

Original Research Article

Unveiling the impact of COVID-19 on diabetics: vaccination status and infection rates in a North Indian state - insights from a primary healthcare centre-based non-communicable disease registry

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ABSTRACT

Background: Patients with diabetes are at an increased risk of severe infection and mortality due to COVID-19. Absence of effective pharmacological treatments, vaccination remains one of the most effective means of controlling the pandemic. Our study aims to investigate the prevalence of COVID-19 infection among patients with diabetes mellitus and assess the coverage of COVID-19 vaccination among these patients.

Methods: The patients were identified from a primary healthcare centre (PHC) based non-communicable disease (NCD) registry at PHC Najafgarh, New Delhi. A total of 480 patients were included in this study. The data was retrieved from NCD registry and vaccination status was confirmed from their vaccination certificates.

Results: In our study 91.3% (438) of diabetic patients had received the first dose of COVID-19 vaccine and the coverage for second dose and third dose among these same patients are 84.6% and 27.3% respectively.

Conclusions: Only a quarter of all the patients have received precautionary dose (3rd dose), and almost a tenth of all the patients have not even received a single dose of COVID-19 vaccine, the patients should be counselled and encouraged for vaccination. Also, it is recommended to take COVID-19 vaccination into consideration while taking the medical history of diabetics.

Keywords: Diabetes mellitus, COVID-19, COVID-19 vaccination

INTRODUCTION

The COVID-19 pandemic has had a substantial impact on both the global and Indian populations, as evidenced by the number of confirmed cases and deaths recorded to date. As of 27 January 2023, the pandemic has resulted in over 120 million confirmed cases and 2.6 million deaths worldwide.¹ In India, the situation has been particularly dire, with a markedly high number of cases and deaths reported. As of 31 January 2023, the country has reported over 25 million confirmed cases and more than 280,000 deaths. The healthcare system in India has been stretched to capacity, with hospitals facing shortages of beds, oxygen, and other necessary resources.²

India has been witnessing a surge in the incidence of diabetes in recent years, with the country having the highest number of individuals living with diabetes worldwide. According to the International Diabetes Federation (IDF), an estimated 77 million individuals in India were affected by diabetes in 2019.³ The projections for 2030 are even more alarming, with an expected rise in the number of individuals with diabetes to 134 million. Individuals with diabetes have a heightened risk of severe illness and complications from COVID-19 infection. Research has shown that individuals with diabetes have an elevated likelihood of contracting the virus, and if infected, are more likely to experience severe symptoms and require hospitalization.⁴ This increased risk is thought to be due to diabetes' ability to compromise the immune system,

making it more difficult for the body to combat the virus. Furthermore, diabetes is frequently associated with other underlying health conditions, such as cardiovascular disease and obesity, which can also increase the risk of severe illness from COVID-19.

Multiple studies have demonstrated that individuals with diabetes who contract COVID-19 are at an increased risk of developing severe complications such as pneumonia, acute respiratory distress syndrome (ARDS), and organ failure. Furthermore, these individuals have a higher mortality rate compared to those without diabetes.⁵ In the ongoing battle against COVID-19, vaccines have emerged as a critical tool that can help protect against severe illness, hospitalization, and death from the virus but acceptance of vaccination is also a matter of concern.⁶

In India, the rollout of COVID-19 vaccines began in January 2021 with the launch of the first phase of the country's vaccination drive. These efforts aimed to protect individuals from severe illness, hospitalization, and death caused by COVID-19 by utilizing the authorized vaccines.

The current study aims to investigate the prevalence of COVID-19 infection among individuals with diabetes in India and the vaccination coverage among this population. With India having the highest number of people living with diabetes in the world, and diabetes being a known risk factor for severe illness and complications from COVID-19, it is important to understand the impact of the pandemic on this vulnerable population. Furthermore, the study will provide valuable insights into the vaccination coverage among individuals with diabetes and help identify any gaps in coverage that need to be addressed.

METHODS

Study design, setting, and population

The patients with diabetes were identified and their data was retrieved from non-communicable disease (NCD) register, at primary healthcare centres (PHC), Najafgarh, New Delhi. The registry included all the patients with diabetes and hypertension at PHC Najafgarh. It is located in South West Delhi district of the National Capital Territory of Delhi, India. The history of COVID-19 infection and vaccination status was collected using a semi-structured questionnaire.

Sample size and method

From 28 January 2022 to 31 January 2023, there were 480 patients recruited with type 2 diabetes in the NCD registry. In this study, we included all the patients registered in the NCD register of PHC Najafgarh, New Delhi.

Study tool

This registry which is necessarily a digital database of all the NCD patients seeking care from PHC Najafgarh. This

registry was established in January 2022 to strengthen diabetes surveillance, manage patients with diabetes, and provide a support system for clinicians to make evidence-based decisions. These registry data can also be used to see the trends in the demographic and clinical characteristics as well as the outcomes of patients with diabetes over time. The NCD registry is fully electronic, using a web-based (Google sheet) system. The registry includes socio-demographic data of the patients, their contact details, diseases, and follow-up related data. Consequently, from the registry, the patients with diabetes were identified and retrieved. We used the COVID Vaccination certificate to assess their vaccination status. In our study, we used the latest vaccination record that was available with the patient.

Statistical analysis

For statistical analysis, we used STATA statistical software (v17.0). Qualitative variables were expressed as frequency and percentages, while quantitative variables were expressed as mean with standard deviation. The prevalence of COVID-19 infection was reported as a percentage with 95% confidence interval (CI). If the expected number in a cell was found to be less than five, Fisher's exact test was used. Normally distributed continuous data were presented as a mean and standard deviation. All tests were performed with an alpha error rate of 5%; thus, a value less than 0.05 (p-value 0.05) was considered statistically significant.

Ethical clearance

The study was conducted within ethical boundaries of the Declaration of Helsinki.

RESULTS

The study included 480 patients with type 2 diabetes who had complete identification information recorded in the NCD registry. The distribution of gender was 59.8% female (n=287) and 40.2% male (n=193). The average age of the participants was 54.2 years (SD=10.7), with 31.7% of the participants being in the 51-60 years age group. In regards to health behaviours, 8.3% (n=40) reported alcohol consumption, and 16.3% (n=78) reported being smokers. Additionally, 52.7% (n=253) of the participants had a diagnosis of hypertension. The median duration of diabetes was 4 years (interquartile range: 2-7).

The results of the study showed that out of the total, 80 participants 16.6% [95% CI: 13.4-20.3%] tested positive for COVID-19, while the remaining individuals reported no history of infection. Among the infected, 31.2% (n=25) [95% CI: 21.3-42.5%] required hospital admission for treatment, while the rest were managed at home. Additionally, 18.7% (n=15) [95% CI: 10.8-29%] of the COVID-19 positive cases required oxygen therapy, and 3.7% (n=3) [95% CI: 0.8-10.5%] needed ICU care.

The study found that 91.3% (n=438) of patients with type 2 diabetes received the first dose of a vaccine [95% CI: 88.3-93.6%]. The rate of receiving the second dose was 84.6% (n=406) [95% CI: 81-87.7%]. The coverage of the third dose among these patients was 27.3% (n=131) [95% CI: 23.4-31.5%]. In this study, 8.75% (n=42) of the patients were unvaccinated, and 15.4% (n=74) were not fully vaccinated (did not receive the second dose) (Figure 1). The vaccines administered to the patients included covishield (84.5%, n=370) and covaxin (15.5%, n=68).

Our study found that an equivalent number of males and females were infected with COVID-19, however, the infection rate was higher among males. The majority of those infected with the virus were in the age range of 41-60 years. Those who were overweight, with 36 individuals, had the highest infection rate. Patients without hypertension had a higher infection rate compared to those with hypertension. Alcohol consumption and smoking were also identified as risk factors for infection, with the infection rate being higher among alcoholics and smokers. The results of our study indicate that there was no statistically significant association between COVID-19 infection and gender, age, and body mass index (BMI). However, a statistically significant association was observed between infection and tobacco intake and hypertension ($p < 0.05$) (Table 1).

Table 1: Association between infection with COVID 19 and the patient's characteristics.

Variable	History of COVID 19 infection, n (%)		P value
	Yes (n=80)	No (n=400)	
Gender			
Male	40 (20.7)	153 (79.3)	0.05
Female	40 (13.9)	247 (86.1)	
Age category (years)			
Less than 40	5 (9.3)	49 (90.7)	0.36
41-50	26 (18.2)	117 (81.8)	
51-60	29 (19.1)	123 (80.9)	
More than 60	20 (15.3)	111 (84.7)	
BMI			
Underweight	3 (30)	7 (70)	0.43
Normal weight	30 (15.9)	159 (84.1)	
Over weight	36 (18.5)	159 (81.5)	
Obese	11 (12.8)	75 (87.2)	
Hypertension			
Yes	32 (12.6)	221 (87.4)	0.01*
No	48 (21.2)	179 (78.8)	
Alcohol			
Yes	9 (22.5)	31 (77.5)	0.30
No	71 (16.1)	369 (83.9)	
Tobacco			
Yes	24 (30.8)	54 (69.2)	0.01*
No	56 (13.9)	346 (86.1)	

Chi square test

Our study found that a higher proportion of male patients (94.8%) received COVID-19 vaccination compared to female patients (88.9%), with a statistically significant difference ($p < 0.05$). Despite this discrepancy, the vaccination coverage was relatively consistent across all age groups, with the highest coverage observed in individuals under the age of 40 ($p > 0.05$). Additionally, a higher proportion of non-hypertensive patients were vaccinated compared to hypertensive patients ($p > 0.05$), however, current alcohol and tobacco use did not show any significant association with vaccination status. Our results indicate that a similar proportion of patients with and without previous COVID-19 infection received the COVID-19 vaccine (Table 2).

Table 2: Association between vaccination status and patient characteristics.

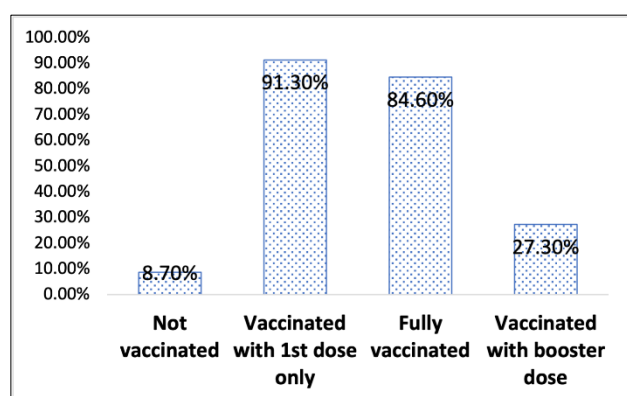
Characteristics	Vaccination status (1 st dose only), n (%)		P value
	Yes (n=438)	No (n=42)	
Gender			
Male	183 (94.8)	10 (5.2)	0.02*
Female	255 (88.9)	32 (11.2)	
Age (years)			
Less than 40	50 (92.6)	4 (7.4)	0.77
41-50	128 (89.5)	15 (10.5)	
51-60	141 (92.8)	11 (7.2)	
More than 60	119 (90.8)	12 (9.2)	
Hypertension			
Yes	227 (89.7)	26 (10.3)	0.21
No	211 (92.9)	16 (7.1)	
Current alcohol consumption			
Yes	38 (8.7)	400 (91.3)	0.38
No	2 (4.8)	40 (94.2)	
Current tobacco user			
Yes	71 (16.2)	367 (83.8)	0.93
No	7 (16.7)	35 (83.3)	
History of the previous infection with COVID 19			
Yes	73 (91.3)	7 (8.7)	1.0
No	365 (91.3)	35 (8.7)	

The impact of socio-demographic characteristics on full vaccination status among patients with type 2 diabetes mellitus was evaluated using univariate and multivariate logistic regression. In univariate regression, those variables with a p value of less than 0.2 were included in the multivariate regression analysis. The results showed that the female sex had a lower likelihood of full vaccination, with an adjusted odds ratio of 0.55 (95% confidence interval=0.30-0.99). Age groups of 51-60 years and older than 60 years had higher odds of full vaccination compared to individuals under the age of 40, although this was not statistically significant. The results also showed that hypertension, tobacco use, and previous COVID-19 infection has lower odds of full vaccination status, though these relationships were not statistically significant (Table 3).

Table 3: Logistic regression for factors associated with full vaccination status of the patients.

Variable	Full vaccination status (completed two doses), n (%)		Adjusted odds ratio (95% CI)	P value
	Yes (n=406)	No (n=74)		
Gender				
Male	171 (88.6)	22 (11.4)	Ref	0.04*
Female	235 (81.9)	52 (18.1)	0.55 (0.30-0.99)	
Age (years)				
Less than 40	46 (85.2)	8 (14.8)	Ref	0.28
41-50	114 (79.7)	29 (20.3)	0.77 (0.32-1.85)	
51-60	131 (86.2)	21 (13.8)	1.36 (0.53-3.46)	
More than 60	115 (87.8)	16 (12.2)	1.42 (0.53-3.75)	
Hypertension status				
Hypertensive	211 (83.4)	42 (16.6)	0.68 (0.39-1.18)	0.44
Non-hypertensive	195 (85.9)	32 (14.1)	Ref	
Current alcohol consumption				
Yes	35 (87.5)	5 (12.5)	1.52 (0.49-4.75)	0.58
No	371 (84.3)	69 (15.7)	Ref	
Current tobacco consumption				
Yes	65 (83.3)	13 (16.7)	0.59 (0.26-1.33)	0.74
No	341 (84.8)	61 (15.2)	Ref	
History of previous infection with COVID 19				
Yes	67 (83.7)	13 (16.3)	0.88 (0.44-1.77)	0.82
No	339 (84.7)	61 (15.3)	Ref	

Chi square test.

**Figure 1: The rate of vaccination among patients with type 2 diabetes as of 31 January 2023.**

DISCUSSION

It has been clearly documented that one can still be infected with COVID-19 even after receiving COVID vaccination. This is true for the diabetic population as well but we have enough scientific evidence to comment that vaccination can significantly bring down the risk of severity of illness, hospital admission, and mortality.

The current study aims to investigate the prevalence of COVID-19 infection among individuals with diabetes in India and the vaccination coverage among this population. This is one of the very few studies focussing on the vaccination status and prevalence of COVID-19 infection in diabetics.

Our study found that 16.6% of the participants tested positive for COVID-19, which is higher when compared to 7.5% in a study conducted by Nachimuthu et al but around equal to 17.1% in the study by Tourkamani et al whereas 11% and 8% prevalence of diabetes in patients with COVID-19 in studies by Singh et al and Yang et al respectively.⁷⁻¹⁰

In India, 70% of the total population is fully vaccinated and almost 16% of the total population has also received the 3rd precautionary dose.² Our study found that 91.3% of subjects received at least one dose, which is far much higher than the 21.5% found in the study by Nachimuthu et al in 2021 and 25.2% in Chinese patients in the study by Duan et al in 2022, but nearly equal to 84.8% found in study by Tourkamani et al Saudi Arabia in 2022.^{7,8,11} This finding clearly indicates the efficacy and increased coverage of vaccination drives over the last one year all over India and the similarity in the vaccination coverage in India and across the globe.

Almost 85% of diabetic patients in our study are fully vaccinated with 2 doses and a quarter of them even have received an additional 3rd dose as well which is more than the general population. Globally, 65% population has received 2 doses of the COVID vaccine, whereas, among the diabetic population, Tourkamani et al from Saudi Arabia reported that 55% of them were fully vaccinated with 2 doses of vaccination.^{8,12} It is lower than the general global population and our study as well. This difference could be attributed to the difference in vaccination strategy and the inclusion of a third booster dose in the COVID-19

vaccination regimen in India, unlike Saudi Arabia where the regimen consisted of two doses only. In our study, 84.5% of the diabetes patients were vaccinated with covishield as compared to the 61% of the study by Nachimuthu et al. Remaining were vaccinated with covaxin in both studies.⁷

The COVID-19 pandemic has derailed many aspects of daily life, including getting to a healthcare facility, timely medicines, and regular blood sugar investigations. All these can lead to poor management and sometimes fatal outcome for diabetic patients.

Strengths and limitations

The strengths of the study include- being one of the very few studies investigating COVID-19 infection rates and vaccination status in patients with diabetes. The patient's data was obtained from the NCD register, a reliable governmental data source.

Limitations of the study include data from one NCD clinic, thus the findings could not be generalized. It was a cross-sectional study and thus the findings are subject to change with time and the findings might not be comparable with the published literature.

CONCLUSION

In conclusion, while it is possible for someone with diabetes to still get infected with COVID-19 after being vaccinated, the vaccine can significantly reduce the risk of severe illness, hospitalization, and death. People with diabetes should continue to take precautions, monitor their condition, and follow the recommendations of their healthcare providers to stay protected during the pandemic.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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