Original Research Article

Comparison of Coronavirus Disease Severity Using National Early Warning Score in Vaccinated versus Unvaccinated Patients Against COVID-19 Presenting to the Emergency Department

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Abstract: *Coronavirus disease severity varies widely at presentation, and early risk stratification in emergency settings is essential for timely management. The National Early Warning Score is a validated tool for assessing clinical deterioration.* **Objective:** *To determine coronavirus disease severity using the National Early Warning Score and to compare disease severity between vaccinated and unvaccinated patients presenting to the emergency department.* **Methods:** *This descriptive cross-sectional study was conducted at the Emergency Department of Shifa International Hospital, Islamabad. A total of 95 laboratory-confirmed patients with coronavirus disease presenting to the emergency department were enrolled. Patients were categorised into two groups: fully vaccinated against coronavirus disease and unvaccinated. Vaccination status was verified through patient or family confirmation using the NADRA coronavirus disease vaccination certificate. National Early Warning Score values and demographic and clinical variables were recorded. Data were analysed using SPSS, and comparisons between groups were performed, with p-values of 0.05 or less considered statistically significant.* **Results:** *The mean age of the participants was 60.78 ± 16.97 years, with 54 patients aged between 50 and 75 years. Males comprised 57.9 percent of the study population. The overall mean National Early Warning Score was 4.55 ± 3.04. Low, moderate, and high risk scores were observed in 49.5 percent, 27.4 percent, and 23.2 percent of patients, respectively. Vaccinated individuals constituted 73.7 percent of the cohort. The mean National Early Warning Score was significantly lower in vaccinated patients compared to unvaccinated patients (3.53 ± 2.62 vs 7.40 ± 2.22, p < 0.0001). High risk scores were observed in 64 percent of unvaccinated patients compared to 8.6 percent of vaccinated patients, demonstrating a highly significant association (p < 0.0001).* **Conclusion:** *Unvaccinated patients presenting with coronavirus disease have a significantly higher risk of severe illness compared to vaccinated patients. Vaccination is strongly associated with reduced disease severity as assessed by the National Early Warning Score.*

Keywords: COVID-19; Coronavirus Infections; Emergency Service, Hospital; National Early Warning Score; Severity of Illness Index; Vaccination

Introduction

COVID-19 (Coronavirus disease of 2019) pandemic continues to cause havoc worldwide, resulting in significant morbidity and mortality (1). Until November 2024, more than 776.8 million confirmed cases of COVID-19 and over 7 million deaths had been reported across 234 countries worldwide (2). In Pakistan, the total number of confirmed cases reached 1,581,936, with 30,664 reported deaths by April 2024 (3). The introduction of vaccination against SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2) was a major milestone in altering the global course of the COVID-19 pandemic (4).

Available data suggest that although COVID-19 is generally milder when acquired after vaccination compared to unvaccinated individuals, mortality remains substantial among hospitalized patients. Data from the International Severe Acute Respiratory and Emerging Infection According to the National Institute for Health and Care Excellence, the National Early Warning Score (NEWS) is a standardized tool used to assess routinely measured physiological parameters at the patient's bedside, with the primary objective of identifying patients at risk of clinical deterioration. The NEWS scoring system incorporates seven physiological parameters, including temperature, use of supplemental oxygen, oxygen saturation, systolic blood pressure, pulse rate, level of consciousness or new-onset confusion, and respiratory rate (6,7).

According to a United States study, as regional vaccination rates increased, fully vaccinated individuals visited emergency departments far less frequently than unvaccinated individuals. Using negative binomial regression analysis, the rate of emergency department visits and hospitalizations related to COVID-19 severity was 96% lower among individuals who had received all recommended vaccinations compared to those who were unvaccinated (multiplicative effect: 0.04, 95% CI 0.03–0.06, p < 0.001) (1). Irrespective of vaccination status, the same study also demonstrated that older individuals with significant comorbidities were at an increased risk of severe disease requiring hospital-based care (1). Despite this, breakthrough infections continue to occur in vaccinated individuals (4).

Consortium reported a mortality rate of 27.0% (400 out of 1482 patients) among hospitalized individuals in the United Kingdom more than 21 days after vaccination, which is comparable to mortality rates observed during the first wave of the pandemic in March to April 2020 (5).

This study has not previously been conducted in our population. If NEWS is used as a parameter to assess disease severity among vaccinated and unvaccinated COVID-19 patients and the findings demonstrate reduced disease severity in vaccinated individuals, the results of this study could serve as evidence supporting the benefits of COVID-19 vaccination and may help encourage higher vaccination uptake within our population.

Methodology

This descriptive cross-sectional study was conducted in the Emergency Department of Shifa International Hospital, Islamabad, over six months from 20 November 2022 to 20 May 2023. The study population comprised adult patients presenting to the emergency department with confirmed COVID-19 infection. The sample size was calculated using the World Health Organization sample size calculator, assuming a 95 percent confidence level, a 4 percent margin of error, and an anticipated response distribution of 96 percent. Based on these parameters, a total sample size of 95 participants was determined.

Participants were enrolled using a non-probability consecutive sampling technique. Eligible patients included individuals aged 18 to 95 years of either gender, including pregnant and non-pregnant females, with confirmed COVID-19 infection by polymerase chain reaction testing. Patients were included irrespective of the presence or absence of comorbid conditions and regardless of their COVID-19 vaccination status. Patients who had received only a single dose or were partially vaccinated against COVID-19 were excluded. Additionally, individuals who presented to the emergency department for unrelated medical or surgical conditions and were incidentally found to be COVID-19 positive during mandatory screening, without clinical symptoms suggestive of COVID-19, were also excluded.

Participants were categorized into two groups based on vaccination status. Group 1 comprised fully vaccinated individuals, defined as those who had received two or more doses of a COVID-19 vaccine. Group 2 included unvaccinated individuals who had not received any dose of a COVID-19 vaccine. Vaccination status was verified through confirmation by the patient or a family member using the official NADRA COVID-19 vaccination certificate.

Disease severity at presentation was assessed using the National Early Warning Score. The NEWS is a validated clinical tool that evaluates seven physiological parameters, including body temperature, oxygen saturation, systolic blood pressure, pulse rate, respiratory rate, level of consciousness or new onset confusion, and the requirement for supplemental oxygen. Each parameter is scored from 0 to 3 based on the degree of deviation from normal physiological values, with higher scores indicating greater clinical deterioration. The cumulative score is used to stratify patients into different risk categories and guide clinical decision-making.

In the emergency department where the study was conducted, NEWS was routinely documented at presentation on both the triage chart and the hospital intranet system. For this study, patients with a NEWS score of 1 to 4 were classified as low risk and categorized as having mild COVID-19 disease. Those with a NEWS score of 5 to 6 were classified as medium risk and considered to have moderate disease severity. Patients with a NEWS score of 7 or higher were classified as high risk and categorized as having severe COVID-19 disease. The NEWS and relevant demographic and clinical data of each participant were recorded for subsequent statistical analysis.

Ethical approval for the study was obtained from the Institutional Review Board and Ethical Committee of Shifa International Hospital prior to data collection. Written informed consent was obtained from all participants or their legally authorized representatives. Participant confidentiality was strictly maintained throughout the study, and all collected data were anonymized and used solely for research purposes.

NATIONAL EARLY WARNING SCORE:

Physiological Parameters	Score						
	3	2	1	0	1	2	3
Respiratory rate (per minute)	< 8		9-11	12-20		21-24	> 25
Oxygen saturations (%)	< 91	92-93	94-95	> 96			
Any supplemental oxygen?		Yes		No			
Systolic blood pressure (mmHg)	< 90	91-100	101-110	111-219			> 220
Pulse (per minute)	< 40		41-50	51-90	91-110	111-130	> 131
Consciousness				Alert			CVPU*
Temperature (°C)	< 35.0		35.1-36.0	36.1-38.0	38.1-39.0	> 39.1	

*CVPU: New confusion, Voice, Pain, Unresponsive

SPSS version 23 was used to enter and analyse the data. The chi-square test was used to compare severity scores between the vaccinated and unvaccinated group of patients using NEWS.

Results

The chi-square test was used to compare severity scores between the vaccinated and unvaccinated group of patients using NEWS.

RESULTS:

In this study, the Mean age of patients was 60.78 ± 16.97 years, with 54 (56.8%) patients aged 50-75 years. There were 24 (25.3%) young (25-50 years) and 17 (17.9%) old (>75 years). There were 55 (57.9%) males and 40 (42.1%) females. Out of 95, 44 (46.3%) were diabetics, 42 (44.2%) had hypertension, and 45 (47.4%) were smokers. The mean NEWS score of all the patients was 4.55 ± 3.04. (Table 1)

Out of 95 cases, 47 (49.5%) were at low risk, 26 (27.4%) were at moderate risk, and 22 (23.2%) were at high risk for severe COVID-19 infection. (Fig 1)

Out of 95 cases, 70 (73.7%) had vaccination against COVID-19, while 25 (26.3%) did not have vaccination against COVID-19. (Fig 2)

In patients who received a COVID-19 vaccination, the mean NEWS score was 3.53 ± 2.62, whereas in patients without a COVID-19 vaccination, the mean NEWS score was 7.40 ± 2.22. The difference was highly significant ($p<0.0001$). (Table 2)

Among vaccinated patients, 45 (64.3%) were at low risk, 19 (27.1%) at moderate risk, and 6 (8.6%) at high risk of severe COVID-19 infection. Among non-vaccinated patients, 2 (8%) were at low risk, 7 (28%) at moderate risk, and 16 (64%) at high risk of severe COVID-19 infection. The difference was also highly significant ($p<0.0001$). (Table 3)

Table 1: Demographics of patients enrolled in the study (n = 95)

Parameters	F (%), mean ± SD
Age (in years)	60.78 ± 16.97
Age 25-50 years	24 (25.3%)
Age 50-75 years	54 (56.8%)
Age >75 years	17 (17.9%)
Gender	
Male	55 (57.9%)
Female	40 (42.1%)
Diabetes	
Yes	44 (46.3%)
No	51 (53.7%)
Hypertension	

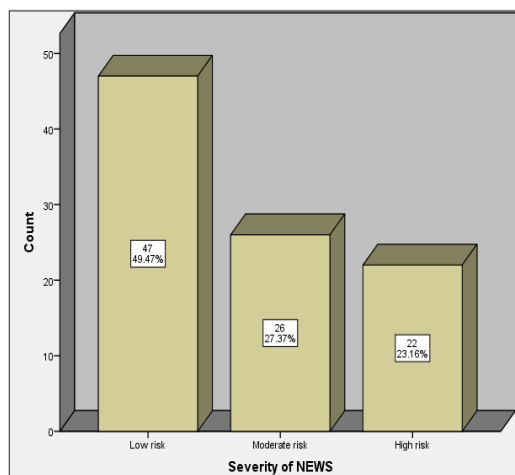|	
Yes	42 (44.2%)
No	53 (55.8%)
Smoking	
Yes	45 (47.4%)
No	50 (52.6%)
Mean NEWS score	4.55 ± 3.04

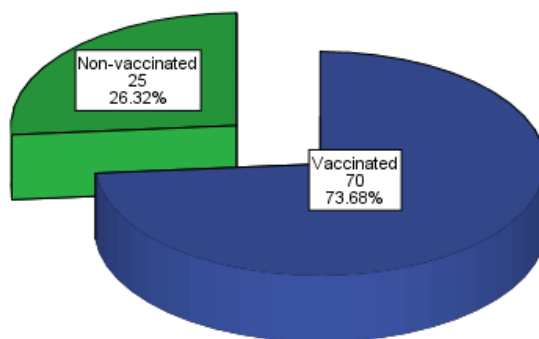**Fig. 1: Distribution of severity of disease based on NEWS score**

Fig 2: Distribution of patients according to COVID-19 vaccination status

Table 2: Comparison of mean NEWS score in patients with or without COVID-19 vaccination

	Group		p-value
	Vaccinated	Non-vaccinated	
n	70	25	<0.00001
Mean NEWS score	3.53 ± 2.62	7.40 ± 2.22	

Table 3: Comparison of severity of COVID-19 based on the NEWS scoring system in patients with and without COVID-19 vaccination

		Vaccination status		Total
		Vaccinated	Non-vaccinated	
Severity	Low risk	45	2	47
		64.3%	8.0%	49.5%
	Moderate risk	19	7	26
		27.1%	28.0%	27.4%
	High risk	6	16	22
		8.6%	64.0%	23.2%
Total		70	25	95
		100%	100%	100%

P-value <0.00001

Discussion

In response to the growing disease burden during the COVID-19 pandemic, governments and healthcare institutions implemented a range of mitigation strategies and operational modifications as the situation escalated globally. Early public health policies emphasized avoiding unnecessary hospital utilization to reduce viral transmission and ensure

adequate healthcare capacity during surges in COVID-19 cases (8). As the pandemic overwhelmed emergency departments (EDs), many hospitals were compelled to reorganize emergency care delivery systems. Simultaneously, emergency physicians faced significant challenges in keeping pace with rapidly evolving scientific evidence, with more than 2,000 COVID-19-related articles published weekly (9). Although reduced ED visits during the initial pandemic wave suggested a potential to limit low-acuity presentations, this decline also raised concerns regarding missed or delayed care, potentially increasing patient harm (10).

The National Early Warning Score (NEWS) is a clinical tool designed to rapidly and efficiently identify patients at risk of clinical deterioration or life-threatening illness in healthcare settings (11). In the present study, the mean NEWS score among all participants was 4.55 ± 3.04. Of the 95 patients included, 47 (49.5%) were classified as low risk, 26 (27.4%) as moderate risk, and 22 (23.2%) as high risk for severe COVID-19 disease. NEWS facilitates early recognition of clinical and physiological deterioration, enabling timely intervention and escalation of care (12).

Vaccination remains one of the most effective strategies to mitigate the impact of COVID-19 on healthcare systems and society. The COVID-19 vaccination campaign began in January 2021 with the goal of achieving 70–90% population coverage in the United States; however, several challenges hindered universal immunization (13). In the current study, 70 patients (73.7%) were vaccinated against COVID-19. The mean NEWS score was significantly lower among vaccinated patients (3.53 ± 2.62) than among unvaccinated patients (7.40 ± 2.22), with a highly significant difference ($p < 0.0001$). Comparable findings have been reported in other studies, in which 37% of ED patients lacked complete vaccination, and earlier studies reported vaccine hesitancy rates of 39% and 32% among emergency care populations (14–16).

Previous research has demonstrated a substantial reduction in COVID-19 infection following vaccination, with effectiveness observed as early as 12 days after the first dose. Vaccine effectiveness reached 60% (95% CI 49–68) for ChAdOx1 nCoV-19 and 69% (95% CI 66–72) for BNT162b2 at 21–44 days, increasing further to 72% (95% CI 63–79) after 45–59 days (17). An Israeli study reported that two doses of BNT162b2 significantly reduced hospitalizations, COVID-19-related mortality, symptomatic and asymptomatic infections, and overall disease severity. Vaccine effectiveness at seven days or more after the second dose was estimated at 95.3% (95% CI 94.9–95.7), with incidence rates of 91.5 per 100,000 person-days among unvaccinated individuals compared to 3.1 per 100,000 person-days in fully vaccinated individuals (18).

A Bangladesh-based study reported that the CoronaVac vaccine, produced by Sinovac Life Sciences, demonstrated 83.6% effectiveness in preventing COVID-19 after the second dose (19). Similarly, a United Kingdom study concluded that vaccination significantly reduced new COVID-19 infections, with the greatest protective effect observed after two doses, particularly against symptomatic and high-viral-load infections (20). A United States study conducted between March and May 2021 further confirmed vaccine effectiveness, reporting an 86.9% reduction (95% CI 80.4–91.2) in COVID-19 related hospitalizations among fully vaccinated adults (21).

Thus, in our study, the vaccinated group comprised 45 patients (64.3%) categorized as low risk, 19 (27.1%) as moderate risk, and 6 (8.6%) as high risk. In contrast, among unvaccinated patients, only 2 (8%) were classified as low risk, while 7 (28%) had moderate risk and 16 (64%) were at high risk for severe disease. This difference was statistically highly significant ($p < 0.0001$).

Conclusion

Hence, the risk of severe COVID-19 disease is higher in non-vaccinated patients as compared to the patients vaccinated against the coronavirus (COVID-19). Also, the NEWS score can be useful in forecasting the likelihood of developing a serious illness. Thus, in the future, we recommend that patients get vaccinated against such a deadly virus.

Counselling sessions and seminars should be held to enhance the general population's knowledge and appreciation of vaccination's benefits.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned.
Consent for publication
Approved
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Not applicable

Conflict of interest

The authors declared no conflict of interest.

Author Contribution

AI (PGR)**, ASK** (Consultant and supervisor)
Manuscript drafting, Study Design, Review of Literature, Data entry, Data analysis, and drafting an article.
AKS (Assistant Consultant)**, MA** (MO)
Conception of Study, Development of Research Methodology Design, Study Design, manuscript review, Manuscript revisions, and critical input.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the study's integrity.

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