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Validation of the Covid-19 Severity Index: A Retrospective Study among Egyptian Patients

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Abstract

Background: The COVID-19 Severity Index is a predictive tool that aims to identify hospitalized patients with COVID-19 who are at risk of clinical deterioration and intensive care unit (ICU) admission. However, its validity and applicability in different settings and populations remain uncertain.

Aim of Study: To evaluate the performance of the COVID-19 Severity Index in predicting ICU admission among Egyptian patients diagnosed with COVID-19 infection.

Patients and Methods: This was a retrospective cohort study of 100 patients with confirmed COVID-19 who were admitted to Ain Shams University Hospital from October to December 2021. The patients were divided into two groups: ICU (n=30) and non-ICU (n=70). The COVID-19 Severity Index was calculated based on clinical, laboratory and radiological parameters at hospital admission (day 0), 48 hours and 24 hours prior to ICU admission for ICU group, and the same corresponding days for non-ICU group. The predictive performance of the index was assessed using receiver operating characteristic (ROC) curve analysis.

Results: The COVID-19 Severity Index had a high sensitivity and specificity for predicting ICU admission 24 hours and 48 hours before the actual admission, with area under the curve (AU-ROC) of 0.998 and 0.997 at 48 hours and 24 hours prior to ICU admission, respectively. The index had poor predictive value at admission day, with (AU-ROC) of 0.575.

Conclusion: The COVID-19 Severity Index showed a good prediction and high discriminatory ability to detect patients at ward level of care who are at risk of clinical deterioration 48 and 24 hours prior to the need of ICU admission. It can be used as a prognostic index for ICU admission among Egyptian patients with COVID-19 infection. However, further validation studies are needed to confirm its applicability and utility in different settings and populations.

Key Words: COVID-19 Severity Index – Early Warning score – SARS-Cov-2 – Critical care – COVID-19.

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Introduction

THE COVID-19 pandemic has caused unprecedented challenges and impacts on various aspects of human life, such as health, economy, society, and environment. According to the World Health Organization, as of February 2024, more than 750 million people have been infected and over 7 million have died from the disease worldwide **[1]**. The pandemic has also exposed the fragility and vulnerability of the health care systems **[2]**. Early warning systems (EWS) are tools that can help improve the recognition and management of acutely ill patients, by scoring their physiological parameters and triggering appropriate clinical actions **[3]**.

Huespe et al. **[4]** have developed The COVID-19 Severity Index, which is a predictive score that combines clinical, laboratory and radiological parameters, aiming to improve the detection of patients at risk of unexpected deterioration and ICU admission. The index has shown promising results in a retrospective study conducted in Argentina, **[5]** but it has not been validated in other countries or regions. Therefore, the aim of study is to evaluate the performance of the COVID-19 Severity Index in predicting ICU admission among Egyptian patients diagnosed with COVID-19 infection.

Patients and Methods

Setting: This study was carried out in Ain Shams University Hospitals.

Study design: Retrospective study from the period of October 2021 to December 2021.

Sample size calculation: Huespe et al. **[5]** reported AUC of COVID-19 Severity Index to discriminate between those who needed ICU admission and

those who did not. The AUC was as high as 79%-80% when the index was measured 24 hours-48 hours pre-ICU transfer compared to 61% when the index was measured on hospital admission. A sample of 25 ICU cases and 55 non-ICU cases will produce a statistically significant AUC with level of significance <0.05 and a two-sided 95% confidence interval with a width of 0.2 when the sample AUC is 0.8. PASS 11 Power Analysis and Sample Size Software (2011). NCSS, LLC. Kaysville, Utah, USA, ncss.com/software/pass.

Patients:

This study included 100 hospitalized Egyptian adult (age ≥18 years) patients with confirmed diagnosis of COVID 19 infection with + vepolymerase chain reaction (PCR).

Exclusion criteria: Hospitalized patients with unexpected mortality during their hospitalization course.

The main outcome: Was ICU admission for each patient's hospitalization, classifying each of them as "ICU admitted"or "non-ICU admitted".

Methods:

100 patients were assigned to 2 groups, Group A (ICU admission) (n=30) and Group B (Non-ICU admission) (n=70), whose clinical condition didn't require to be admitted to ICU during their hospitalization period. Clinical and demographic data of patients were collected and The COVID-19 Severity Index was applied to every patient, on admission for both groups, and in 48hrs and 24hrs. before admission to ICU for ICU admission group (A), and on the same corresponding days for Non-ICU admission group (B). Data were collected including: 1- Full medical history including age, sex, smoking, comorbidities, Vaccination status and specific drugs received for COVID-19 infection. 2- Full clinical examination: (General & local). 3- Imaging: Plain chest X-ray. 4- Laboratory investigations: A. Complete blood count (CBC) with differential. B. Urea & creatinine. C. Na+, K+ serum levels. D. CRP, IL6, D-dimer and procalcitonin (PCT).

Statistical analysis:

Quantitative Data were summarized as mean with standard deviation (SD), or range with minimum and maximum (Min-Max). Qualitative data were expressed as frequency and percentage. Differences between groups were determined using Mann-Whitney test to compare between abnormally distributed quantitative data, or *t*-test to compare between normally distributed quantitative data between the two groups of patients. Differences between categorical variables will be evaluated with the Chi-square test, or Fisher's Exact. Calculations of sensitivity and specificity for different thresholds in the score to plot ROC curve, then ROC curve analysis and measurement of the area under the receiver operating curve (AU-ROC) as an indicator of the performance of COVID-19 severity index as a predictive tool. Data were analyzed using Statistical package for Social Science (SPSS) version 25.0. For ROC curve plot and analysis, Medcalc version 17.0 was used.

Ethical approval: Was obtained from Medical Ethical Committee of Faculty of Medicine Ain Shams University. This was a retrospective observational study thus informed consent was waived.

Results

Table (1): Demographic data.

Demographic data	ICU patients (n=30)	Non-ICU patients (n=70)	Test	*p*-value
Age (years):				
Mean ± SD	65.2±12.1	64.14±14.4	U=1060.5	*p*=.93
Gender (M/F):				
Male (%)	19 (63.3%)	30 (42.9 %)	X^2=3.5	*p*=.06
Female (%)	11 (36.7%)	40 (57.1%)		
BMI (Kg/m^2):				
Mean ± SD	22.2±2.6	23.8±3.3	U=746	*p*=.02*

Data are presented as mean ± SD.
*: *p*-value <0.05 is considered statistically significant.
U: Mann Whitney test.
χ2: Chi-square test.

Table (2): Co-morbidities.

Co-morbidity	ICU patients (n=30) No. (%)	Non-ICU patients (n=70) No. (%)	Test	*p*-value
Smoking	12 (40%)	14 (20%)	$\chi2$= 4.366	*p*=0.037*
Obesity	7 (23.3%)	25 (35.7%)	$\chi2$= 1.479	*p*=0.224
Hypertension	20 (66.7%)	39 (55.7%)	$\chi2$= 1.041	*p*=0.308
Diabetes with end organ damage	9 (30.0%)	18 (25.7%)	$\chi2$= 0.196	*p*=0.658
COPD	6 (20.0%)	3 (4.3%)	$\chi2$= 6.332	*p*=0.012*
Congestive heart failure	4 (13.3%)	3 (4.3%)	FE	*p*=0.193
Liver disease	1 (3.3%)	1 (1.4%)	FE	*p*=0.512
Kidney disease	4 (13.3%)	7 (10.0%)	$\chi2$= 0.238	*p*=0.625
Thyroid disease	0 (0%)	3 (4.3%)	FE	*p*=0.552

Data are represented as number of patients (No.) & percent (%).
* : *p*-value <0.05 is considered statistically significant.
$\chi2$: Chi-square test.
FE: Fischer Exact Probability.
Shows statistical significance between the two groups as regards smoking and COPD.

Table (3): Vital signs of both groups on hospital admission (day 0), 48 hrs. & 24 hrs. prior to ICU admission for ICU group, and the same corresponding days for non-ICU group.

Vital signs	ICU patients (n=30)	Non-ICU patients (n=70)	Test	*p*-value
Respiratory rate (breath per minute)				
Median ± SD:				
Day 0 (Hospital admission)	18.1±1.07	17.6±2.96	U=811.0	*p*=0.069
48 hrs	21.9±2.5	16.5±2.1	U=1969.5	*p*=0.001*
24 hrs	27.3±2.86	16.7±1.54	U=1.0	*p*<0.001*
Heart rate (beat per minute)				
Median ± SD:				
Day 0 (Hospital admission)	84.3±6.64	81.3±9.66	U=803.5	*p*=0.063
48 hrs	93.9±7.8	80.9±7.8	U=1912	*p*=0.001*
24 hrs	108.3±17.12	77.07±7.1	U=20.0	*p*<0.001*
SpO_2 (%)				
Median ± SD:				
Day 0 (Hospital admission)	93.76±2.73	93.9±2.92	U=853.5	*p*=0.934
48 hrs	93.96±2.33	93.9±2.92	U=0	*p*=0.001*
24 hrs	85.96±3.14	95.7±1.099	U=0.0	*p*<0.001*
SpO_2 (%)				
Median ± SD:				
Day 0 (Hospital admission)	137.33±22.18	133.9±11.9	U=1046.5	*p*=0.979
48 hrs	133.33±20.09	131.9±10.6	U=2100	*p*=0.001*
24 hrs	122.8±22.96	129.6±10.19	U=865.5	*p*=0.163
Temperature (°C)				
Median ± SD:				
Day 0 (Hospital admission)	37.62±0.91	37.3±0.49	U=737.5	*p*=0.015*
48 hrs	37.8±0.69	37.3±0.49	U=2100	*p*= .001*
24 hrs	38.2±0.92	37.07±0.22	U=229.0	*p*<0.001*

Shows significant statistical difference between the two groups in 48hr and 24hr days prior to ICU admission and their corresponding days of non-ICU group, in respiratory rate, heart rate, SpO2, systolic blood pressure and temperature.
Data are represented as mean ± SD.
*: *p*-value <0.05 is considered statistically significant.
U: Mann Whitney test.

Table (4): Comparison between both groups as regards dyspnea & O2 therapy on hospital admission (day 0), 48 hr & 24 hr prior to ICU admission for ICU group, and the same corresponding days for non-ICU group.

Dyspnea & O_2 therapy	ICU patients (n=30) No. (%)	Non-ICU patients (n=70) No. (%)	Test	*p*-value
Dyspnea:				
Day 0 (hospital admission):	3 (10.0%)	6 (8.6%)	$\chi2$= 0.052	*p*=0.819
48 hrs.	15 (50%)	0 (0%)	$\chi2$= 41.17	*p*<0.001*
24 hrs.	25 (83.3%)	0 (0%)	$\chi2$= 77.778	*p*<0.001*
O_2 therapy:				
Day 0 (hospital admission)	12 (40.0%)	25 (35.7%)	$\chi2$= 0.165	*p*=0.684
48 hrs.	29 (96.7%)	10 (14.3%)	$\chi2$= 59.9	*p*<0.001*
24 hrs.	30 (100%)	1 (1.4%)	$\chi2$= 95.392	*p*<0.001*

Shows statistical significance between the 2 groups in the 48 hr& 24 hr prior to ICU admission.
Data are represented as number of patients (No.) & percent (%).
* : *p*-value < 0.05 is considered statistically significant.
$\chi2$: Chi-square test.

Table (5): Comparison between both groups as regards laboratory investigations on hospital admission (day 0), 48 hrs.& 24 hrs. prior to ICU admission for ICU group, and the same corresponding days for non-ICU group.

Laboratory investigations	ICU patients (n=30)	Non-ICU patients (n=70)	Test	*p*-value
Hemoglobin (g/dl)				
Median ± SD:				
Day 0 (hospital admission)	12.9±2.73	11.35±2.15	U=642.0	*p*=0.002*
48 hrs	12.5±2.09	11.18±1.81	*t*=3.14	*p*=0.002*
24 hrs	11.99±2.09	11.24±1.81	*t*=1.815	*p*=0.073
WBCs (/mm3)				
Median ± SD:				
Day 0 (hospital admission)	10508.6±5873.21	9721.6±13403.79	U=794.5	*p*=0.055
48 hrs	11234.16±5680	8360.74±3649.47	U=1386.5	*p*=0.01*
24 hrs	11097.2±5740.59	8588.9±2742.92	U=675.0	*p*=0.005*
Lymphocytes (/mm^3)				
Median ± SD:				
Day 0 (hospital admission)	1697.9±1103.35	1391.4±1045.35	U=894.0	*p*=0.241
48 hrs	1851.3±1165.13	1545.12±953.96	U=1205	*p*=0.2
24 hrs	1492.93±1023.89	1588.4±798.44	U=898.5	*p*=0.254
Neutrophils (/mm^3)				
Median ± SD:				
Day 0 (hospital admission)	13718.13±30902.83	6430.5±4022.39	U=794.0	*p*=0.054
48 hrs	8982.93±4705.57	6345.3±3213.8	U=1393	*p*=0.01*
24 hrs	9270.23±4259.71	6608.73±2630.83	U=612.0	*p*=0.001*
Platelets (/mm3)				
Median ± SD:				
Day 0 (hospital admission)	222700.0±106498.55	248842.9±113631.7	U=896.0	*p*=0.247
48 hrs	233300± 134946.26	251174.28±104759.06	U=877	*p*=0.19
24 hrs	221800.0±131145.72	255471.43±108980.08	U=813.0	*p*=0.075
D-Dimer (ng/ml)				
Median ± SD:				
Day 0 (hospital admission)	998.4±1066.38	364.9±229.95	U=260.0	*p*<0.001*
48 hrs	893.96±594.8	323.71±175.4	U=1949	*p*<0.001*
24 hrs	903.33±440.6	252.53±145.5	U=35.0	*p*<0.001*

Table (5): Cont.

Laboratory investigations	ICU patients (n=30)	Non-ICU patients (n=70)	Test	*p*-value
CRP (mg/L)				
Median ± SD:				
Day 0 (hospital admission)	54.4±30.23	48.3±33.42	U=766.5	*p*=0.319
48 hrs	61.26±34.1	30.6±20.8	U=684	*p*<0.001*
24 hrs	54.88±31.73	26.35±19.51	U=266.5	*p*<0.001*
Urea (mg/dl)				
Median ± SD:				
Day 0 (hospital admission)	62.37±27.71	60.87±36.19	U=893.0	*p*=0.382
48 hrs	61.26±34.1	30.6±20.8	U=684	*p*<0.001*
24 hrs	54.88±31.73	26.35±19.51	U=266.5	*p*<0.001*
Creatinine (mg/dl)				
Median ± SD:				
Day 0 (hospital admission)	1.45±0.47	1.46±0.71	U=967.0	*p*=0.767
48 hrs	1.49±0.6	1.09±0.58	*t*=2.810	*p*=0.006*
24 hrs	1.54±0.6	1.23±0.41	*t*=2.810	*p*=0.006*
Na+ (mEq/L)				
Median ± SD:				
Day 0 (hospital admission)	136.8±7.18	136.3±6.35	U=755.0	*p*=0.275
48 hrs	129.9±29.39	97.34±62.8	U=684	*p*<0.001*
24 hrs	137.5±7.47	136.59±5.35	*t*=0.593	*p*=0.555
K+ (mEq/L)				
Median ± SD:				
Day 0 (hospital admission)	4.3±0.48	3.9±0.55	*t*=3.106	*p*=0.003*
48 hrs	4.1±1.06	2.9±1.9	*t*=2.8	*p*=0.005*
24 hrs	4.41±0.55	4.04±0.4	*t*=3.360	*p*=0.001*
IL6 (pg/ml)				
Median ± SD:				
Day 0 (hospital admission)	245.2±763.53	83.4±230.82	U=379.5	*p*=0.176
48 hrs	111.2±102.94	5.98±2.56	*t*=2.5	*p*=0.03*
24 hrs	252.33±382.94			
PCT (ng/ml)				
Median ± SD:				
Day 0 (hospital admission)	0.79±1.8	0.56±1.15	U=576.5	*p*=0.685
48 hrs	0.58±74	0.46±0.59	U=149	*p*=0.649
24 hrs	1.33±2.0	0.29±0.31	U=113.0	*p*=0.016*

- Data from hospital admission day, 48hr & 24 hr prior to ICU admission in ICU group, and the corresponding days for non-ICU group, Data are represented as mean ± SD.

*: *p*-value <0.05 is considered statistically significant.

U: Mann Whitney test.

t: *t*-test. Grey shaded cell represents missed data.

Table (6): Comparison between both groups as regards chest X-ray infiltration on hospital admission (day 0), 48 hrs. & 24 hrs. prior to ICU admission for ICU group, and the same corresponding days for non-ICU group.

Chest X-ray infiltration	ICU patients (n=30)		Non-ICU patients (n=70)		Test of significance	*p*-value
	No.	%	No.	%		
Day 0 (hospital admission)	23	76.7	34	48.6	$\chi2$=6.763	*p*=0.009*
24 Hours	29	96.7	36	48.6	$\chi2$=18.891	*p*<0.001*
48 Hours	29	96.7	36	48.6	$\chi2$=18.891	*p*<0.001*

- Shows statistical significance between 2 groups at all time points.Data are represented as number of patients (No.) & percent (%).

*: *p*-value < 0.05 is considered statistically significant. $\chi2$: Chi-square test.

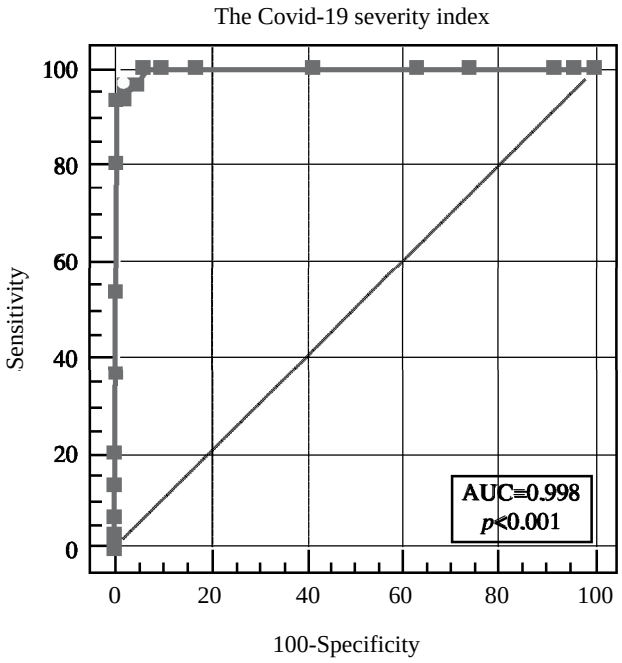

Fig. (1): (ROC) curve, and the Area Under the Curve (AU-ROC), indicating good ability of The Covid-19 Severity Index 48 hr prior to ICU admission in prediction of ICU admission in hospitalized patients with SARS-COV-2 infection among Egyptian population with AUC=0.998, (95% Confidence Interval) (0.96 to 1), and significant $p<.001$*.

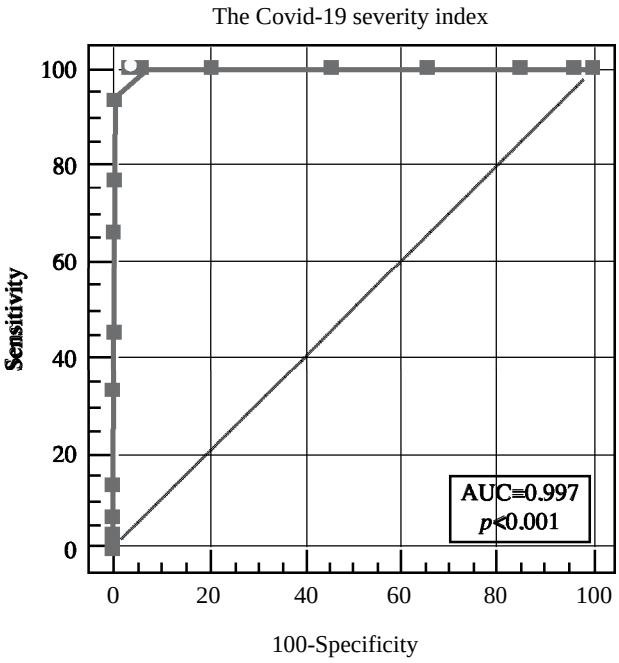

Fig. (2): (ROC) curve, and the area under the curve (AU-ROC), indicating good ability of The Covid-19 Severity Index 24hr prior to ICU admission in prediction of ICU admission in hospitalized patients with SARS-COV-2 infection among Egyptian population with AUC=0.997 with (95%confidence interval) (0.96 to 1), and significant $p<.001$*.

Discussion

In the present study, we demonstrated that The COVID-19 severity Indexis a valid score for prediction of the unexpected need for ICU admission in patients at ward level hospitalized with COVID-19 infection, it was observed that The COVID-19 Severity Index had a high sensitivity and specificity for predicting ICU admission 48 hours and 24 hours before the actual admission, with area under the curve (AU-ROC) of 0.998 ($p<0.001$) and 0.997 ($p<0.001$) at 48 hours and 24 hours prior to ICU admission, respectively. The index had poor discrimination capacity to identify patients at risk for ICU admission at hospital admission day, with (AU-ROC) of 0.575. These findings were consistent with findings reported in the original study by Huespe et al. **[5].**

ICU patients had a significantly higher percentage of Smokers and COPD patients than non-ICU patients. In agreement with the present study, Reddy et al. **[6]** have reported significant increase of COVID-19 severity and mortality risk in patients with current smoking and a smoking history. Also, Rabbani et al. **[7]** have reportedin a meta-analysis that patients with pre-existing COPD had more severe COVID-19 and 3 times higher risk of mortality.

In the current study, despite there were no statistical difference, ICU patients had a higher percentage of congestive heart failure patients than non-ICU patients, and odds ratio of (OR=3.6) for predicting ICU admission. This was in consistent with findings of Bhatt et al. **[8]** who reported that hospitalized HF patients with COVID-19 are more susceptible to complications, and almost one in four of them pass away while in the hospital.

ICU patients had a higher percentage of diabetes with end organ damage patientsbut the difference was not statistically significant. Pre-existing diabetes is significantly associated with an elevated risk of severe/critical illness and in-hospital death in patients admitted to hospitals with COVID-19 **[9].**

In the present study, ICU patients had significantly higher temperature, heart rate and respiratory rate than non-ICU patients at 24 and 48 hours prior to ICU admission and their corresponding days in non-ICU group. These findings were consistent with multiple research studies; Uchiyama et al. **[10]** have reported maximum body temperature (BT) as an independent predictor of mortality in COVID-19 infected patients, interestingly, with every one degree increase in maximum BT was associated with

1.88-fold higher mortality. It was reported that Patients with tachyarrhythmias had a higher risk of all-cause death **[11].** Also, Du et al. **[12]** have reported the correlation between increased respiratory rate and poor outcome.

In the current study, ICU patients had significantly lower SpO2 than non-ICU patients at 24 hours prior to ICU admission and its corresponding day for non-ICU group. These findings were consistent with research findings that hypoxemia was independently associated with in-hospital mortality **[13].**

In the present study, regarding Systolic blood pressure, there was no significant difference between ICU and non-ICU patients in systolic blood pressure except at 48 hrs. prior to ICU admission in ICU group and the same corresponding day in non-ICU group. Research demonstrated that Elevated SBP was related to higher mortality in COVID-19 patients **[14].**

In the present study, the percentage of ICU patients who had dyspnea and needed O2 therapy increased over time, and was significantly higher than non-ICU group, especially in 48 & 24 hrs. before ICU admission for ICU group and the corresponding days for non-ICU group. These results were consistent with research findings that dyspnea 15 and high oxygen requirements 16 were associated with severity of COVID-19.

In the present study, ICU patients had higher levels of inflammatory and sepsis markers (white blood count, neutrophils, CRP, IL-6 and procalcitonin), coagulation marker (D-dimer), Potassium and renal function tests (urea & creatinine), than non-ICU patients at 24 and 48 hours prior to ICU admission and the corresponding days for non-ICU group, which may be contributed to more severe infection, bacterial co-infection, higher risk of thrombosis and impaired kidney function and possible acute kidney injury. These findings were consistent with results reported in previous studies **[17-23].**

In the present study, ICU patients had a significantly higher percentage of bilateral chest X-ray infiltration than non-ICU group. Chest X-rays have been considered in different scores to assess severity and prognosis of COVID-19 infection **[24].**

In the present study, ICU patients had a significantly longer hospital stay and higher mortality.

Despite being a variable of the studied Index, in the present study, there was no significant difference between ICU and non-ICU patients as regards age, lymphocyte and platelet count at day 0, 24 hours, and 48 hours. However, studies have reported the correlation between increased age, lymphopenia, and thrombocytopenia and COVID-19 severity **[25-27].** These results may be attributed to the relatively small sample size of the studied cohort.

The present study has some limitations, First, it's a single centered study in Egypt which may limit generalizability of the results to other populations and settings. Second, it's a retrospective study, which may introduce selection bias. Third, Inter-rater reliability concern as the studied score included bilateral chest X-ray infiltration as a variable which may vary depending on the training and experience of the staff who performed the measurements.

We recommend Further studying of the COVID-19 Severity Index using Multicentered prospective study to help increase the generalizability and external validity of the results and reduce the risk of selection bias and confounding factors. It would also help to assess the impact of utilizing the COVID-19 Severity Index score on clinical outcomes, such as mortality, length of stay, or resource utilization. This would help evaluate the clinical utility and cost-effectiveness of the index.

Conclusion:

The present study has validated the ability of the COVID-19 severity index to predict unexpected ICU admission 48 & 24 hrs before the need to ICU admission, among 100 Egyptian patients hospitalized and diagnosed with SARS-COV-2 infection, the score showed good performance represented with high area under the receiver operating curve (AU-ROC), the study also demonstrated the poor predictive ability of the score when applied on hospital admission day.

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Appendix

Table (7): Points of ability of The Covid-19 Severity Index 24h before ICU admission in prediction of ICU admission in hospitalized patients with SARS-COV-2 infection.

Criterion	Sensitivity	95% CI	Specificity	95% CI	+PV	95% CI	–PV	95% CI
≥0	100	88.4 - 100.0	0.00	0.0 - 5.1	30.0	21.2 - 40.0		
>0	100	88.4 - 100.0	4.29	0.9 - 12.0	30.9	21.9 - 41.1	100	29.2 - 100.0
>1	100	88.4 - 100.0	15.71	8.1 - 26.4	33.7	24.0 - 44.5	100	69.2 - 100.0
>2	100	88.4 - 100.0	32.86	22.1 - 45.1	39.0	28.0 - 50.8	100	85.2 - 100.0
>3	100	88.4 - 100.0	52.86	40.6 - 64.9	47.6	34.8 - 60.7	100	90.5 - 100.0
>4	100	88.4 - 100.0	80.00	68.7 - 88.6	68.2	52.4 - 81.4	100	93.5 - 100.0
>5	100	88.4 - 100.0	92.86	84.1 - 97.6	85.7	69.7 - 95.2	100	94.5 - 100.0
>6	100	88.4 - 100.0	95.71	88.0 - 99.1	90.9	75.7 - 98.1	100	94.6 - 100.0
>7	93.33	77.9 - 99.2	98.57	92.3 - 100.0	96.6	81.8 - 99.9	97.2	90.2 - 99.7
>8	76.67	57.7 - 90.1	100	94.9 - 100.0	100.0	85.2 - 100.0	90.9	82.2 - 96.3
>9	66.67	47.2 - 82.7	100	94.9 - 100.0	100.0	83.2 - 100.0	87.5	78.2 - 93.8
>10	46.67	28.3 - 65.7	100	94.9 - 100.0	100.0	75.3 - 100.0	81.4	71.6 - 89.0
>11	33.33	17.3 - 52.8	100	94.9 - 100.0	100.0	69.2 - 100.0	77.8	67.8 - 85.9
>12	13.33	3.8 - 30.7	100	94.9 - 100.0	100.0	39.8 - 100.0	72.9	62.9 - 81.5
>13	6.67	0.8 - 22.1	100	94.9 - 100.0	100.0	15.8 - 100.0	71.4	61.4 - 80.1
>14	3.33	0.08 - 17.2	100	94.9 - 100.0	100.0	2.5 - 100.0	70.7	60.7 - 79.4
>15	0.00	0.0 - 11.6	100	94.9 - 100.0			70.0	60.0 - 78.8

Table (8): Points of ability of The Covid-19 Severity Index 48h before ICU admission in prediction of ICU admission in hospitalized patients with SARS-COV-2 infection.

Criterion	Sensitivity	95% CI	Specificity	95% CI	+PV	95% CI	–PV	95% CI
≥0	100	88.4 - 100.0	0	0.0 - 5.1	30.0	21.2 - 40.0		
>0	100	88.4 - 100.0	4.29	0.9 - 12.0	30.9	21.9 - 41.1	100	29.2 - 100.0
>1	100	88.4 - 100.0	8.57	3.2 - 17.7	31.9	22.7 - 42.3	100	54.1 - 100.0
>2	100	88.4 - 100.0	25.71	16.0 - 37.6	36.6	26.2 - 48.0	100	80.5 - 100.0
>3	100	88.4 - 100.0	37.14	25.9 - 49.5	40.5	29.3 - 52.6	100	86.8 - 100.0
>4	100	88.4 - 100.0	58.57	46.2 - 70.2	50.8	37.5 - 64.1	100	91.4 - 100.0
>5	100	88.4 - 100.0	82.86	72.0 - 90.8	71.4	55.2 - 84.4	100	93.7 - 100.0
>6	100	88.4 - 100.0	90.00	80.5 - 95.9	81.1	64.8 - 92.0	100	94.3 - 100.0
>7	100	88.4 - 100.0	94.29	86.0 - 98.4	88.2	72.5 - 96.7	100	94.5 - 100.0
>8	96.67	82.8 - 99.9	95.71	88.0 - 99.1	90.6	74.6 - 98.1	98.5	92.1 - 100.0
>9	96.67	82.8 - 99.9	98.57	92.3 - 100.0	96.7	82.4 - 99.9	98.6	92.3 - 100.0
>10	93.33	77.9 - 99.2	98.57	92.3 - 100.0	96.6	81.8 - 99.9	97.2	90.2 - 99.7
>11	93.33	77.9 - 99.2	100	94.9 - 100.0	100	87.2 - 100	97.2	90.3 - 99.7
>12	80.00	61.4 - 92.3	100	94.9 - 100.0	100	85.8 - 100	92.1	83.6 - 97.0
>13	53.33	34.3 - 71.7	100	94.9 - 100.0	100	79.4 - 100	83.3	73.6 - 90.6
>14	36.67	19.9 - 56.1	100	94.9 - 100.0	100	69.2 - 100	78.7	68.7 - 86.6
>15	20	7.7 - 38.6	100	94.9 - 100.0	100	54.1 - 100	74.5	64.4 - 82.9
>16	13.33	3.8 - 30.7	100	94.9 - 100.0	100	39.8 - 100	72.9	62.9 - 81.5
>18	6.67	0.8 - 22.1	100	94.9 - 100.0	100	15.8 - 100	71.4	61.4 - 80.1
>19	3.33	0.08 - 17.2	100	94.9 - 100.0	100	2.5 - 100	70.7	60.7 - 79.4
>20	0.00	0.0 - 11.6	100	94.9 - 100.0			70.0	60.0 - 78.8

Table (9): COVID-19 Severity Index. [4]

Parameters	3	2	1	0	1	2	3
Age (years)				≤60	61-64	≥65	
Male gender			Yes	No			
Heart failure			Yes	No			
COPD			Yes	No			
Diabetes with end-organ damage			Yes	No			
Chest X-ray*				Normal or without bilateral infiltrates	Bilateral infiltrates		
Respiratory rate (breaths per minute)	≤8		9-11	12-20		21-24	≥25
SpO_2 (%)	≤91	92-93	94-95	≥96			
SpO_2 (%) in COPD	≤83	84-85	86-87	≥88			
Suplemental O_2	Yes			No			
Systolic BP(mmHg)	≤90			90-219			≥220
Pulse (beats per minute)	≤40		41-50	51-90	91-110	111-130	≥131
Temperature (ºC)	≤35		35.1-35.5	35.6-37.9	38-39	≥39.1	
Dyspnoea		Yes		No			
D-Dimer** (ng/ml)				≤1000	>1000		
Lymphocytes** (per mm^3)				≥1000	<1000	≤500	
Platelets** (per mm^3)				≥10000	<10000		

* Chest X-ray should be analyzed on admission, but it will be reconsidered when a new one is performed.
** If laboratory test results are of more than 48 hours, they will not be considered.

Table (10): COVID-19 Severity Index risk Chart. [4]

Score	Clinical risk	Alert level	Nursing Surveillance	Response	Solution
0-2	Low	Green	Every 12 hours	Standard nursing surveillance	General ward
3-5	Moderate	Yellow	Every 6 hours	Frequent nursing surveillance	General ward
6-7	High	Orange	Every 2-3 hours	Intensive nursing surveillance and physician notification	Evaluate intensive care admission
8 or more	Critical	Red	Continuous monitoring	Immediate physician notification	Intensive care unit

التحقق من صحة مؤشر خطورة كوفيد-١٩: دراسة بأثر رجعى بين المرضى المصريين

مؤشر خطورة COVID-19 هو أداة تنبؤية تهدف إلى تحديد المرضى فى المستشفى المصابين ب COVID-19 المعرضين لخطر التدهور السريرى ودخول وحدة الرعاية المركزة. ومع ذلك، لا تزال صلاحيته وإمكانية تطبيقه فى مختلف البيئات والسكان غير مؤكدين.

الهدف من الدراسة: تقييم أداء مؤشر خطورة COVID-19 للتنبؤ بدخول وحدة الرعاية المركزة بين المرضى المصريين الذين تم تشخيصهم بعدوى COVID-19.

طريقة الدراسة: كانت هذه دراسة رهط بأثر رجعى ل ١٠٠ مريض مصاب ب COVID-19 تم حجزهم بمستشفى جامعة عين شمس من أكتوبر إلى ديسمبر ٢٠٢١. تم تقسيم المرضى إلى مجموعتين: مرضى وحدة الرعاية المركزة (ن = ٣٠)، ومرضى لم يتم دخولهم للرعاية المركزة (ن = ٧٠). تم حساب مؤشر خطورة COVID-19 بناء على القياسات السريرية والمخبرية والإشعاعية عند دخول المستشفى (اليوم ٠) ، قبل ٤٨ ساعة و ٢٤ ساعة من دخول وحدة الرعاية المركزة لمجموعة وحدة الرعاية المركزة ، ونفس الأيام المقابلة لمجموعة غير وحدة الرعاية المركزة.

أظهرت نتائج الدراسة أن مؤشر خطورة COVID-19 له قدرة جيدة للتنبؤ وقدرة تمييزية عالية على اكتشاف المرضى المعرضين لخطر التدهور قبل ٤٨ و ٢٤ ساعة من الحاجة إلى دخول وحدة الرعاية المركزة. لذا، يمكن استخدامه كمؤشر تنبؤى لدخول وحدة الرعاية المركزة بين المرضى المصريين المصابين بعدوى COVID-19.