

PAKISTAN BIOMEDICAL JOURNAL

https://www.pakistanbmj.com/journal/index.php/pbmj/index ISSN(E): 2709-2798, (P): 2709-278X Volume 8, Issue 08 (August 2025)



Original Article



Assessment of Post-COVID-19 Complications in the Pakistani Population: A Detailed Survey into Late-Onset Adverse Events through Cross-Sectional Analysis

Abo Ul Hassan Madni¹, Noor Hassan², Sajid Hameed³¹, Maryam Naeem Satti⁴, Rana Hamad Ullah⁴, Hafsa Adnan⁵, Muhammad Faisal Mushtaq⁵ and Tallat Anwar Faridi²

ARTICLE INFO

Keywords:

Covid-19 Pandemic, Vaccination, Adverse Effects, Immunity

How to Cite:

Madni, A. U. H., Hassan, N., Hameed, S., Satti, M. N., Ullah, R. H., Adnan, H., Mushtaq, M. F., & Faridi, T. A. (2025). Assessment of Post-COVID-19 Complications in the Pakistani Population: A Detailed Survey into Late-Onset Adverse Events through Cross-Sectional Analysis: Post-COVID-19 Complications in the Pakistani Population: Late-Onset Adverse Events. Pakistan BioMedical Journal, 8(8), 34-42. https://doi.org/10.54393/pbmj.v8i8.1299

*Corresponding Author:

Sajid Hameed

Department of Public Health, Green International University, Lahore, Pakistan doctorsajidhameed@gmail.com

Received Date: 18th June, 2025 Revised Date: 19th August, 2025 Acceptance Date: 25th August, 2025 Published Date: 31st August, 2025

ABSTRACT

COVID-19 was a health crisis that severely obstructed the healthcare system and public wellbeing. Although vaccination has been very instrumental in reducing mortality and morbidity due to COVID-19, concerns are still prevalent regarding its short- and long-term side effects. Objectives: To investigate the incidence and severity of the pandemic, which vary considerably across different demographic groups, especially in older age. Methods: The current descriptive exploratory study examines post-vaccination effects among various age and gender groups in Pakistan through an online survey of 220 individuals. Results: Nearly 24% of respondents have suffered from COVID-19 during the pandemic, with a high prevalence in older age. A vast majority, i.e., 92% were vaccinated for COVID-19. Results show that 47 percent of respondents have been affected by one or more kinds of post-vaccination effects. Segregating results, 28 percent faced neurological effects, 16% cardiovascular effects, 11% bleeding complications, 11% gastrointestinal effects, and 18% allergic reactions. Among female, 22% reported menstrual changes after receiving the vaccination for COVID-19. Two deaths were also reported among the respondents temporally following vaccination; however, the small number and the study design preclude any causal inference with multiple post-vaccination effects. Conclusions: Pre-existing health conditions, experiencing surgery, and growing age were significantly associated with a higher likelihood of reporting post-vaccination complications. This study plays an important part in tailoring future vaccination approaches and plans, eventually assisting Pakistan's long-term public health preparedness.

INTRODUCTION

COVID-19 became a health crisis in late 2019 in Wuhan, China, due to the spread of the SARS-CoV-2 virus. It has caused more than 770 million confirmed cases and above 7 million deaths globally [1]. In Pakistan, over 1.58 million cases were confirmed, and more than 30,000 deaths were reported due to the numerous waves of the pandemic. It

severely obstructed the healthcare system and public well-being. The morbidity rates were high, especially amongst persons who had pre-existing conditions. The epidemic likewise uncovered weaknesses in the healthcare setup, predominantly in rural and neglected populations. As a countermeasure, the Government of Pakistan executed

¹Department of Population Welfare, Government of Punjab, Jhelum, Pakistan

²Department of Chemistry, Government Graduate College, Lahore, Pakistan

³Department of Public Health, Green International University, Lahore, Pakistan

⁴Pak Red Crescent Medical and Dental College, Lahore, Pakistan

⁵Department of Biological Sciences, National University of Medical Sciences, Rawalpindi, Pakistan

⁶Government Teaching Hospital, Lahore, Pakistan

⁷University Institute of Public Health, The University of Lahore, Lahore, Pakistan

mitigation plans including lockdowns, measures for social distancing, and campaigns for mass vaccination to contain the virus's spread and lessen mortality rates. In this regard, Pakistan started its national vaccination program in early 2021, arranging a variety of vaccines that were WHOapproved. They included Sinopharm, Sinovac, AstraZeneca, Pfizer, and Moderna [2]. The execution of the vaccination campaign greatly helped in controlling the spread and severity. The existing literature highlights that the incidence and severity of the pandemic vary considerably across different demographic groups. The studies also reflect that older persons with diabetes, cardiovascular diseases, and hypertension were at high risk of morbidity and mortality [3]. Furthermore, men experienced higher mortality rates compared to women. Although vaccination has been very instrumental in reducing mortality and morbidity due to COVID-19, concerns are still prevalent regarding its short-term and long-term side effects. These effects have been reported differently for vaccine type, age, gender, and underlying health conditions. Examining these effects is critical for numerous reasons, including addressing public concerns, improving healthcare response, informing public health policies, and contributing to global research. The reported side effects' symptoms are fever, fatigue, and muscle pain, whereas in some situations, severe health effects have been reported [4, 5]. Against this backdrop, some studies highlight that females and young adults report stronger immunity compared with older persons [6, 7]. Nevertheless, vaccination has had successes in reducing morbidity and mortality, yet a research gap still exists regarding post-vaccination effects in the country. In this regard, understanding these effects is necessary for improving post-vaccination care as well as informing public policies. The current study examines post-vaccination effects among various age and gender groups in Pakistan. This study aims to investigate post-vaccination effects, future vaccination approaches, and plans, eventually assisting Pakistan's long-term public health preparedness.

METHODS

This descriptive exploratory cross-sectional study was conducted between December 2024 and February 2025. An online survey was conducted on the general population with a minimum age of 18 years and a maximum age of 65 years. The sample size was calculated using Raosoft software, with a 95% confidence level and a 50% response distribution due to the unavailability of prior data on post-vaccination effect prevalence in Pakistan. A margin of error of 6.6% was selected to achieve a feasible sample size given the exploratory nature of the study and the challenges in participant recruitment for an online survey

on this topic. This resulted in a sample size of 220, which was deemed adequate for the primary descriptive and exploratory objectives of this research. The vaccination effect was assumed to be 50% which was a standard practice in calculating sample size for an adequate sample. This makes the sample size 220 individuals. Inclusion criteria were individuals aged 18 and above and those who were willing to participate in the survey, while exclusion criteria were children lower the age of 18 and those not willing to participate. A structured questionnaire was developed through an extensive literature review and converted into Google Forms. The questionnaire was shared through various social media platforms, including WhatsApp, Facebook, Instagram, etc., and also through sharing with universities and hospitals. Snowball technique was also applied to reach out to the deaths after vaccination, and respondents' immediate family members filled out the forms on their behalf. This approach introduces the potential for proxy or recall bias, as the family members' reporting of symptoms and medical history may not be fully accurate. Although convenient sampling and an online survey may lead to selection bias and limited access to certain individuals, various platforms have been used, as mentioned above, to reach the maximum number of individuals. Moreover, the purpose of the study was to capture the response of willing individuals who were also easily accessible. However, acknowledging the limitations, future studies should be done to incorporate probability sampling for a more representative sample. Furthermore, the sample size of 220, while calculated for feasibility, may not have been large enough to reliably capture rare adverse events or to allow for robust subgroup analyses (e.g., among the elderly or individuals with specific pre-existing conditions). In particular, the regression analysis for predictors with very small subgroups (e.g., smoking, n=12) may have produced unstable estimates, as indicated by wide confidence intervals, and should be interpreted with caution. Consent was embedded in the start of the Performa, and respondents were asked to give consent before filling in the forms. The questionnaire carries important social, demographic and health-related information including gender, age, education, occupation, marital status, number of children, smoking, exposure to air pollution or road traffic, sleeping pattern, physical activity, pre-existing health conditions, undergone any surgery, previously had Covid-19, and vaccination status (though data on the specific vaccine type received, e.g., mRNA vs. adenoviral, was not collected). pre-existing health conditions, undergone any surgery, previously had Covid-19, and received a vaccination or not. To explore post-vaccination effects in the respondents' different groups, the different symptoms faced by the respondents were examined.

These broad groups were neurological effects, cardiology effects, platelet count and bleeding complications, gastrointestinal effects, allergic reactions, and menstrual changes (applicable for female only A pilot test was conducted on a sample of 20 participants to ensure the validity of the questionnaire. The validity of the questions was assessed through expert review by three public health specialists for clarity, relevance, and comprehensiveness. The internal consistency reliability of the multi-item sections of the questionnaire (e.g., symptom checklists) was assessed using Cronbach's alpha on the main study data, which yielded a value of 0.78, indicating good reliability. Data were analyzed in SPSS version 27.0 in the form of univariate, bivariate, and multivariate analyses. Bivariate analysis was performed for the purpose of examining the differentials in COVID-19 infection rate and adverse effects of vaccination by age and gender. For bivariate analysis, both the Chi-square Test and Fisher's Exact Test were applied as per requirements. For the variable of age, certain cells contain a sample size less than 5, which makes the results of the Chi-square test less reliable, so Fisher's Exact test was applied there; however, for the variable of gender, the Chi-square test is applied. For multivariate analysis, Binary Logistic Regression is applied due to the dichotomous nature of dependent variables (in Yes/No options). Seven separate regressions are run firstly by taking the combined variable of postvaccination effects, and then all six other categories of post-vaccination effects separately. All social, demographic, and health variables collected through the questionnaire were taken as independent variables in the models. A p-value of <0.05 was considered significant. Odds ratios were reported alongside their 95% confidence intervals (CIs) to indicate the precision of the estimates.

RESULTS

The demographic profile of the respondents reveals that more than 2/3rd of the respondents belonged to the 20-35 age group and were female. Regarding education and occupation, more than half of the respondents were undergraduate students. Respondents who were working in any sector are 31% and those who were not working and neither studying are 11%. The majority, i.e., 75% of the respondents, are not married, and 24% are married with an average of 2 children. Behavioral factors of the respondents were also explored, according to which very few, i.e., 6 percent of the respondents, have a habit of smoking. While smoking is very low among respondents, exposure to traffic and air pollution is very prevalent, i.e., 84%. A very high percent, i.e., 59% take less than eight hours, 36 percent take eight hours or more, and only 6 percent take more than 8 hours. Regarding staying physically active, 73 percent of the respondents are physically active. If the study explores the type of most prevalent physical activity among those who stay active, walking is most common, with 60 percent of responses.

Table 1: Demographic and Behavioral Factors of the Respondents

Variables	Categories	Frequency (%)					
Demographic Factors							
	Below 20	32 (14.5%)					
A	20-35	148 (67.3%)					
Age	36-50	26 (11.8%)					
	51-65	14 (6.4%)					
0 1	Male	77 (35.0%)					
Gender	Female	143 (65.0%)					
	Higher Secondary	25 (11.4%)					
Education	Undergraduate	127 (57.7%)					
	Postgraduate	68 (30.9%)					
	Not working	23 (10.5%)					
Occupation	Students	116 (52.7%)					
	Working	81(36.8%)					
	Single	165 (75.0%)					
Marital Status	Married	53 (24.1%)					
	Divorced	2(0.9%)					
Total	_	220 (100.0%)					
Mean Number of Children	_	2.2 Children					
Beh	avioral Factors						
Smoking	Yes	12 (5.5%)					
Sillokilig	No	208 (94.5%)					
Exposure to Air Pollution	Yes	184 (83.6%)					
or Road Traffic	No	36 (16.4%)					
	Less Than 8 Hours	129 (58.6%)					
Sleeping Pattern	8 Hours	78 (35.5%)					
	More Than 8 Hours	13 (5.9%)					
Dhysical Activity	Yes	160 (72.7%)					
Physical Activity	No	60 (27.3%)					
Total	_	220 (100.0%)					
	Walking	119 (60.4%)					
T (D)	Exercise	44 (22.3%)					
Type of Physical Activity (Multiple Response)	Cycling	3 (1.5%)					
(multiple response)	Sports	21(10.7%)					
	Others	10 (5.1%)					

Those questions that were mentioned as multiple responses throughout the paper, for which more than one response was selected by the respondents. Therefore, the percentage was calculated among the responses, not respondents, and their total was not 220.

Respondents were asked whether they had suffered from COVID-19 during the pandemic, and 24 percent had previously had COVID-19. Male and female were both equally affected by COVID; however, these results were significant. With age, the risk of getting infected with COVID-19 increases significantly (Figure 1).

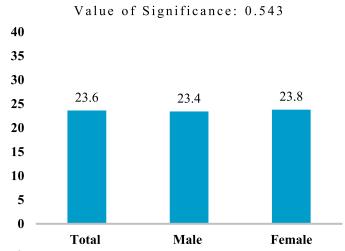


Figure 1: Percentage of Respondents Suffering from COVID-19 by Gender

Among respondents who are below 20 years old, only 13 percent suffered from COVID-19. However, among those who are between 51 and 65 years of age, 50 percent of the respondents had previously gotten infected by the pandemic(Figure 2).

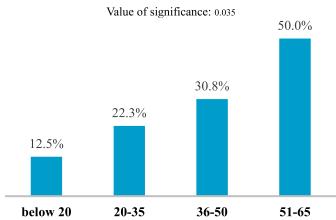


Figure 2: Percentage of Respondents Suffered from Covid-19 by Age

A large number of respondents i.e., 92 percent, have received the vaccination for Covid-19 (Figure 3).



Figure 3: Percentage of Respondents Who Received Covid-19 Vaccination

Information regarding the presence of any comorbidity and surgeries undergone was also explored from the respondents. Only 7 percent of the respondents had pre-existing conditions before Covid-19, among which the majority reported hypertension (8 responses), closely followed by Diabetes (6 responses). The

majority of them are undoing medical treatment for their disease. Similarly, only 13 percent of the respondents had undergone any kind of surgery, including C-section, appendix removal, Craniotomy, femto-LASIK surgery, toe surgery, removal of an iron rod from the leg, root canal, stenting, and ENT-related surgeries. Within different types of post-vaccination effects, the symptoms faced by the respondents were also probed. According to the results, among neurological effects, most respondents face difficulty in concentrating or focusing on tasks (12 percent), followed by memory difficulties (8 percent). It is important to interpret this data with caution due to the potential for proxy bias. Cardiology effects highlight chest pain and difficulty breathing (8 percent) as the common symptoms. Abdominal pain (7 percent) was most prevalent among gastrointestinal effects. Similarly, skin rashes or itching (9 percent) and having trouble breathing or wheezing (7 percent) were common symptoms reported in allergic reactions. In females who reported menstrual changes post vaccination, they reported changes in timings and duration of periods (15 percent), mood swings and bloating (12 percent), and more pain or irregular periods than before (8 percent). (Table 2).

Table 2: Pre-existing Diseases and Surgeries Undergone by Respondents and Type of Effects with Symptoms on the Respondents

Variables	Categories	Frequency (%)
	Demographic Factors	
Pre-existing	Yes	15 (6.8%)
Conditions Before Covid-19	No	205 (93.2%)
Vaccination	Total	220 (100.0%)
	Diabetes	6 (30.0%)
Name of Disease	High Blood Pressure (Hypertension)	8(40.0%)
(Pre-Existing Health Condition)	Cardiovascular Conditions	2(10.0%)
(Multiple	Genetic Disease	1(5.0%)
Response)	Others	3 (15.0%)
	Total	20 (100.0%)
Undergoing	Yes	13 (86.7%)
Any Medication/	No	2(13.3%)
Treatment	Total	15 (100.0%)
	Yes	29 (13.2%)
Any Surgeries/ Operations	No	191(86.8%)
	Total	220 (100.0%)
	Frequent Migraines/Severe Headaches	15 (6.6%)
	Difficulty Concentrating or Focusing on Tasks	28 (12.3%)
Neurological	Memory Difficulty	19 (8.3%)
Effects	Strange Body Sensations	17 (7.5%)
	Others	3 (1.3%)
	None	146 (64.0%)
	Total	228 (100.0%)
	Heart Problems Like A Heart Attack	6(2.7%)
	Chest Pain or Difficulty Breathing	18 (8.2%)
Cardiology	Feeling Weak or Paralyzed	13 (5.9%)
Effects	Changes in Your Blood Pressure	11 (5.0%)
	None	171 (78.1%)
	Total	219 (100.0%)

	Nose Bleeding	5(2.4%)
	Platelet Levels Checked	8 (3.9%)
	Wound Healing Delays	4 (1.9%)
PC and Bleeding Complications	More Bruises	6(2.9%)
Complications	Any Other Unusual Bleeding	3 (1.4%)
	None	181 (87.4%)
	Total	207 (100.0%)
	Persistent Nausea or Vomiting	7(3.4%)
	Abdominal Pain Related to GERD	14 (6.8%)
Gastrointestinal Effects	Others	6(2.9%)
Liteoto	None	180 (87.0%)
	Total	207 (100.0%)
	Skin Rashes or Skin Itching	19 (9.0%)
	Lips, Tongue, or Throat Swell	4 (1.9%)
	Trouble Breathing or Wheezing	14 (6.6%)
Allergic Reactions	Allergies to Meds, Food, or Vaccines	3 (1.4%)
Reactions	Others	4 (1.9%)
	None	167 (79.1%)
	Total	211 (100%)
	More Pain or Irregular	11 (7.9%)
	Mood Swings or Bloating	17(12.2%)
Menstrual	Bleeding Much Different	3(2.2%)
Changes (Only Applicable for	Period Timing or Duration Changed	21(15.1%)
Female)	Others	2 (1.4%)
	None	85 (61.2%)
	Total	139 (100.0%)

Note: All of these are Multiple Response Questions, so the total varies as per responses in each category and can be greater than 220. The percentages calculated are among the responses, not the respondents.

Respondents were asked what type of effects they experienced after receiving the vaccination. Nearly 47 percent of respondents have been affected by one or more kinds of effects after vaccination. As represented in Graph 3, 28 percent have neurological effects, 16 percent have cardiovascular effects, 11 percent have platelet count and bleeding complications, 11 percent have gastrointestinal effects, and 18 percent have allergic reactions. Among female, 22 percent reported menstrual changings after receiving vaccination of Covid-19 (Figure 4).

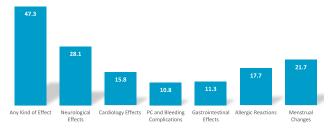


Figure 4: Percentage of Respondents Reported Post-Vaccination Effects

There were two male death reports among the respondents, and their immediate family members have filled out questionnaires on their behalf. This makes the

percent mortality rate among the respondents who have been administered vaccination 2 percent among those who have reported vaccination. One of the two previously suffered from Covid-19. Neither has any pre-existing disease nor undergone any surgery. One reported all types of post-vaccination effects, and the other reported neurological, cardiology, and allergic effects (Table 3).

Table 3: Post-Vaccination Deaths Reported among Respondents

Variables	Respondent 1	Respondent 2
Gender	Male	Male
Age	51-65	51-65
Had Covid-19	Yes	No
Vaccination	Yes	Yes
Pre-Existing Health Conditions	No	No
Undergone Surgery	No	No
Neurological Effects	Yes	Yes
Cardiology Effects	Yes	Yes
Bleeding Complications	Yes	No
Gastrointestinal Effects	Yes	No
Allergic Reactions	Yes	Yes

When a difference in post-vaccination effects was seen by gender, female reported a slightly higher number of effects due to a higher number reporting menstrual changes. While for all other types, male reported higher post-vaccination effects than female, but the results were insignificant (Table 4).

Table 4: Post-Vaccination Effects by Gender

Effects -		Male		nale	Significance	
		No	Yes	No	Significance	
Any Kind of Effect	41.9	58.1	50.4	49.6	0.154	
Specific K	ind of	Effec	ts			
Neurological Effects	29.7	70.3	27.1	72.9	0.405	
Cardiology Effects	18.9	81.1	14.0	86.0	0.230	
PC and Bleeding Complications	12.2	87.8	10.1	89.9	0.405	
Gastrointestinal Effects	12.2	87.8	10.9	89.1	0.472	
Allergic Reactions	21.6	78.4	15.5	84.5	0.182	
Menstrual Changes	NA	NA	34.1	65.9	NA	

Results show the difference in post-vaccination effects by age. Data show that older ages, that was above 36 years, were profoundly affected compared to younger age groups. Results are significant for neurological, cardiology, and gastrointestinal effects (Table 5).

Table 5: Post-Vaccination Effects by Age

Effects	Below	Below Age 20		20-35 Years		36-50 Years		Years	Significance	
Effects	Yes	No	Yes	No	Yes	No	Yes	No	Significance	
Any Kind of Effect	39.3	60.7	43.4	56.6	68.0	32.0	64.3	35.7	0.059	
	Specific Kind of Effects									
Neurological Effects	17.9	82.1	23.5	76.5	48.0	52.0	57.1	42.9	0.004	
Cardiology Effects	10.7	89.3	12.5	87.5	20.0	80.0	50.0	50.0	0.007	
PC and Bleeding Complications	7.1	92.9	10.3	89.7	12.0	88.0	21.4	78.6	0.499	
Gastrointestinal Effects	3.6	96.4	9.6	90.4	12.0	88.0	42.9	57.1	0.005	
Allergic Reactions	10.7	89.3	15.4	84.6	24.0	76.0	42.9	57.1	0.052	
Menstrual Changes	21.4	78.5	18.4	81.6	44.0	56.0	NA	NA	0.148	

Binary logistic regression is performed firstly with the variable of the combined effect of post-vaccination and then separately with all types of reported effects. Results show that for overall effects, pre-existing conditions, surgery, and marital status are significant variables. The results, presented as odds ratios (OR) with 95% confidence intervals (CI), show that for overall effects, pre-existing conditions, surgery, and marital status are significant variables. It is important to note that variables with very wide confidence intervals indicate less stable estimates, often due to small numbers in specific subgroups. Those who have experienced a surgery have 3 times more chances of post-vaccination effects than those who have not undergone any surgery. Similarly, those who have any comorbidity have 8 times more chances of suffering from post-vaccination effects as compared to those who do not have any comorbidity. This suggests an association where individuals with a pre-existing health condition or a history of surgery were more likely to report post-vaccination effects. Marital status was also significant in overall and neurological effects, with married people less likely to report these effects than single individuals. It may be due to different lifestyles, health behaviors, and stress in unmarried individuals, leading to weaker immunity. Age came out to be a significant variable in neurological, cardiology, gastrointestinal, and allergic effects. Education is a significant variable in gastrointestinal effect. Those who have previously suffered from Covid-19 are highly and significantly affected by allergic reactions, while less likely and significantly affected by menstrual changes. For menstrual effects among female, physical activity and sleeping patterns are also significant variables. Those who are involved in physical activity and those with more than 8 hours are more likely to report menstrual changes (Table 6).

Table 6: Results of Regression Analysis

Independent Variables	Any Effect	Neurological Effects	Cardiology Effects	PC and Bleeding Complications	Gastrointestinal Effects	Allergic Reactions	Menstrual Changes
Gender (Male)	0.846	1.244	1.793	1.536	1.449	2.101	-
Previously Had Covid (Yes)	1.038	1.068	1.241	1.085	0.970	3.205*	0.293*
Surgery (Yes)	3.160*	0.688	0.519	2.139	1.200	1.962	1.781
Smoking (Yes)	3.497	3.716	1.564	2.855	1.833	0.756	0.000
Exposure to Pollution (Yes)	1.257	1.427	1.012	10.172	4.036	1.291	1.864
Physical Activity (Yes)	1.229	0.773	0.751	0.941	1.367	0.736	4.099*
Pre-Existing Conditions (Yes)	8.501*	5.738*	7.049*	0.987	3.507	0.753	5.763
Age (20-35)	1.291	1.774	1.425	2.060	11.319	2.235	0.478
Age (36-50)	5.363	42.621*	5.364	26.938	16.645	4.360	1.121
Age (51-65)	2.365	31.701*	14.020*	54.726	45.76*	12.047*	0.065
Occupation (Students)	0.292	0.651	0.764	0.435	1.065	0.258	0.324
Occupation (Working)	0.628	0.900	1.149	0.301	0.544	0.646	0.845
Education (Undergraduate)	0.816	0.901	0.708	1.418	0.116*	0.339	0.716
Education (Postgraduate)	0.700	0.668	0.592	1.115	0.257	0.318	0.842
Sleep (8 hours)	0.961	0.669	0.877	1.527	1.238	0.998	0.881
Sleep (More than 8 hours)	2.085	1.190	1.836	3.968	5.103	0.509	8.404*
Marital Status (Married)	0.252*	0.084*	0.256	0.079	0.868	0.231	1.439
Marital Status (Divorced)	0.231	0.121	1.927	0.000	0.000	2.166	2.509
Model Predicted Percentage	64.0%	75.0%	86.0%	89.0%	90.0%	83.0%	74.0%

Reference Categories: Gender (Female), Previously Had Covid (No), Surgery (No), Smoking (No), Exposure to Pollution (No),

Physical Activity (No), Pre-Existing Conditions (No), Age (Below 20 years), Occupation (Not working), Education (Higher secondary),

Sleep (Less than 8 hours), Marital Status (Single). *Indicates significant values.

DISCUSSION

The respondents of the study were largely young adults, constituting around 1/3rd the population aged 20-35 years, with 65% being female and highly educated, with 58% undergraduate and 31% being postgraduate. More than half are students (53%), while 37% respondents are employed, and 11% are not working at all. Around 3/4th of respondents are single. The findings highlight a strong representation of young, educated female, mainly students. This demographic insight is critical for understanding vaccine effects and improving future efforts. Existing studies highlight that age significantly increases vulnerability to post-COVID-19 vaccination effects. The CDC reports that the death rate was 360 times higher for those aged 85 years and above when compared with young age groups [8, 9]. These findings highlight that older persons face far greater effects of COVID-19 vaccination. Similarly, the findings reflect that around one out of ten respondents had preexisting conditions before COVID-19 vaccination. The preexisting conditions included hypertension (40%) and diabetes (30%), which were the most common. Additionally, 87% were on medication, and 13% had a history of surgeries. The literature shows that individuals with hypertension, diabetes, and cardiovascular diseases face a higher risk of severe Covid-19 vaccination outcomes [10]. The findings regarding post-vaccination effects comply with existing studies, which show neurological effects have been observed but remain rare [11]. Similarly, cardiac effects cases have been reported post-mRNA vaccination, though the CDC confirms these cases are infrequent [8, 9]. The studies also show that allergic reactions following COVID-19 vaccination are rare [12]. In accordance with key findings, existing literature shows that gastrointestinal effects, including nausea, diarrhea, and abdominal discomfort, are generally reported [13]. Regarding menstrual and bleeding issues, the existing studies report menstrual irregularities and bleeding postvaccination. While observational studies suggest a likely link, no conclusive underlying connection has been recognized [14]. Two deaths were reported in the survey among males aged 51-65 years. It is critical to emphasize that this study cannot establish causality, and these reports represent temporal associations only. This complies with existing research that highlights that older persons with chronic illnesses are more at risk of adverse health outcomes post-vaccination, mainly because of a vulnerable immune system [4]. The research also reflects that prior Covid-19 infections, particularly recurrent cases, can result in immunity dysregulation, thus contributing to the possibility of inflammatory or cardiovascular complications post-vaccination [15]. Some studies suggest that persons with previous infections can also experience stronger immunity reactions, possibly adding to neurological and cardiac effects [16]. Both respondents reporting on behalf of the deceased patients highlighted neurological and cardiovascular effects, which adequately align with documented cases of post-vaccine complications [17, 18]. Moreover, one respondent suffered from mild bleeding and gastrointestinal problems, whereas the other had additional severe complications. These signs have been associated with rare vaccine-induced immune thrombotic thrombocytopenia (VITT) and inflammatory responses in persons with pre-existing conditions [19, 20]. Although rare, post-vaccination mortality has been experienced by persons with multiple comorbidities, as established by studies conducted across the world [21]. The symptoms reported by respondents, including difficulty concentrating, memory issues, and cognitive impairment, resemble post-COVID-19 vaccine-associated neuro-inflammatory responses, which have been documented in studies linking mRNA vaccines to mild cognitive disturbances [17, 18]. Moreover, research highlights that systemic inflammation caused by vaccination can lead to brief neurological effects, mostly in persons with pre-existing problems [17]. The study also reported chest pain and difficulty in breathing, which are consistent with research on post-vaccination. Studies indicate that mRNA-based COVID-19 vaccines can result in mild myocarditis, though cases are rare [18]. The study found that 7% of respondents experienced abdominal pain, which aligns with reports of post-vaccine gastrointestinal disturbances. Covid-19 vaccines, particularly adenoviral vector vaccines, have been associated with nausea, diarrhea, and abdominal discomfort due to mild systemic inflammation [18]. These signs are generally short-lived and improve without any medication. This is particularly relevant for variables like smoking and pollution exposure, where the small size of the exposed group limits the reliability of the point estimates. The findings regarding skin rashes or itching, as well as trouble breathing or wheezing, highlight results from prior research on vaccinerelated allergic responses. Some people get mild dermatological reactions, possibly because of vaccine adjuvants or immune activation [22]. Similarly, the study respondents reflected changes in period timing and duration, mood swings, bloating, and increased menstrual pain or irregularity, which is in compliance with existing research. It highlights that menstrual cycle disturbances post-vaccination are associated with transient immune activation and inflammatory responses affecting ovarian function[14]. However, a comprehensive study established that though some females undergo minor menstrual changes, this impact is provisional and does not influence

fertility [22]. To alleviate these hazards, improved prevaccination screening and post-vaccine monitoring are critical, especially for high-risk persons. Effective communication on the benefits and hazards of vaccination is essential to safeguard learnt decision-making while upholding community assurance in vaccination programs. A follow-up mechanism should be established for guiding individuals reporting adverse post-vaccination effects to reduce their risk and severity. Secondly, the inclusion of data from family members for deceased individuals, while necessary to capture these rare events, introduces the potential for proxy and recall bias, which may affect the accuracy of the reported symptoms and medical history. Thirdly, the regression analysis for some specific outcomes, particularly those with low prevalence, yielded estimates with wide confidence intervals, indicating instability and a lack of precision.

CONCLUSIONS

The present study has assessed that a significant proportion of individuals had faced any kind of adverse effects from vaccination against COVID-19. Individuals who are in their later age groups not only have a higher chance of contracting the disease but also report higher postvaccination effects. Moreover, pre-existing health conditions and a history of surgery were associated with a higher reported susceptibility to post-vaccination effects, which may be related to underlying health status.

Authors Contribution

Conceptualization: AUHM Methodology: AUHM, NH

Formal analysis: AUHM, SH, RHU, MFM, TAF Writing review and editing: MNS, HA, TAF

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

REFERENCES

- [1] World Health Organization (WHO). WHO Coronavirus (COVID-19) Dashboard [Internet]. Geneva: World Health Organization; 2024 [cited 2024 Jan 25]. Available from: https://covid19.who.int.
- Verity R, Okell LC, Dorigatti I, Winskill P, Whittaker C, Imai N et al. Estimates of the Severity of Coronavirus Disease 2019: A Model-Based Analysis. The Lancet Infectious Diseases. 2020 Jun; 20(6): 669-77. doi: 10.1016/\$1473-3099(20)30243-7.

- Peckham H, de Gruijter NM, Raine C, Radziszewska A, Ciurtin C, Wedderburn LR et al. Male Sex Identified by Global COVID-19 Meta-Analysis as A Risk Factor for Death and ITU Admission. Nature Communications. 2020 Dec; 11(1): 6317. doi: 10.1038/s41467-020-19741-
- Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S et al. Safety and Efficacy of the BNT162b2 mRNA COVID-19 Vaccine. New England Journal of Medicine. 2020 Dec; 383(27): 2603-15. doi: 10.1056/NEJMoa2034577.
- [5] Baden LR, El Sahly HM, Essink B, Kotloff K, Frey S, Novak R et al. Efficacy and Safety of the mRNA-1273 SARS-CoV-2 Vaccine. New England Journal of Medicine. 2021 Feb; 384(5): 403-16. doi: 10.1056/NEJ Moa2035389.
- [6] Gee J. First Month of COVID-19 vaccine Safety Monitoring-United States, December 14, 2020-January 13, 2021. Morbidity and Mortality Weekly Report. 2021; 70(8): 283-288. doi: 10.15585/ mmwr.mm7008e3.
- Frydrysiak-Brzozowska A, Haor B, Pluta A, Głowacka M. Population-Based Analysis of Vaccination Status and Post-Vaccination Adverse Events in Adults Aged 55 and Older. Journal of Clinical Medicine. 2025 Jun; 14(12): 4297. doi: 10.3390/jcm14124297.
- Link-Gelles R. Interim Estimates of 2024-2025 COVID-19 Vaccine Effectiveness among Adults Aged ≥ 18 years—VISION and IVY Networks, September 2024-January 2025. Morbidity and Mortality Weekly Report. 2025; 74.
- [9] Chen CY and Su TC. Benefits and Harms of Covid-19 Vaccines in Cardiovascular Disease: A Comprehensive Review. Journal of Lipid and Atherosclerosis. 2023 May; 12(2): 119. doi: 10.12997/ jla.2023.12.2.119.
- [10] Petrilli CM, Jones SA, Yang J, Rajagopalan H, O'Donnell L, Chernyak Y et al. Factors Associated with Hospitalization and Critical Illness Among 4,103 Patients with COVID-19 Disease in New York City. MedRxiv. 2020 Apr: 2020-04. doi: 10.1101/2020.04.0 8.20057794.
- [11] Patone M, Handunnetthi L, Saatci D, Pan J, Katikireddi SV, Razvi S et al. Neurological Complications After First Dose of COVID-19 Vaccines and SARS-CoV-2 Infection. Nature Medicine. 2021 Dec; 27(12): 2144-53. doi: 10.1038/s41591-021-01556-
- [12] Blumenthal KG, Robinson LB, Camargo CA, Shenoy ES, Banerji A, Landman AB et al. Acute Allergic Reactions to mRNA COVID-19 Vaccines. Journal of the American Medical Association. 2021 Apr; 325(15):

- 1562-5. doi: 10.1001/jama.2021.3976.
- [13] Menni C, Klaser K, May A, Polidori L, Capdevila J, Louca P et al. Vaccine Side-Effects and SARS-CoV-2 Infection After Vaccination in Users of the COVID Symptom Study App in the UK: A Prospective Observational Study. The Lancet Infectious Diseases. 2021 Jul; 21(7): 939-49. doi: 10.1016/S1473-3099(21)00224-3.
- [14] Male V. Menstrual Changes After Covid-19 Vaccination. British Medical Journal. 2021 Sep; 374. doi:10.1136/bmj.n2211.
- [15] Nalbandian A, Sehgal K, Gupta A, Madhavan MV, McGroder C, Stevens JS et al. Post-Acute COVID-19 Syndrome. Nature Medicine. 2021 Apr; 27(4): 601-15. doi:10.1038/s41591-021-01283-z.
- [16] Su Y, Yuan D, Chen DG, Ng RH, Wang K, Choi J et al. Multiple Early Factors Anticipate Post-Acute COVID-19 Sequelae. Cell. 2022 Mar; 185(5): 881-95.
- [17] Klein NP, Lewis N, Goddard K, Fireman B, Zerbo O, Hanson KE et al. Surveillance for Adverse Events After COVID-19 mRNA Vaccination. Journal of the American Medical Association. 2021 Oct; 326(14): 1390-9. doi:10.1001/jama.2021.15072.
- [18] Barda N, Dagan N, Ben-Shlomo Y, Kepten E, Waxman J, Ohana R et al. Safety of the BNT162b2 mRNA COVID-19 Vaccine in a Nationwide Setting. New England Journal of Medicine. 2021 Sep; 385(12): 1078-90. doi:10.1056/NEJMoa2110475.
- [19] Greinacher A, Thiele T, Warkentin TE, Weisser K, Kyrle PA, Eichinger S. Thrombotic Thrombocytopenia After ChAdOx1 nCov-19 Vaccination. New England Journal of Medicine. 2021 Jun; 384(22): 2092-101. doi: 10.1056/NEJMoa2104 840.
- [20] Loo J, Spittle DA, Newnham M. COVID-19, Immunothrombosis and Venous Thromboembolism: Biological Mechanisms. Thorax. 2021 Apr; 76(4): 412-20. doi: 10.1136/thoraxjnl-2020-216243.
- [21] World Health Organization. COVID-19 Vaccines: Safety Surveillance Manual. World Health Organization. 2020 Dec.
- [22] Edelman A, Boniface ER, Male V, Cameron ST, Benhar E, Han L et al. Association Between Menstrual Cycle Length And Covid-19 Vaccination: Global, Retrospective Cohort Study Of Prospectively Collected Data. British Medical Journal Medicine. 2022 Sep; 1(1): e000297. doi: 10.1136/bmjmed-2022-000297.