

Clinical outcome of hospitalized COVID-19 patients in relation to COVID-vaccination status

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ABSTRACT

Background: Corona virus disease 2019 (COVID-19) pandemic had placed an enormous burden on health systems worldwide, with severe disease and mortality disproportionately affecting unvaccinated individuals and those with underlying comorbidities. Vaccination remains the most effective strategy to prevent severe outcomes, yet evidence from South Asian settings remains limited. This study examined the clinical outcomes of hospitalized COVID-19 patients in Bangladesh in relation to their COVID-vaccination status.

Methods: This hospital-based retrospective cross-sectional study was conducted at the dedicated COVID-19 ward under the Department of Internal Medicine in Bangladesh Medical University, Dhaka, Bangladesh during August 2021 to September 2021. A total of 492 adult patients were included consecutively irrespective of age and sex, diagnosed with COVID-19 based on clinical history, radiological findings and reverse-transcriptase polymerase chain reaction (RT-PCR) testing, who were treated under National Guidelines on Clinical Management of Coronavirus Disease 2019, were retrospectively enrolled in this study. The collected data were methodologically organized for computer entry and analysis. The data were analyzed using Statistical Package for Social Sciences (SPSS) version 29.0 (SPSS Inc., Chicago, IL, USA). Vaccination status was classified as unvaccinated (not a single dose received), partially vaccinated (received first dose only) and vaccinated (received at least two doses) of COVID-19 vaccine.

Results: Total patients were 492, with mean age of 51.8 ± 17.4 years; 40.9% were aged ≥ 60 years and 66.9% had at least one comorbidity, most commonly diabetes mellitus (43.3%) and hypertension (37.6%). Among the study participants, only 16.9% were fully vaccinated followed by 5.5% partially vaccinated and 60.7% remained unvaccinated. Severe illness occurred in 75.6% of patients, disproportionately affecting the unvaccinated (83.1% vs. 16.9% in vaccinated; $p < 0.001$). Overall mortality was 17.1%, with vaccinated patients experiencing significantly lower mortality (6.0% vs. 94.0%; $p < 0.001$). Vaccination reduced the odds of severe illness by 68% (OR 0.317, 95% CI: 0.201–0.500) and mortality by 82% (OR 0.183, 95% CI: 0.072–0.463). Intensive care unit (ICU) transfer was also less frequent among vaccinated patients (OR 0.342, 95% CI: 0.119–0.979). Length of hospital stay was slightly shorter among vaccinated patients (11.6 vs. 12.8 days), though it was not statistically significant.

Conclusion: Vaccination was protective against severe COVID-19 outcomes, including ICU transfer and death.

Key words: COVID-19, vaccination, hospitalization, Bangladesh, clinical outcomes, mortality, comorbidities.

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) has resulted in unprecedented global morbidity and mortality since its emergence in late 2019, placing immense pressure on health systems worldwide. The development and deployment of safe and effective vaccines significantly altered the trajectory of the pandemic, offering strong protection against severe outcomes, including hospitalization and death.¹ Clinical evidence from multiple regions has confirmed that vaccination reduces the risk of severe illness, even in the presence of comorbidities and advanced age.^{2,3} Although vaccine-induced immunity against infection has been shown to wane over time, protection against hospitalization and death has remained comparatively robust, especially with timely booster doses.^{4,5} Studies from the United States and Europe demonstrated that both homologous and heterologous booster regimens further decreased the risk of intensive care admission and mortality, with effectiveness being most pronounced in individuals who had received their most recent dose within the preceding months.^{6,7}

The emergence of variants such as Delta and Omicron has posed new challenges. Delta was associated with higher disease severity, while Omicron demonstrated greater transmissibility and immune evasion but somewhat reduced intrinsic severity.⁸ Nevertheless, the sheer scale of Omicron transmission led to large numbers of hospitalizations, particularly among unvaccinated individuals and those with incomplete vaccination.⁹ In this context, updated bivalent vaccines targeting Omicron sublineages have shown improved protection against severe disease and hospitalization.¹⁰ Importantly, observational studies of hospitalized cohorts have revealed differences in demographic and clinical characteristics between vaccinated and unvaccinated patients. Vaccinated individuals who require hospitalization are often older and have more comorbidities, whereas unvaccinated patients are disproportionately represented among severe cases requiring intensive care or mechanical ventilation.^{11,12} This underscores the importance of examining not only population-level vaccine effectiveness but also clinical trajectories among hospitalized patients in relation to their vaccination status.

Understanding these outcomes is crucial for guiding vaccination strategies, refining booster recommendations and informing hospital preparedness policies.

Against this backdrop, the present study investigates the clinical outcomes of hospitalized COVID-19 patients in relation to vaccination status, with a focus on disease severity, need for advanced respiratory support, length of stay and in-hospital mortality.

METHODS

This hospital-based retrospective cross-sectional study was conducted at the dedicated COVID-19 ward under the Department of Internal Medicine in Bangladesh Medical University, Dhaka, Bangladesh during August 2021 to September 2021. A total of 492 adult patients were consecutively enrolled, irrespective of age and sex, diagnosed with COVID-19 based on clinical history, radiological findings and RT-PCR testing, who were treated under National Guidelines on Clinical Management of Coronavirus Disease 2019, version 7.0, 28 May 2020 provided by the Disease Control Division, Directorate General of Health Services, Ministry of Health & Family Welfare, Government of the People's Republic of Bangladesh and World Health Organization (WHO), were retrospectively enrolled in this study. Demographic and clinical data were collected using a case record form (CRF) from the medical records and case history of the patients. The collected data were methodologically organized for computer entry and analysis. The data were analyzed using Statistical Package for Social Sciences (SPSS) version 29.0 (SPSS Inc., Chicago, IL, USA). Vaccination status was classified as unvaccinated (not a single dose received), partially vaccinated (received first dose only) and vaccinated (received at least two doses) of COVID-19 vaccine. Clinical outcomes were categorized as cured, transferred to ICU or death. Chi-square tests were performed to assess the association between clinical outcomes and vaccinated vs unvaccinated patient category (subgroup analysis). Binary logistic regression analysis was applied to compare the clinical outcomes (severe illness, ICU transfer, mortality, severe illness with comorbidity) with vaccinated (any dose) and unvaccinated (never taken COVID-19 vaccine), where $p < 0.05$ considered as the level of significance with 95% confidence interval (CI). Formal permission was taken from the Chairman of the Department of Internal Medicine and the protocol of this study was approved by the

Institutional Review Board (IRB) of Bangladesh Medical University, Shahbag, Dhaka, Bangladesh (IRB Registration No.966).

RESULTS

A total of 492 hospitalized COVID-19 patients were enrolled in this study. The mean age of the patients was 51.8 ± 17.4 years. Patients aged ≤ 60 years (201, 40.9%) formed the largest group of hospitalized patients. The sex distribution was nearly equal, with 232 males (47.2%) and 260 females (52.8%). A majority, 329 (66.9%) patients, had at least one co-morbidity and diabetes mellitus was most frequent, present in 213 (43.3%) patients, followed by hypertension in 185 (37.6%) (Table I). Regarding the distribution of the study patients by vaccination status, only 83 (16.9%) patients were fully vaccinated with at least two doses (1st and 2nd dose) and 27 (5.5%) patients were partially vaccinated with a single dose (1st dose only). In contrast, 299 patients (60.7%), the majority of the patients had not received any vaccine.

Severe illness occurred in 372 patients (75.6%). Among them, 63 (16.9%) were vaccinated, whereas 309 (83.1%) were unvaccinated which was statistically significant ($p < 0.001$). Age distribution of severe ill cases showed an increasing trend: 93 of 143 patients aged 18–39 (65.0%) developed severe illness, compared to 110 of 148 patients aged 40–59 (74.3%) and 169 of 201 patients aged ≥ 60 (84.1%) which was statistically significant ($p < 0.001$). Among the study patients, 84 (17.1%) cases died. Among them, 5 deaths (6.0%) occurred in vaccinated patients and 79 deaths (94.0%) in unvaccinated patients which was statistically significant ($p < 0.001$). Mortality also increased with age: 11 of 143 patients aged 18–39 (7.7%) died, compared to 19 of 148 patients aged 40–59 (12.8%) and 54 of 201 patients aged ≥ 60 (26.9%) which was statistically significant ($p < 0.001$). However, among the study cases, ICU transfer was needed in 42 patients. Among these, only 4 patients (9.5%) were vaccinated, while 38 (90.5%) were unvaccinated ($p = 0.037$). The mean length of hospital stay was 11.57 ± 6.90 days for vaccinated patients and 12.82 ± 8.17 days for unvaccinated patients. Although vaccinated patients stayed on average 1.25 days less, the difference was not statistically significant (Table II).

Comparative analysis of vaccination and outcomes (Table III) shows vaccination was significantly protective

against severe illness, with vaccinated patients having nearly 70% lower odds compared to unvaccinated patients (OR 0.317, 95% CI: 0.201–0.500, $p < 0.001$). Similarly, vaccination was associated with an 82% reduction in mortality risk (OR 0.183, 95% CI: 0.072–0.463, $p < 0.001$). For ICU transfer, vaccinated patients had significantly reduced odds compared to unvaccinated patients (OR 0.342, 95% CI: 0.119–0.979, $p = 0.037$). However, among patients with co-morbidities, vaccination did not fully eliminate the risk of severe illness. In fact, the odds of severe disease remained higher among those with co-morbidities (OR 1.71, 95% CI: 1.12–2.62, $p = 0.012$) (Table III).

Table I. Baseline characteristics of hospitalized COVID-19 Patients (N=492)

Age group (years)	n (%)
18-39	143(29.1)
40-59	148(30.1)
≥ 60	201(40.9)
Age(Mean\pmSD)	51.84 \pm 17.43
Sex	-
Male	232(47.2)
Female	260(52.8)
Co-morbidity	-
Yes	329(66.9)
No	163(33.1)
Distribution of co-morbidities	-
Diabetes Mellitus	213(43.3)
Hypertension	185(37.6)
Ischemic Heart Disease	68(13.8)
Chronic Kidney Disease	41(8.3)
Malignancy	20(4.1)
Asthma/COPD	35(7.1)
Obesity	1(0.2)
Others	59(12)
Multi-comorbidities	158(31.4)

Table II. Clinical outcomes of hospitalized COVID-19 patients in relation to vaccination (N = 492)

Outcomes	Subgroup	n (%)	p-value
Severe Illness	Total	372 (75.6%)	<0.001
	- Vaccinated	63 (16.9%)	
	- Non-vaccinated	309 (83.1%)	
Severity by Age Group(years)	18–39	93 (65.0%)	<0.001
	- 40–59	110 (74.3%)	
	- ≥60 years	169 (84.1%)	
Mortality	Total Deaths	84 (17.1%)	<0.001
	- Vaccinated	5 (6.0%)	
	- Non-vaccinated	79 (94.0%)	
Mortality by Age Group	18–39 years	11 (7.7%)	<0.001
	- 40–59 years	19 (12.8%)	
	- ≥60 years	54 (26.9%)	
ICU Transfer	Vaccinated	4 (9.5%)	0.037
	- Non-vaccinated	38 (90.5%)	
Length of Stay (days)	Vaccinated	11.57 ± 6.90	-
	- Non-vaccinated	12.82 ± 8.17	

Chi-square tests were performed to assess the association between vaccinated vs unvaccinated patient category (subgroup) and clinical outcomes, where $p < 0.05$ considered as the level of significance with 95% CI.

Table III. Comparison of clinical outcomes of hospitalized COVID-19 patients in relation to vaccination (N = 492)

Comparison	Odds Ratio (OR)	95% CI	p-value
Severe illness (Vaccinated group vs Unvaccinated group)	0.317	(0.201–0.500)	<0.001
Mortality (Vaccinated group vs Unvaccinated group)	0.183	(0.072–0.463)	<0.001
Severe illness with Comorbidity (Vaccinated group vs Unvaccinated group)	1.71	(1.12–2.62)	0.012
ICU Transfer (Vaccinated group vs Unvaccinated group)	0.342	(0.119–0.979)	0.037

Binary logistic regression analysis were performed with 95%CI where $p < 0.05$ considered as the level of significance.

DISCUSSION

This study examined the clinical outcomes of hospitalized COVID-19 patients in relation to vaccination status in Bangladesh. Our findings showed that vaccination was strongly protective against severe illness, ICU transfer and death, even though the majority of hospitalized patients were unvaccinated. These results highlight both the life-saving role of vaccines and the challenges of low vaccination coverage during the study period.

Among the 492 patients, older age and comorbidities were the most important determinants of poor outcomes,

consistent with global evidence. More than two-thirds of patients had at least one chronic condition and those with diabetes or hypertension were disproportionately represented. While vaccination substantially reduced the odds of severe illness (OR 0.317) and mortality (OR 0.183), patients with multiple comorbidities remained at higher risk of adverse outcomes. This suggests that while vaccines reduce baseline vulnerability, they do not fully offset the risks imposed by chronic disease, particularly in elderly patients. Our results align with evidence from South Asia. In India, a multicenter study

reported that vaccinated patients had significantly lower rates of ICU admission and mortality compared to unvaccinated individuals, despite a high prevalence of comorbidities in the hospitalized cohort.¹³ A study from Pakistan similarly demonstrated that unvaccinated patients accounted for the majority of deaths and critical cases, echoing our findings.¹⁴ In Nepal, partially and fully vaccinated patients were found to have shorter hospital stays and lower oxygen requirements, further reinforcing the protective effect of vaccination.¹⁵ Together, these South Asian data underscore the critical importance of expanding vaccine coverage in the region, where comorbidities such as diabetes and cardiovascular disease are highly prevalent. Comparisons with European cohorts also demonstrate concordance. Studies from the United Kingdom and Italy reported that vaccinated individuals who were hospitalized tended to be older and sicker but had markedly lower mortality and ICU transfer rates than unvaccinated patients.^{16,17} Similarly, data from Spain confirmed that vaccination halved the risk of severe outcomes, even during waves dominated by highly transmissible variants.¹⁸ These parallels suggest that, across diverse health systems, the benefits of vaccination are consistent and durable. Evidence from African countries showed similar protective trends, though vaccine uptake was limited in many regions during the early phases of rollout. A South African study found that vaccinated individuals had a substantially lower risk of hospitalization and death, despite the predominance of the Delta and Omicron variants.¹⁹ In Ethiopia, researchers reported that unvaccinated patients made up the majority of severe cases, mirroring our findings.²⁰ These results suggest that vaccines confer strong protection even in settings with resource-constrained healthcare systems. Importantly, the relatively small proportion of vaccinated patients in our study reflects the slow rollout and inequitable distribution of vaccines in Bangladesh at the time of data collection. Despite these limitations, the significant reduction in severe outcomes among vaccinated individuals highlights the urgency of improving vaccine coverage, particularly among high-risk groups such as the elderly and those with chronic diseases. However, our findings contribute to the growing body of evidence demonstrating that COVID-19 vaccination is effective in reducing hospitalization severity and mortality of

COVID-19 disease. The persistence of severe illness among vaccinated patients with comorbidities highlights the need for booster programs, targeted clinical monitoring, and integrated management of chronic diseases. Expanding vaccine coverage and prioritizing vulnerable groups remain essential strategies for reducing the clinical burden of COVID-19 in Bangladesh.

This study had some limitations. As it was a single-center retrospective analysis, the findings may not be generalizable to the wider Bangladeshi population. The relatively small proportion of vaccinated patients limits the power of subgroup comparisons and the data of this study were collected from hospital records, which may have led to incomplete documentation of clinical variables of this study. Additionally, we did not assess the impact of different vaccine types, variants or booster doses, which could influence outcomes of COVID-19 disease.

Vaccination was strongly protective against severe COVID-19 outcomes, including ICU transfer and death, even in the presence of comorbidities. However, the majority of hospitalized patients were unvaccinated, underscoring the urgent need to expand vaccine coverage in Bangladesh. Prioritizing elderly individuals and patients with chronic conditions is crucial for reducing hospital burden and saving lives.

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