand F, Arshi S, Abtahian Z, Keyvanfar A, et al. Side Effects of COVID-19 Vaccination Among Healthcare Workers in Tehran, Iran. International Journal of Medical Toxicology and Forensic Medicine. 2023; 13(3):E40536. https://doi.org/10.32598/ijmtfm.v13i3.40536

doi) https://doi.org/10.32598/ijmtfm.v13i3.40536



Article info:

Received: 04 Jan 2023 First Revision: 08 Jan 2023 Accepted: 16 Jan 2023 Published: 30 Sep 2023

Keywords:

Adverse effects, COVID-19 vaccines, Iran, Safety, SARS-CoV-2

ABSTRACT

Background: Since the emergence of coronavirus disease 2019 (COVID-19), many people have been vaccinated worldwide. Despite the preventive role of vaccines, their side effects face disease management with challenges. This study aims to investigate the side effects of COVID-19 vaccination among healthcare workers in Tehran, Iran.

Methods: This cross-sectional study was conducted from April to October 2022 on 377 healthcare workers in Tehran, Iran. Data collection was carried out through an interview by a researcher using a checklist assessing systemic and local side effects of COVID-19 vaccines.

Results: The mean age of participants was 36.03 ± 10.24 years, and 68.2% were female. Participants experienced significantly more local (26.5% vs. 14.3%, P<0.001) and systemic (52.0% vs. 31.8%, P<0.001) side effects after the first dose than after the second dose. After the first dose, AstraZeneca (45.9%) caused significantly more local reactions than Sputnik V (21.7%) and Sinopharm (14.5%). AstraZeneca (83.7%) caused significantly more systemic side effects than Sputnik V (50.7%) and Sinopharm (14.5%). The prevalence of local and systemic side effects after the first dose was significantly different in terms of vaccine types (P<0.001). After the second dose, AstraZeneca (20.4%) caused significantly more local reactions than Sputnik V (12.8%) and Sinopharm (10.5%) (P<0.001). Additionally, AstraZeneca (38.8%) and Sputnik V (37.4%) caused significantly more systemic side effects than Sinopharm (10.5%) (P<0.001). Additionally, AstraZeneca (38.8%) and Sputnik V (37.4%) caused significantly more systemic side effects than Sinopharm (10.5%) (P<0.001).

Conclusion: Most healthcare workers in Tehran experienced flu-like symptoms and local reactions at the injection site after vaccination against COVID-19, mainly after the first dose. They had more side effects after vaccination with AstraZeneca and Sputnik V, compared to Sinopharm.

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1. Introduction

he coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was reported for the first time in Wuhan, China [1]. It spread rapidly worldwide, leaving many infected and expired people [2]. On January 30, 2020, the world health organization declared it as a public health emergency [3]. Therefore, several policies were considered to reduce this health threat, including social distancing, lockdown, and vaccination [4, 5]. The vaccines were designed based on different platforms, including nucleic acid (Pfizer-BioNTech), protein-based (e.g. Novavax), viral vector (AstraZeneca and Sputnik V), and inactivated virus (e.g. Sinopharm) platforms [6, 7]. Many people experienced side effects after vaccination against COVID-19, mainly included local reactions at the injection site or flu-like symptoms. However, it may rarely cause severe life-threatening consequences, such as anaphylactic shock [8, 9]. Post-vaccination side effects may delay or cause non-injection of the next dose, making COVID-19 control challenging [10, 11]. About 155 million COVID-19 vaccines were administered by November 13, 2022, in Iran (78% of the population received at least one dose, and 70% were fully vaccinated) [12].

Due to high exposure, healthcare workers are more susceptible to contracting COVID-19 than the general population. It is essential to reach the maximum vaccination coverage in this group. Therefore, they were prioritized to receive vaccines [13]. Like for the general population, the most injected vaccines for healthcare workers in Iran were AstraZeneca, Sputnik V, and Sinopharm [14]. This study aimed to investigate side effects of COVID-19 vaccines on healthcare workers in Tehran, Iran.

2. Materials and Methods

Study design and samples

This cross-sectional study was conducted in Tehran, Iran, from April to October 2022. Following criteria were used for recruiting samples: healthcare workers in Shohadaye-Tajrish, Imam Hossein, Labbafinejad, and Iranmehr hospitals affiliated to Shahid Beheshti University of Medical Sciences, age above 18 years, willing to participate in the study, and receiving the first and second doses of vaccines (AstraZeneca, Sputnik V, or Sinopharm). Using Cochran's formula and according to a study by Babaee et al. [14] who reported a prevalence of side effects after the first dose of COVID-19 vaccine as 55.6%, and considering α =5% and d=0.0556, the sample size was estimated to be 307. The sample size increased to 377 by considering a 20% sample drop. Samples were selected by cluster random sampling method. First, we considered each hospital as a cluster. Then, we obtained the list of eligible healthcare workers from each hospital. Finally, using a simple random method, the samples were selected from each hospital

Data collection instrument

Four specialists in infectious disease designed a checklist that assessed baseline characteristics of participants (age, gender, underlying diseases, profession, injected vaccine) and post-vaccination side effects including local reactions at the injection site (e.g. pain, swelling, and redness) and systemic side effects (e.g. flu-like symptoms, gastrointestinal symptoms, neurological symptoms, cardiovascular symptoms, dermatological symptoms, and anaphylaxis). The checklist was completed by a researcher in the workplace of samples through an interview.

Statistical analysis

Data were processed in SPSS software, version 23 (SPSS Inc. Chicago, IL, USA). The significant level was set at 0.05. Data were reported using frequency, percentage, Mean±SD. Post-vaccination side effects were compared between groups (based on age, gender, and vaccine types) using the chi-square test. The prevalence of side effects was compared between doses of vaccines using the McNemar test.

3. Results

Baseline characteristics of the participants

The mean age of participants (n=377) was 36.03 ± 10.24 years (ranged 18-70 years), and 68.2% were female. Most of the participants were physicians (30.2%) and nurses (33.1%). Most of them had no underlying diseases es (95.8%). In those with underlying diseases, the most prevalent underlying disease was immunocompromised condition (2.1%), followed by diabetes mellitus (1.9%), malignancy (0.5%), and asthma (0.3%). Additionally, the participants were vaccinated with Sputnik V (53.8%), AstraZeneca (27.6%), and Sinopharm (20.2%). Table 1 presents the baseline characteristics of the participants.

Post-vaccination side effects

Table 2 shows the prevalence of post-vaccination side effects based on received doses. Participants experienced significantly more local reactions at the injection

Variables	Categories	No. (%)
Age (y)	<30	133(35.3)
	30-40	113(30)
	40-50	103(27.3)
	>50	28(7.8)
Gender	Male	120(31.8)
	Female	257(68.2)
	Physician	114(30.2)
	Nurse	125(33.1)
Profession	Midwife	48(12.8)
	Medical student	67(17.8)
	Others	23(6.1)
	Diabetes mellitus	7(1.9)
	Thyroid diseases	5(1.3)
	Malignancy	2(0.5)
Lindowhing dispass	Asthma	1(0.3)
Underlying diseases	Hypertension	0(0)
	Renal diseases	0(0)
	Hepatic diseases	0(0)
	Immunocompromised condition	8(2.1)
	Sputnik V	203(53.8)
Injected vaccines	AstraZeneca	104(27.6)
	Sinopharm	76(20.2)
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Table 1. Baseline characteristics of the participants (n=377)

site (26.5% vs. 14.3%, P<0.001) and systemic side effects (52.0% vs. 31.8%, P<0.001) after the first dose compared to those after the second dose. Also, flu-like symptoms, including fever (40.1% vs. 21.0%, P<0.001), sweating (24.4% vs. 11.1%, P<0.001), chills (33.4% vs. 18.0%, P<0.001), myalgia (44.3% vs. 23.1%, P<0.001), and headache (24.7% vs. 13.0%, P<0.001) were significantly more common after the first dose than after the second dose.

Figure 1 depicts the prevalence of post-vaccination side effects based on age (>37 and <37 years). After the first dose, those aged >37 years reported more local (27.5%

vs. 25.4%, P=0.649) and systemic (54.5% vs. 49.2%, P=0.300) side effects than those aged <37 years, but the difference was not statistically significant. After the second dose, those aged >37 years also reported more local (15.0% vs. 13.6%, P=0.690) and systemic (32.0% vs. 31.6%, P=0.940) side effects than those aged <37 years, but the difference was not statistically significant.

Figure 2 illustrates the prevalence of post-vaccination side effects based on gender. After the first dose, the prevalence of local (29.2% vs. 20.8%, P=0.087) and systemic (54.1% vs. 47.5%, P=0.233) side effects was higher in females than in males, but the difference was

Side Effects		No. (%)		P
		1 st Dose	2 nd Dose	P
Local reactions		100(26.5)	54(14.3)	<0.001
Systemic side effects		196(52.0)	120(31.8)	<0.001
Flu-like symptoms	Fever	151(40.1)	79(21.0)	<0.001
	Sweating	92(24.4)	42(11.1)	<0.001
	Chills	126(33.4)	68(18.1)	<0.001
	Myalgia	167(44.3)	87(23.1)	<0.001
	Headache	93(24.7)	49(13.0)	<0.001
	Sore throat	17(4.5)	12(3.2)	0.332
	Rhinorrhea	19(5.0)	13(3.4)	0.180
Gastrointestinal symp- toms	Nausea and vomiting	15(4.0)	7(1.9)	0.077
	Diarrhea	9(2.4)	5(1.3)	0.289
	Abdominal pain	7(1.9)	4(1.1)	0.508
Cardiovascular symptoms	Palpitations	16(4.2)	11(2.9)	0.180
	Chest pain	11(2.9)	6(1.6)	0.227
	Dyspnea	12(3.2)	8(2.1)	0.344
	Limb thrombosis	0(0)	1(0.3)	>0.999
Neurological symptoms	Seizure	1(0.3)	2(0.5)	>0.999
	Visual disturbances	1(0.3)	3(0.8)	0.625
	Limb paralysis	1(0.3)	0(0)	>0.999
	Impaired consciousness	2(0.5)	3(0.8)	>0.999
	Speech impairment	1(0.3)	0(0)	>0.999
Dermatological symp- toms	Rash	4(1.1)	1(0.3)	0.375
	Urticaria	2(0.5)	1(0.3)	>0.999
	Anaphylaxis	6(1.6)	5(1.3)	>0.999

Table 2. Comparison of post-vaccination side effects between the first and second doses

Variables were compared between doses using the McNemar test.

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not statistically significant. After the second dose, the prevalence of local (16% vs. 10.8%, P=0.186) and systemic (28.3% vs. 33.5%, P=0.319) side effects were also higher in females than in males, but the difference was not statistically significant.

After the first dose, AstraZeneca (45.9%) caused more local reactions than Sputnik V (21.7%) and Sinopharm

(14.5%). Furthermore, AstraZeneca (83.7%) caused more systemic side effects than Sputnik V (50.7%) and Sinopharm (14.5%). The prevalence of local (P<0.001) and systemic (P<0.001) side effects after the first dose were significantly different between vaccines (Figure 3). After the second dose, AstraZeneca (20.4%) caused significantly more local reactions than Sputnik V (12.8%) and Sinopharm (10.5%), (P<0.001). Additionally, As-



Figure 1. Prevalence of post-vaccination side effects based on age

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traZeneca (38.8%) and Sputnik V (37.4%) caused significantly more systemic side effects than Sinopharm (7.9%), (P<0.001).

4. Discussion

In this study, we investigated the side effects of CO-VID-19 vaccines among healthcare workers in Tehran. Our results revealed that many vaccinated healthcare workers experienced local and systemic side effects, mostly after receiving the first dose. The prevalence of post-vaccination side effects were not significantly different based on age and gender. Nevertheless, there was a significant difference based on the vaccine type, where healthcare workers had side effects mostly after vaccination with Sputnik V and AstraZeneca. The immune system mediates post-vaccination side effects. After the vaccine injection, the immune cells (neutrophils or macrophages) detect vaccine components, which then cause the release of cytokines. These cytokines trigger immune responses expressed by systemic (fever, chills, sweating, headache, and myalgia) and local reactions at the injection site (pain, swelling, and redness) [15], which were reported in our study.

Consistent with our findings, a study in Jordan revealed that the first dose of vaccines had more side effects than the second dose [16]. However, other studies reported a higher



Figure 2. Prevalence of post-vaccination side effects based on gender

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Figure 3. Prevalence of post-vaccination side effects based on the vaccine type

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prevalence of post-vaccination side effects after the second dose [17, 18]. Various studies adopt different methodologies, which may lead to inconsistent results. A study by Alhazmi et al. showed that age was not associated with vaccine side effects [19], which is consistent with our findings. In contrast, some studies reported that post-vaccination side effects were more common among younger recipients [20, 21]. The literature is contradictory about the association of post-vaccination side effects with gender. Some studies reported that they were more prevalent among women [22, 23], while others reported more prevalence among men [24, 25]. Some studies indicated no association between postvaccination side effects and gender [26, 27]. These discrepancies may be attributed to the study design and vaccine types in different studies.

In our study, most side effects were experienced after vaccination with AstraZeneca, followed by Sputnik V and Sinopharm, which is in line with the literature [14, 28]. Babaee et al. reported that side effects were more prevalent after receiving Sputnik V (82.7%) and AstraZeneca (70.5%) compared to Sinopharm (37.4%) among Iranian vaccinated people [14]. Another study from Jordan illustrated that people complained of post-vaccination side effects more after Sputnik V (50.8%) than AstraZeneca (37.4%) and Sinopharm (16.0%) [28]. Overall, it seems that side effects are related to the platform on which the vaccine was developed. In this way, vector-based vaccines can leave more side effects than vaccines developed by inactive viruses [29]. In our study, 1-2% experienced anaphylaxis following CO-VID-19 vaccination, which is higher than in the previous studies [30, 31]. A study by Hwang et al. in Korea reported that post-vaccination anaphylaxis was extremely rare (5.8

per 1,000,000), most of which occurred within the first 15 minutes after the vaccination. Therefore, it is recommended to stay in the vaccination center for 15-30 minutes so that medical measures can be taken in case of anaphylaxis [31].

Our study had some limitations. The study reported post-vaccination side effects among healthcare workers who had more exposure to SARS-CoV-2. Their immune response to the virus may be different from the general population; therefore, the findings cannot be generalized to the general population in Iran. Side effects were subjectively reported, which may suffer from recall bias.

5. Conclusion

Most healthcare workers in Tehran experienced flu-like symptoms and local reactions at the injection site after vaccination against COVID-19, mainly after the first dose. They had more side effects after vaccination with AstraZeneca and Sputnik V compared to Sinopharm.

Ethical Considerations

Compliance with ethical guidelines

The procedures were in accordance with the Helsinki declaration. The study protocol was approved by the Research Ethics Committee of Shahid Beheshti University of Medical Sciences (Code: IR.SBMU.RETECH.1400.507). In this study, all participants signed the informed consent form..

Funding

This article was taken from disease registry, titled "register of Covid vaccine complications and post Covid vaccination COVID-19 episodes". The study was financially supported by Infectious Diseases and Tropical Medicine Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran (Grant No.: 30132).

Authors' contributions

Conceptualization: Davood Yadegarynia and Afshin Zarghi; Study design: Shabnam Tehrani, Fahimeh Hadavand, Shahnam Arshi, Zahra Abtahian and Afshin Zarghi; Methodology: Amir Reza Keyvanfar; Data curation: Shabnam Tehrani, Fahimeh Hadavand, Shahnam Arshi, Zahra Abtahian and Azar Darvishi; Data analysis: Amir Reza Keyvanfar; Writing original draft: Fahimeh Hadavand, Shahnam Arshi, Zahra Abtahian and Azar Darvishi; Review & editing: Davood Yadegarynia, Shabnam Tehrani and Amir Reza Keyvanfar; Supervision: Davood Yadegarynia.

Conflict of interest

The authors declared no conflict of interest.

Acknowledgements

The authors appreciate participants of the study.

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