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Assessing the Predictive Power of NEWS2 Score in Vaccinated and Non-Vaccinated COVID-19 Inpatients at Omar BONGO ONDIMBA Armed Forces Training Hospital

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ABSTRACT

Background: Since the onset of the COVID-19 pandemic, hospitalized patients have been evaluated through clinical examinations and paraclinical tests to inform initial management. The primary aim of this study was to use the NEWS2 score to assess the prognosis of vaccinated and unvaccinated COVID-19 inpatients in the medical department of HIA OBO.

Patients and Methods: This retrospective, descriptive, monocentric assessment was carried out for a period of 15 months (September 1, 2021 to January 30, 2022) with a total of 219 patients included.

Results: The most represented age group in the study was 40-64 years (43%), with a median age of 60 years. Non-vaccinated patients accounted for 90% of the study population. Comorbidities were present in 71% of patients and mainly consisted of arterial hypertension (40%), diabetes (17.8%), heart disease (8.25%), and COPD (2.7%). The most commonly observed clinical symptoms were asthenia and fever in 72.47% of patients, followed by cough in 65.13%. The NEWS2 score, which was used to assess the prognosis of COVID-19 inpatients, was high in 16% of cases, moderate in 76% of cases, and low in 1% of cases.

Conclusion: The results of our study indicate similarities in clinical forms of COVID-19 between unvaccinated and vaccinated patients. Additionally, the NEWS2 score was a valuable tool for assessing patient prognosis upon admission and optimizing therapeutic management.

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Introduction

On March 11, 2020, the WHO declared SARS-CoV-2 infection a pandemic due to its rapid spread and global acceleration of cases [1,2]. While the disease's clinical manifestations are primarily respiratory, it can also present as a systemic illness that affects multiple organ systems, leading to thrombosis, neurological, digestive, cardiac, hepatic, ocular, ear, nose, throat (ENT), and skin disorders [3].

The National Early Warning Score 2 (NEWS2) was used in our study to evaluate the clinical status of hospitalized patients, especially those who exhibited worsening health upon admission. NEWS2, which was first established in 2012 and updated in 2017, is a UK risk stratification score designed for patients with sepsis and pneumonia. The WHO and the Royal College of Physicians of London recommend using the NEWS2 score for risk stratification

in the context of COVID-19, as it enables the assessment of patient prognosis at admission. Higher NEWS2 scores indicate a greater need for rapid support. This score is based on an analysis of vital signs such as age, respiratory rate, oxygen saturation, oxygen supplementation, temperature, systolic blood pressure, heart rate, and level of consciousness [4,5].

Since the emergence of the COVID-19 pandemic, researchers worldwide have made remarkable progress in developing vaccines to combat Severe Acute Respiratory Syndrome Coronavirus de type 2 (SARS-CoV-2) and reduce related hospitalizations and fatalities [6-9]. As a result of the ongoing public health crisis, vaccines have been developed and deployed rapidly to help mitigate the pandemic [10-12].

Gabon established the National Vaccination Committee (COPIVAC) in March 2021 to develop the national vaccination plan and distribute three vaccines: Sinopharm, Sputnik V, AstraZeneca, and Pfizer-BioNTech. As of February 2022, COPIVAC reported

that 209,705 individuals (71.48%) had been vaccinated, of which 1,385 (44.72%) were men over 60, 11,734 (4.00%) had arterial hypertension, and 3,213 (1.09%) were diabetic. Health personnel represented 2.82% of those vaccinated (8,262 volunteers), while personnel from the defense and security forces represented 6.06% (17,750) of those vaccinated [13].

Against this backdrop, we conducted a single-center retrospective study to evaluate the predictive power of the National Early Warning Score 2 (NEWS2) in assessing the prognosis of COVID-19 patients admitted to the hospital, regardless of their vaccination status. Our study aimed to determine the effectiveness of NEWS2 in predicting the clinical outcomes of both vaccinated and non-vaccinated COVID-19 patients during hospitalization.

Patients and Methods

This study was a retrospective, descriptive, and monocentric analysis conducted in the Internal Medicine Department's COVID Unit at the Omar Bongo Ondimba Armed Forces Training Hospital (HIA OBO) in Libreville, Gabon. The study spanned a period of 15 months, from September 1, 2021, to January 30, 2022.

Measures and Definitions

All patients included in the study had confirmed SARS-CoV-2 infection through polymerase chain reaction (PCR) analysis performed on nasal or pharyngeal swab samples. We classified the patients into two groups: vaccinated and non-vaccinated. The NEWS2 score was used to assess the severity of the patients. The study relied on the clinical records of hospitalized patients aged 15 years and older.

We defined severe forms of COVID-19 as patients with acute respiratory distress syndrome ($SpO_2 \leq 90\%$), requiring supplemental oxygen therapy and having a NEWS2 score greater than or equal to 7 (high risk) in the vaccinated and non-vaccinated patient groups. The presence of fever, respiratory clinical signs ($SpO_2 > 90\%$), and a score between 5 and 6 (moderate risk) defined moderate forms of COVID-19. The presence of an influenza-like illness and a score between 1 and 4 (low risk) defined mild forms of COVID-19.

Data Collection and Analysis

We collected data from patient registers and hospital records, and analyzed the data using software such as Pack Office 2019 and Epi info version 7.2.2.6.

Ethical considerations

During the current COVID-19 pandemic, all inpatients provided their informed consent to participate in this study, and were fully informed of the study's purpose. To protect patient confidentiality, all data collected was kept anonymous.

Results

Sociodemographic Characteristics

We included 219 patients who were admitted to the Internal Medicine department (COVID Unit) of HIA OBO for COVID-19 management between September 1, 2021 and January 30, 2022. The most represented age group was 40-64 years, comprising 43% of the patients, while 40% were aged between 65 and 89 years. The median age of patients was 60 years with a range of 15 to 89 years. Among the patients, 45% were male (99 patients), and 55% were female (120 patients), with a sex ratio (male/female) of 0.8 in favor of women.

Comorbidities

Our study revealed that comorbidities were present in 71% of cases, with hypertension being the most common at 40%, followed by diabetes (17.8%), heart disease (8.25%), and COPD (2.7%). Many patients had multiple comorbidities, with those having two comorbidities being the most common (Table 1).

Table 1: Breakdown of Patients by Age

Age groups (years)	Number of patients	Percentage
15-39	36	16%
40-64	95	43%
65-89	88	40%
Total	219	100%

Anti-COVID-19 Vaccination

Out of the 219 patients included in the study, 197 (90%) were unvaccinated while 22 (10%) were vaccinated before admission. The Sinopharm vaccine was the most administered vaccine, accounting for 77.3% (n=17) of cases, followed by Sputnik V (9.1%, n=2), AstraZeneca (9.1%, n=2), and Pfizer-BioNTech (4.5%, n=1).

Clinical Feature

The most common functional and general signs observed in our study were the "asthenia-fever-cough" triad, with 65.13% of patients reporting cough, 93.94% reporting asthenia, and 47% reporting dyspnea. The majority of patients (81%) had a normal body temperature, while 19% (n=41) presented with hyperthermia. Among vaccinated and non-vaccinated patients, the proportion of patients with normal body temperature was similar, with 86% (n=169) of vaccinated patients and 80% (n=19) of non-vaccinated patients reporting normal body temperature (Table 2).

Table 2: Distribution of the Two Groups of Patients According To Comorbidities

Vaccination status	Comorbidities				
	0	1	2	3	4
Non-vaccinated patients	56	91	45	5	0
Vaccinated	8	10	1	2	1
Total	64	101	46	7	1

Cardiac Frequency

The majority of patients exhibited tachycardia, with 90% of cases having an average heart rate of 89 beats per minute, with a range of 55 to 125 beats per minute.

Systolic Blood Pressure

The majority of patients had normal blood pressure on admission, with 63% of cases showing a respective mean of 138 mmHg. The minimum systolic blood pressure observed was 70 mmHg, with a maximum of 200 mmHg. Of the unvaccinated patients, 22% (n=44) had normal blood pressure, while only 9% (n=2) of vaccinated patients showed the same.

Respiratory Rate

Among the 219 patients in our study, 37 or 19% of them had an oxygen saturation of 90% or less in ambient air on admission, which is considered a severe form of the disease. In 81% of the reported cases, polypnea was observed, with an average respiratory rate of 30.14 cycles per minute (Table 3).

Table 3: Distribution of Patients According to Temperature

Temperature	Non-vaccinated patients	Vaccinated patients
36-36,5	94	13
36,5-37	28	3
37-37,5	37	3
37,5-38	10	0
38-38,5	19	2
38,5-39	9	1
Total	197	22

Supplemental Oxygen Therapy

Pulse oxygen saturation in ambient air was between (85%; 95%) and the average was 89.66%. Oxygen therapy was prescribed in 17% (n=37) of patients.

Neurological Signs

The majority of cases in our study were neurologically stable. More than half of the patients or 80% admitted to the service had a Glasgow score between 8 and 12/15.

Assessment of the News2 Scoring System and Clinical Forms of Covid-19

Our evaluation of the NEWS2 scoring system and clinical forms of COVID-19 revealed a predominance of moderate forms in both vaccinated and non-vaccinated patient groups. Specifically, among unvaccinated patients, 75.6% (n=149) with moderate COVID-19 had a moderate score, 17.3% (n=34) with severe COVID-19 had a high NEWS2 score, and 7.1% (n=14) with mild COVID-19 had a low score. Among vaccinated patients, 77.3% (n=17) with moderate COVID-19 had a moderate score, 13.6% (n=3) with mild COVID-19 had a low score, and 9.1% (n=2) with severe COVID-19 had a high score (Table 4).

Table 4: Distribution of Patients According to Respiratory Rate

Respiratory rate	Non-vaccinated patients	Vaccinated patients
16-25	96	8
26-35	44	6
36-45	42	5
46-55	7	2
56-65	8	1
Total	197	22
Total	197	22

Follow-up and Outcomes

Following the initial hospital management, our study found that 78% (n=170) of patients were cured and 22% (n=49) resulted in death. The percentage of cured patients was higher in the vaccinated group, with 91% of patients cured compared to 76% in the unvaccinated group. The average length of hospital stay was 7 days (Table 5).

Table 5: Distribution of Patients According to Evolution

Vaccination status	Deceased	Non deceased
Non-vaccinated patients	47	150
Vaccinated patients	2	20
Total	49	170

Discussion

Our study population had a median age of 60 years, with a range of 15 to 89 years. This result is consistent with findings from previous studies, including those by Guan et al (median age of 47 years with a range of 35 to 58 years), Wu et al (median age of 51 years with a range of 43 to 60 years), and Zhou et al (median age of 56 years with a range of 46 to 67 years) [14-18]. However, our result may also be influenced by the younger population in Gabon, where COVID-19 has also affected children and adolescents.

The age distribution in our study population showed the highest representation in the 40-64 age group, accounting for 43% of cases, followed by the 65-89 age group, which represented 40% of cases. Our findings were consistent with those of other studies by Guan et al, Wu et al, and Zhou et al, who reported similar age groups with an age group of 46 – 67 years in 52, 38% of cases, 60 – 80 years old in 33.11% of cases and an age group of 35 – 58 years old in 58.7% of cases. This may likely due to the fact that older age is a known risk factor associated with the severity of COVID-19, as reported in the literature, making individuals over 40 more vulnerable to the disease [17-19].

The sex ratio was 0.8 in favor of women, with a female predominance observed in 55% of cases. This finding differs from those reported in studies by Guan et al, Wu et al, and Zhou et al, which found a male predominance in 58% of cases, 58% of cases with a sex ratio of 1.4, and 75% of cases with a sex ratio of 1.7, respectively [14,15,18-20]. However, the difference in sex ratios may be due to the small sample size, highlighting the need for a larger study to determine the actual sex ratio in our region.

In our study, comorbidities were observed in 71% of patients, with hypertension being the most common comorbidity at 40%, followed by diabetes (17.8%), heart disease (8.25%), and COPD (2.7%). Similar studies have reported these same comorbidities, ranging from 46.26% according to Wu et al, 65.55% according to Grasselli et al, and 49.29% according to Xie et al [14,15,20,21]. The comorbidities observed in our study could be considered as risk factors for the severity of COVID-19 disease [17-19].

The functional and general signs were dominated by the "asthenia-fever-cough" triad, with cough reported in 65.13% of patients, asthenia in 93.94%, and dyspnea in 47%. In our study, the temperature was normal in 178 of the patients, or 81%, and normal in 86% (n=169) of vaccinated patients and 80% (n=19) of unvaccinated patients. These findings are consistent with those of other authors who also reported similar prevalence rate. Guan et al found fever in 43.8%, cough in 67.8%, asthenia in 38.1%, and dyspnea in 18.7% of cases; Wu et al reported fever in 93.5%, cough in 81.1%, asthenia in 32.8%, and dyspnea in 39.8% of cases; and according to Zhou et al, cough predominated in 94%, asthenia in 79%, and dyspnea in 23% of cases [15,17,19].

Our study found that 16% of patients in our population had a high NEWS2 score on admission, indicating severe forms of COVID-19. The moderate forms of the disease were the most prevalent with 76% of patients scoring in this range. The use of the NEWS2 score is recommended by the WHO and the Royal College of Physicians of London for the risk stratification of COVID-19 patients and can aid in therapeutic management by evaluating and classifying patients based on their risk of progressing to a severe form of the disease [5]. The higher the score, the worse the prognosis, and the more urgent the need for treatment.

The median pulse oxygen saturation in ambient air in our study was 89.66%, with a range of 85% to 95%, and 17% (n=37) of patients received oxygen therapy. Ketfi et al reported an oxygen therapy rate of 12.8% in Algerian patients, with 11.8% having a high NEWS2 score, 25.9% having a moderate score, and the majority (62.3%) having a basal score. Similarly, Zhang et al found that 82.1% of patients required oxygen therapy, with most (59.79%) having basic NEWS2 scores and 21.13% having moderate scores (14,22). The observed prevalence of high NEWS2 scores in our study was 19.08%, which is similar to the findings of Guan et al. who reported 15.74% of patients with high scores and 84.26% with moderate scores, and a 43.3% oxygen therapy rate (15). These results suggest that mortality may be closely related to oxygen saturation, with the duration of episodes of hypoxemia (SpO₂<90%) being an important predictor of mortality.

The occurrence of arterial hypotension and hypoxemia may have a deleterious additive effect on mortality, and it is recommended to maintain a partial oxygen pressure (PaO₂) > 60 mmHg and to avoid any SpO₂ desaturation <90% during initial treatment [21].

We observed that after hospital treatment, 170 patients (78%) had recovered and 49 cases (22%) resulted in death. The proportion of recovered cases in our study was significantly lower than that reported in other studies (ranging from 21% to 90%) [15,17,19,20]. The average duration of hospitalization in our study was 7 days, which is lower than that reported in other studies (ranging from 9 to 14 days) [21-23].

Conclusion

Our findings suggest that clinical forms of COVID-19 present similarly in both unvaccinated and vaccinated patients, and the presence of comorbidities worsens the prognosis in both groups. Moderate forms were more prevalent in both groups, while severe forms were more common among unvaccinated patients. The NEWS2 score was effective in assessing patient prognosis on admission, thereby helping to optimize therapeutic management. This work highlights the importance of risk stratification using the NEWS2 score and careful monitoring of oxygen saturation in the management of COVID-19 patients in our region.

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