Letter to the Editor

NEWS2 is a valuable tool for appropriate clinical management of COVID-19 patients

Coronavirus disease 2019 (COVID-19) is a severe acute respiratory infection caused by an emergent coronavirus, SARS-CoV-2, recognized in Wuhan (China) in December 2019. The World Health Organization (WHO) declared COVID-19 a pandemic on 11 March 2020.

According to the literature, approximately 15%–20% of hospitalized patients develop a severe or critical disease, defined as the need for intensive-care-unit (ICU) treatment or a fatal outcome [1]. The most common diagnosis is severe pneumonia, with a number of complications, such as acute respiratory disease syndrome, sepsis, and septic shock, and multiorgan failure [2]. Increased risk of in-hospital mortality from COVID-19 was shown in older patients and those with comorbidities [3].

In COVID-19 patients, an early minimally symptomatic phase is often followed by deterioration. Parameters on admission may, however, be fraught with heterogeneity due to the timing of presentation and the severity of the disease. Risk-stratification scores that transform complex clinical pictures into tangible numerical values, and allow for the early identification of patients who are at higher risk of death and require a higher intensity of care are crucial in the management of patients infected with SARS-CoV-2 [4].

During the pandemic outbreak, the WHO recommended the use of medical early warning scores (e.g., NEWS2) to facilitate the early recognition and escalation of deteriorating patients [2]. National Early Warning Score 2 (NEWS2) was also recommended for the management of COVID-19 patients in critical care by the National Institute for Health and Care Excellence (NICE) [5].

The NEWS2 calculation is obtained by nursing staff through the measurement of six physiological parameters: (i) respiratory rate, (ii) oxygen saturation and air or oxygen supplementation, (iii) temperature, (iv) systolic blood pressure, (v) pulse rate, and (vi) level of consciousness according to AVPU scale (Alert, Voice, Pain, Unresponsive) [6]. The Royal College of Physicians categorized NEWS2 into three categories: low (0–4), medium (5–6), and high (≥7) clinical risk [6].

Despite early warning scores being commonly adopted by hospitals for triage and continuous assessment, there is still limited direct evidence on the performance of such scores to guide clinical decisions in COVID-19 patients.

With this letter, reporting data from a prospective observational cohort study, we want to bring evidence supporting the hypothesis that the NEWS2 is a valuable tool for SARS-CoV-2 patients' risk stratification and prediction of intrahospital mortality.

Our setting was a public general hospital with 300 beds (Santa Maria del Carmine Hospital of Rovereto), identified in the first phase of Italian COVID-19 outbreak as a hub hospital for COVID patients in the autonomous province of Trento (northeastern Italy, 500,000 inhabitants). NEWS2 was regularly in use in the medical and emergency wards of all hospitals of the province for patient risk stratification and allocation to the most appropriate level of care (usual, sub-intensive, and intensive care) [7,8].

All adults with laboratory-confirmed SARS-CoV-2 infection admitted via emergency department were recruited from 1 March to 31 May 2020. Patients were triaged on admission, and parameters for NEWS2 calculation were collected. The primary endpoint was intrahospital mortality. Secondary endpoints were length of stay, 30-day post-discharge mortality, and intrahospital complications. To determine the predictive power of NEWS2 and other risk factors predicting intrahospital mortality, we used univariate logistic-regression models. Univariate models were performed for age, gender, comorbidities, PaO_2/FiO_2 ratio, and NEWS2. The area under a receiver-operating-characteristic curve (AUROCC) was used to assess the discriminatory intrahospital mortality power of NEWS2, and Youden's method to estimate the best NEWS2 cut-off.

Clinical characteristics and outcomes are presented in Table 1. Among 477 patients, 305 (63.9%) were male, global median age was 71 (58-81) years, male median age 68 (56-78), and female median age 76 (62-85).

Factors affecting intrahospital mortality in the univariate logistic regressions were age, cardiovascular, pulmonary, and renal comorbidities, PaO_2/FiO_2 ratio < 300 (indicating any level of respiratory failure), NEWS2 5–6 which increased the death probability of about 6 times in respect to NEWS2 0-4, and NEWS2 ≥ 7 of about 18 times in respect to NEWS2 0-4. Moreover, NEWS2 was accurate in discriminating the death of COVID-19 patients, as it showed an AUROCC = 0.84, 95% CI=0.79–0.90, and NEWS2 > 5 on admission was identified as the best cut-off in predicting intrahospital mortality. Median length of stay was 10 days, intra-hospital mortality was 11.5%, and 30-day post-discharge

Table 1
Patients' characteristics and outcomes.

Characteristics: Female, n (%)	172 (36.1)	OR (95% CI) reference	p-value
Male, n (%)	305 (63.9)	1.04 (0.58-1.89)	0.14
Age, median (Q1-Q3) years	71 (58-81)	1.13 (1.09-1.17)	<0.01
P/F ratio at admission, median (Q1-Q3)	313 (191.0-371)	0.99 (0.99-0.99)	<0.01
P/F ratio at admission <300, n (%)	220 (46.2)	9.66 (4.27-21.88)	<0.01
NEWS2 at admission, median (Q1-Q3)	4 (2-7)	1.48 (1.34-1.63)	<0.01
NEWS2 at admission 0-4, n (%)	261 (54.7)	reference	
NEWS2 at admission 5-6, n (%)	86 (18.0)	6.23 (2.23-17.42)	<0.01
NEWS2 at admission ≥7, n (%)	130 (27.3)	17.55 (7.18-42.89)	<0.01
Comorbidities:			
Cardiovascular (including hypertension), n (%)	294 (61.6)	2.68 (1.34-5.34)	<0.01
Diabetes, n (%)	83 (17.4)	1.60 (0.81-3.14)	0.17
Gastrointestinal, n (%)	74 (15.5)	0.94 (0.42-2.08)	0.88
Autoimmune, n (%)	62 (13.0)	1.62 (0.77-3.42)	0.20
Obesity, n (%)	55 (11.5)	0.76 (0.29-2.00)	0.58
Pulmonary, n (%)	58 (12.2)	2.05 (0.99-4.24)	0.05
Renal, n (%)	51 (10.7)	5.91 (3.03-11.53)	<0.01
Cancer, n (%)	58 (12.2)	1.78 (0.84-3.76)	0.13
Outcomes:			
Length of stay, median (Q1-Q3)	10 (6-16)		
Intra-hospital mortality, n (%)	55 (11.5)		
30-day post-discharge mortality, n (%)	74 (15.5)		
Complications:			
Venous thromboembolism (pulmonary embolism – Deep vein thrombosis), n (%)	28 (5.9)		
Acute coronary syndrome, n (%)	9 (1.9)		
Sepsis, n (%)	24 (5.1)		
Guillian-Barrè syndrome, n (%)	1 (0.2)		
Pneumothorax, n (%)	4 (0.8)		
Pneumomediastinum, n (%)	7 (1.5)		
Patients with 1 or more complications, n (%)	66 (13.9)		

Abbreviations: NEWS2=National Early Warning Score 2; n=number, P/F ratio= PiO2/FiO2 ratio; Q1= first quartile; Q3=third quartile.

mortality 15.5%. Among complications, the most frequent were venous thromboembolism (5.9%), and sepsis (5.1%); in addition, 13.9% of patients showed more than one complication.

Our results showed that NEWS2 was a strong predictor of intra-hospital mortality for COVID-19 patients both performing a logistic regression and considering the NEWS2 diagnostic performance as it showed good accuracy in discriminating intrahospital mortality for patients with a score greater than 5. This result is consistent with the guidance of the Royal College of Physicians, which indicates, in the pre COVID era, 5 as a threshold for patients with medium risk of clinical deterioration that could incur in negative outcomes, and recommends prompt and greater urgency in the management of patients with NEWS2 ≥7 [6]. The dedicated literature on NEWS2 as a supportive tool for SARS-CoV-2 patient risk stratification is fragmented. Indeed, reports are sparse, heterogeneous, and characterized by methodological discrepancies such as small sample size and the retrospective nature of studies, claiming for more rigorous research [9]. Another group of studies compare different scores and prognostic models available for clinical management decisions, indicating moderate performance, and no

benefit to clinical decision making of COVID-19 hospitalized patients [4]. However, among 22 tested prognostic models, one of the two highest AUROCCs was achieved by the NEWS2 score for prediction of deterioration over 24 hours (0.78; 95% CI 0.73–0.83) [10].

Our data reinforce the recommendation of NEWS2 to support clinical judgement, and provide a standardized communication tool that could be practically feasible in a short time scale, and in the context of strained resources and operational pressure faced by hospitals during the emergency phase of the COVID-19 pandemic outbreak, or during post-epidemic peak phases to treat the regular case mix of patients and sporadic COVID cases without needing disease-specific prognostic scores. In addition, the use of NEWS2 in nonhospital settings (i.e., primary, and long-term care facilities) could be profitably implemented for the early recognition and community treatment of suspected or confirmed cases of SARS-CoV-2 and risk stratification. In the ongoing COVID-19 pandemic, there is, indeed, an urgent need to stratify patients according to the risk of clinical deterioration in order to optimize patients management and allocation to the most appropriate level of care (i.e. home care, standard hospitalization, sub-intensive, and intensive care).

We are aware that many factors, such as the consolidated experience in the use of NEWS2, the timing of NEWS2 assessment, clinical setting, and pandemic environment could modify NEWS2 performance and patient outcomes. On the other hand, we believe that our findings, based on a mixed and well-characterized population over a three-month period in a region highly hit by the infection, contribute to evidence generation, and indicate the need for further research on the use of standardized and validated scores in the context of the COVID-19 pandemic in multicenter, international and larger sample size studies.

Availability of Supporting Data

Data were analyzed in aggregate and anonymized form. The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declaration of Competing Interest

The authors declare they have no conflict of interest.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ejim.2020.11.020.

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