A modified emergency severity index level is associated with outcomes in cancer patients with COVID-19

Demis N. Lipe MD, Sorayah S. Bourenane RN, Monica K. Wattana MD,
Susan Gaeta MD, Patrick Chaftari MD, Maria T. Cruz Carreras MD,
Joanna-Grace Manzano MD, Cielito Reyes-Gibby DrPH

THE UNIVERSITY OF TEXAS

M. D. ANDERSON CANCER CENTER

Background

The novel coronavirus disease 2019 (COVID-19) pandemic has brought many challenges involving the care of COVID-19 patients in the emergency department (ED).

Patients with cancer are particularly vulnerable to COVID-19 given their compromised immune system. Cancer patients with COVID-19 can present to the ED with a spectrum of symptoms of variable severity.

Accurate triage of COVID-19 patients presenting to the ED is paramount for patient safety and efficient flow in the ED.

ED Triage Tool : The Emergency Severity Index

Recurrent COVID-19 surges have led to adaptations of ED triage protocols to better manage patient influx and strain on hospital resources.

Most hospitals in the United States currently use the emergency severity index (ESI) triage tool which has been shown to provide timely, high-quality emergency care for patients.

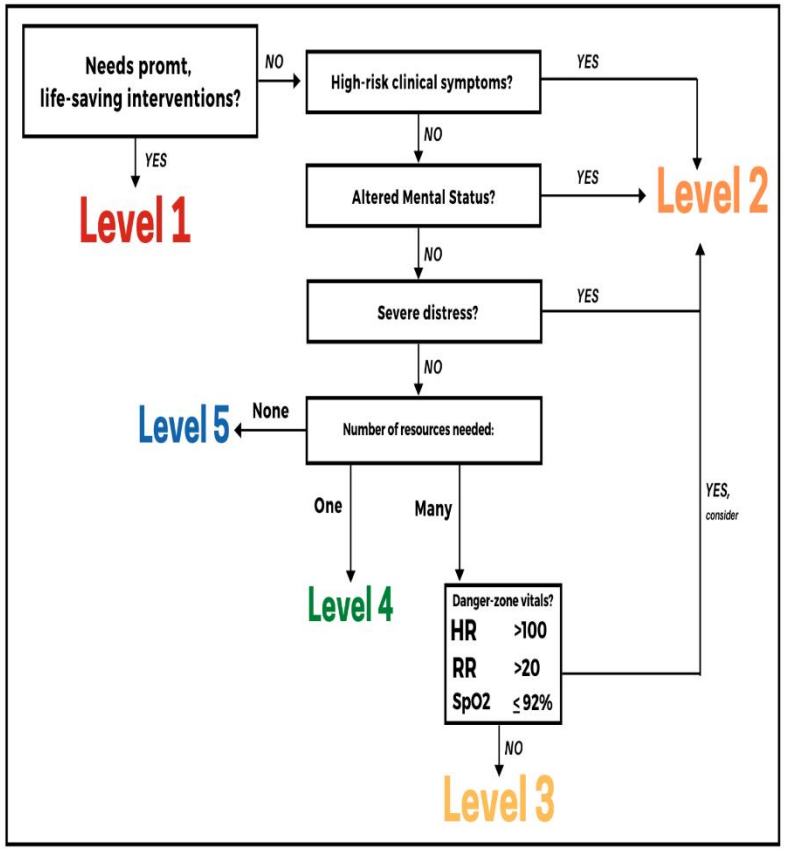
The ESI triage tool is a 5-level triage process initially developed in 1998 by the Agency for Healthcare Research & Quality.

Modified ESI for cancer patients

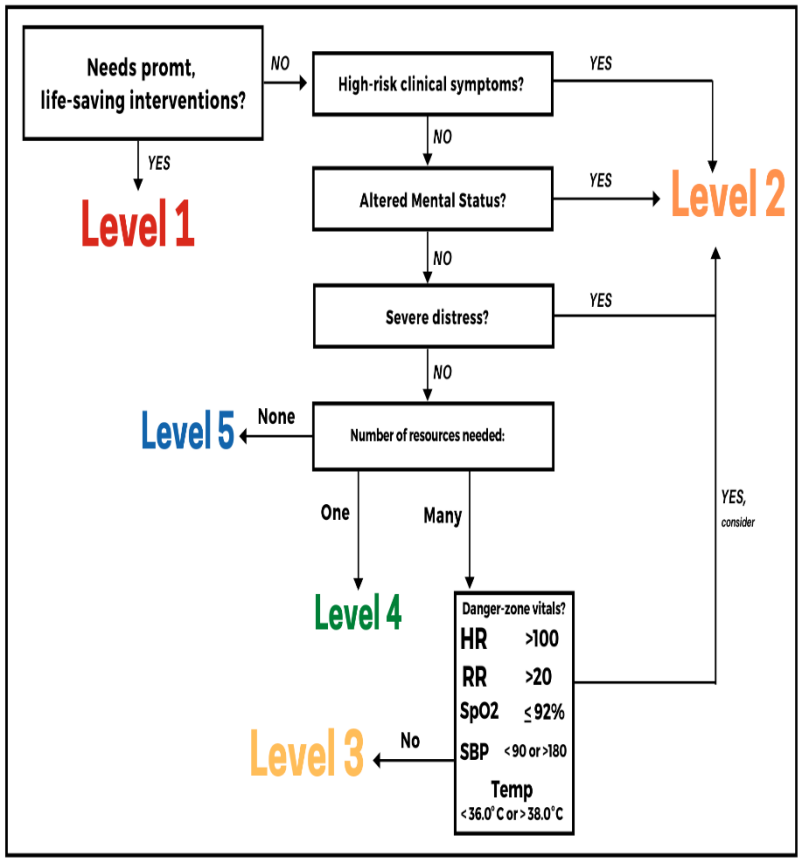
The original version of the ESI algorithm includes heart rate, respiratory rate, and oxygen saturation with age-specific ranges to indicate “danger zone” vital signs, suggesting a high-risk situation prompting a higher-acuity triage level.

ESI was adapted for use at our center, which expanded these potential “danger zone” vital signs to include consideration of systolic blood pressure and temperature vital signs. The ESI algorithm was enhanced at our center to better identify high-risk scenarios commonly seen in cancer patients, such as neutropenic fever and sepsis.

Original ESI



Modified ESI



Objectives and Methods

In the current study, we assessed associations between a modified ESI (mESI) level and disposition, hospital LOS, and overall survival in a large cohort of patients with cancer presenting to the ED and diagnosed with COVID-19 infection.

This retrospective observational study included all cancer patients presenting to the ED at The University of Texas MD Anderson Cancer Center between March 22, 2020, and March 12, 2021, for whom reverse-transcriptase polymerase chain reaction analysis of a nasopharyngeal swab or bronchoalveolar lavage specimen revealed SARS-CoV-2 infection. Excluded patients were those without cancer or with a negative SARS-CoV-2 test result.

Data Collection

Data related to the initial COVID-19 diagnosis were obtained from patient electronic medical records.

Variables collected included modified ESI level, demographic information, comorbidities, vital signs at presentation to the ED, laboratory test results during the ED encounter, ED disposition, and clinical outcomes.

Data were aggregated in the Syntropy platform, Palantir Foundry, as part of the Data-Driven Determinants of COVID-19 Oncology Discovery Effort (D3CODE) protocol at our institution.

Variables

Main Independent Variable was the modified ESI.

The primary outcome variable was ED disposition. Our electronic medical record data indicated whether the patient was a) admitted to the hospital, b) observed in the hospital, or c) discharged to home after the ED visit.

Our secondary outcome variables included hospital LOS among those admitted to the hospital and overall survival. Survival time was calculated from the date of ED presentation for initial COVID-19 diagnosis to the date of death of any cause or last follow-up/contact date with MD Anderson.

Variables

Epidemiologic factors included age, sex, race, ethnicity, smoking status, and body mass index.

Clinical factors included comorbidities and medical interventions during the ED stay, including use of oxygen.

Laboratory values included albumin, lactic dehydrogenase (LDH), and aspartate transaminase, which have previously been shown to be prognostic factors for severity and mortality in patients with COVID-1919.

We focused on these variables because they were available during the ED encounter.

Selected characteristics for the whole population (n = 306) and by triage level

Characteristic	No. (%)		
		Triage level	
	All patients, n=306	Level 2 – emergent, n=138	Level 3 – urgent, n=168
Sex			
Female	134 (43.8)	65 (47.1)	69 (41.1)
Male	172 (56.2)	73 (52.9)	99 (58.9)
Race			
White	201 (65.7)	83 (60.1)	118 (70.2)
Black	49 (16.0)	26 (18.8)	23 (13.7)
Other	56 (18.3)	29 (21.0)	27 (16.1)
Ethnicity			
Hispanic	83 (27.1)	43 (31.2)	40 (23.8)
Non-Hispanic	218 (71.2)	92 (66.7)	126 (75.0)
Unknown	5 (1.6)	3 (2.2)	2 (1.2)
Smoking status			
Never smoker	178 (58.2)	78 (56.5)	100 (59.5)
Former smoker	108 (35.3)	57 (41.3)	51 (30.4)
Current smoker	11 (3.6)	6 (4.3)	5 (3.0)
Unknown	9 (2.9)	3 (2.2)	6 (3.6)
Mean body mass index (range)	29.8 kg/m^2 (±6.7 kg/m^2)	30 kg/m^2 (±6.7 kg/m^2)	29.5 kg/m^2 (±6.8 kg/m^2)
Comorbidities			
Hypertension	233 (76.1)	103 (74.6)	120 (71.4)
Cardiac arrythmia	148 (48.4)	68 (49.3)	80 (47.6)
Diabetes mellitus	144 (47.1)	65 (47.1)	79 (47.0)
Chronic kidney disease	103 (33.7)	41 (29.7)	62 (36.9)
Myocardial infarction	54 (17.6)	26 (18.8)	28 (16.7)
Atrial fibrillation	43 (14.1)	18 (13.0)	25 (14.9)
Obstructive sleep apnea	41 (13.4)	24 (17.4)	17 (10.1)
Non-asthma chronic pulmonary disease	39 (12.7)	17 (12.3)	22 (13.1)
Deep vein thrombosis	38 (12.4)	15 (10.9)	23 (13.7)
Asthma	33 (10.8)	14 (10.1)	19 (11.3)
Congestive heart failure	33 (10.8)	15 (10.9)	18 (10.7)

Continued Table	No. (%)		
		Triage level	
	All patients, n=306	Level 2 – emergent, n=138	Level 3 – urgent, n=168
Obesity	33 (10.8)	17 (12.3)	16 (9.5)
Atherosclerosis	30 (9.8)	13 (9.4)	17 (10.1)
End-stage renal disease	17 (5.6)	6 (4.3)	11 (6.5)
Pulmonary hypertension	8 (2.6)	2 (1.4)	6 (3.6)
Coronary artery disease	6 (2.0)	3 (2.2)	3 (1.8)
Human immunodeficiency virus	3 (1.0)	2 (1.4)	1 (0.6)
Mean no. of comorbidities (standard deviation)	3.14 (2.09)	3.10 (0.16)	3.13 (0.17)
Disposition*			
Discharge	60 (19.6)	17 (12.3)	43 (25.6)
Observation	9 (2.9)	6 (4.3)	3 (1.8)
Inpatient admission*	189 (61.8)	89 (64.5)	100 (59.5)
Intensive care unit admission*	48 (15.7)	26 (18.8)	22 (13.1)
Clinical trajectory			
Mean emergency department length of stay (standard deviation) *	6.35 hours (2.40 hours)	5.97 hours (2.19 hours)	6.67 hours (2.52 hours)
Mean hospital length of stay (standard deviation)	8.20 days (8.65 days)	9.15 days (8.96 days)	7.41 days (8.32 days)
Oxygen requirements*			
Nasal cannula	226 (73.9)	113 (81.9)	113 (67.3)
High-flow nasal cannula	61 (19.9)	37 (26.8)	24 (14.3)
Intubation and mechanical ventilation	23 (7.5)	14 (10.1)	9 (5.4)
Bilevel positive airway pressure	9 (2.9)	3 (2.2)	6 (3.6)

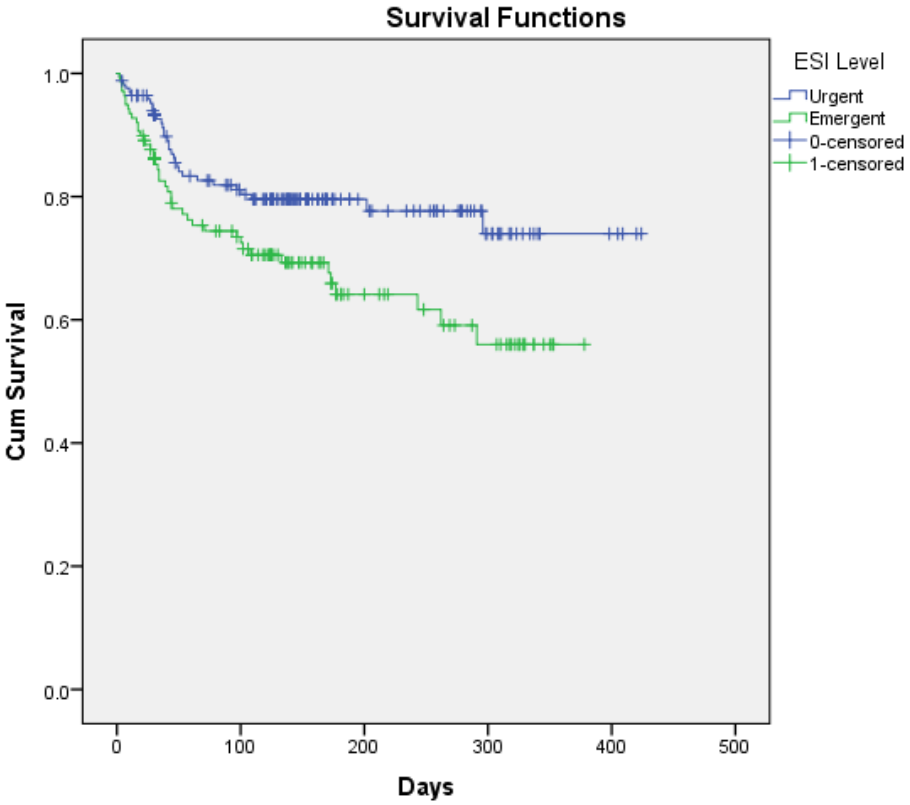
*P<0.05

Laboratory values obtained during the ED visit, for the entire cohort (n = 306) and by triage level.

Laboratory value	No. (%)		
		Triage level	
	All patients, n=306	Level 2 – emergent, n=138	Level 3 – urgent, n=168
Albumin (reference range 3.5-5.2 gm/dL)*			
High	214 (71.1)	99 (71.7)	115 (70.6)
Low	87 (28.9)	39 (28.3)	48 (29.4)
Lactate dehydrogenase (reference range 135-225 U/L)			
High	174 (56.9)	83 (60.1)	91 (54.2)
Low	132 (43.1)	55 (39.9)	77 (45.8)
Alanine aminotransferase (reference range ≤41 U/L)*			
High	78 (25.9)	33 (23.9)	45 (27.6)
Low	223 (74.1)	105 (76.1)	118 (72.4)
Aspartate aminotransferase (reference range ≤40 U/L)†			
High	104 (34.7)	47 (34.1)	57 (35.2)
Low	196 (65.3)	91 (65.9)	105 (64.8)

*Data were missing for 5 patients (all urgent patients). Percentages reflect the number of patients with data available.
†Data were missing for 6 patients (all urgent patients). Percentages reflect the number of patients with data available.
All non-signifcant

Kaplan-Meier curves for overall survival by modified ESI level for the entire cohort (n = 306)



Predictors of overall survival in the multivariable model*

Variable	Hazard ratio	95% confidence interval	p
Albumin			
Normal	1.0		
High	1.833	1.132-2.967	.014
Lactate dehydrogenase			
Normal	1.0		
High	1.792	1.051-3.055	.032
No. of comorbidities (0-17)	1.157	1.046-1.280	.005
Emergency severity index level			
Level 3: Urgent	1.0		
Level 2: Emergent	1.752	1.091-2.811	.020

*Of the candidate variables assessed (age, sex, race, ethnicity, smoking status, body mass index, number of comorbidities, albumin, lactate dehydrogenase, aspartate aminotransferase, alanine transaminase, disposition, and emergency severity index level, COVID-19 chief complaint), only albumin, lactate dehydrogenase, number of comorbidities, and emergency severity index level were significant in the univariate model ($p < 0.05$).

Discussion

Our modified ESI triage tool is strongly associated with disposition, ED LOS, and overall survival in cancer patients with COVID-19.

ESI level was still associated with disposition, ED LOS, and overall survival, even when accounting for laboratory values suggesting that laboratory values do not need to be captured to assign the correct ESI level to a cancer patient with COVID-19.

Our study has a few important limitations. First, it was a retrospective, single-center study in a cancer-specific hospital, which may limit generalizability. We also focused on variables that are available during the ED encounter and that have been linked to prognosis. We did not evaluate every available laboratory test result obtained in these patients. Finally, we used overall survival as our outcome rather than COVID-19–specific mortality and did not account for stage of disease in our analyses.

Conclusions

The COVID-19 pandemic has raised concern about potential negative outcomes related to ED overcrowding and how to avoid these bad outcomes as ED wait times increase.

To the best of our knowledge, the utility of the ESI triage tool in cancer patients with COVID-19 has not been previously studied.

Our findings suggest that in cancer patients with COVID-19, a significant association exists between ESI and ED disposition, ED LOS, and overall survival. Therefore, the ESI triage tool may be used effectively in cancer patients presenting to the ED with COVID-19.

Acknowledgement

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