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ORIGINAL RESEARCH

Comparison of validity of Korean triage and acuity scale levels assessed by triage nurse in real-time and by retrospectively applying strict systemic inflammatory response syndrome criteria in patients with fever

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Abstract

The strict application of vital signs has substantial risk of over-triage. Therefore, this study assessed the predictive value of Korean Triage and Acuity Scale (KTAS) level calculated using strict Systemic Inflammatory Response Syndrome (SIRS) criteria versus that evaluated by a verified triage nurse (TN). The study is based on a retrospective observational cohort of a single-center emergency department (ED) from 01 May 2018 to 30 April 2019. Study subjects were patients aged $\geq$18 years with fever. Intensive care unit admission rate or death in ED (IADE) and general ward admission rate according to two differently defined KTAS levels were compared by receiver operating characteristic curve and logistic regression. A total of 2322 patients were included. In comparing the area under the curves (AUCs) of TN- and SIRS-KTAS, TN-KTAS' predictive power for IADE (0.802) was higher than that of SIRS-KTAS (0.7440, $p = 0.0489$). The odds ratio of level 3 for IADE (1.35) was not significantly different from that of level 4 in SIRS-KTAS ($p = 0.5429$). In KTAS, the severity of illness in patients was more accurately predicted by the triage nurse's decision based on clinical experience than the strict application of SIRS criteria with only vital signs.

Keywords

Emergency service; Triage; Systemic inflammatory response syndrome; Patient acuity; Patient safety; Hospitalization

1. Introduction

The initial triage is an essential process/component in the emergency department (ED) that supports effective and prioritized care to patients while optimizing resource usage and timing [1, 2]. In addition, triage is a critical intervention to manage patient flow safely especially in overcrowded ED [3, 4].

The Korean Triage and Acuity Scale (KTAS) is an emergency patient classification tool developed in 2012 based on the Canadian Triage and Acuity Scale (CTAS) [5, 6]. The scale determines the proper time to first contact with a physician. It stratifies 5 levels of progressively increasing urgency of a patients designating Level 5 "Non-urgency" recommending patients belonging to the category to be seen within 120 minutes, to level 1 requiring immediate care titling the level "Resuscitation".

The allocation of patients to one of the five categories is done through evaluating patients' chief complaints and namely modifiers. The modifiers are physiologic and/or historical information that are applied to determine the appropriate level of urgency [6]. Modifiers include evaluation in respiration, body temperature, hemodynamic status, level of consciousness, pain, bleeding disease and mechanism of injury.

Applied in the scales, the systemic inflammatory response syndrome (SIRS) criteria could be used to screen for patient with fever with suspected infection [7–9]. In KTAS, SIRS can evaluate KTAS levels 2–4 depending on how many criteria are satisfied. KTAS level 2 has 3 positive SIRS criteria and Level 3 satisfies 2 positive SIRS criteria. If a patient has fever as the only SIRS criterion, triage nurse (TN) assesses the patient as level 3 or 4 by his or her general condition (Fig. 1).

Previously, studies on ED patients have shown that mechanical application of vital signs poses a risk of over-triage of patients in the emergency room [10, 11]. Therefore, it is necessary to evaluate the risk that SIRS in KTAS, which evaluates patients only with heart rate, body temperature and respiratory rate, will over-triage ED patients with fever. Because even though white blood cell count is a component of SIRS criteria, it is impossible to measure at the stage of triage it wasn't included as a variable.

We compare validities of the TN-KTAS level evaluated to reflect TN's clinical considerations in real-time for ED patients with fever and of the KTAS level of the same patients calculated retrospectively by applying SIRS criteria (SIRS-

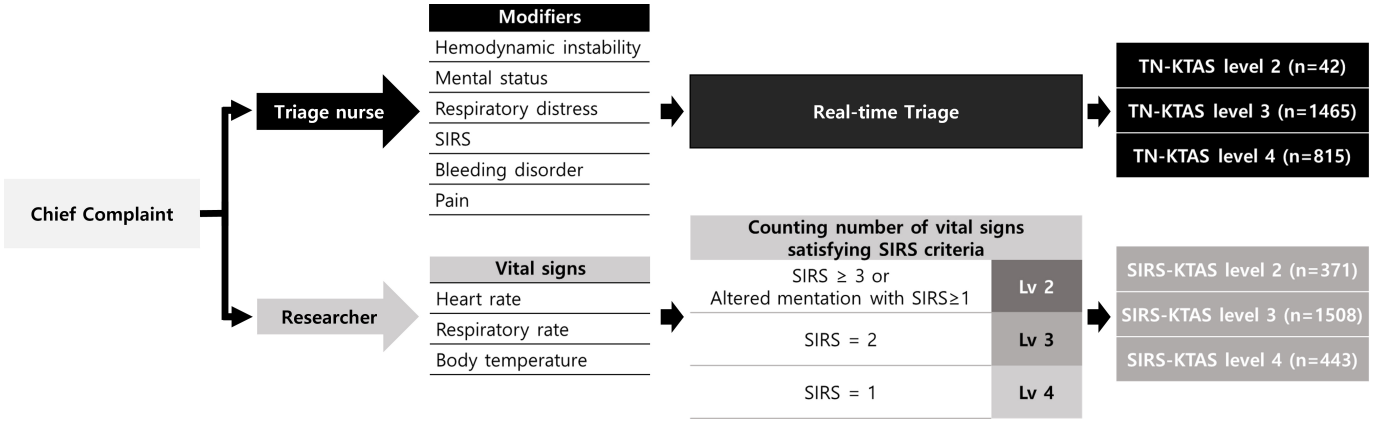

FIGURE 1. Process of triaging with KTAS by TN and simulating retrospective SIRS-KTAS process for study. KTAS: Korean triage and acuity scale; Lv: level; SIRS: systemic inflammatory response system; TN: triage nurse.

KTAS) with the initial vital signs recorded in electrical medical record [12–14].

2. Material and methods

2.1 Study design

This retrospective observational cohort study was performed at our university Seoul Hospital, which is an academic tertiary hospital with an ED that treats an annual average of 40,000 patients. We retrieved the medical records of patients who visited the ED from 01 May 2018 to 30 April 2019. A total of 31,297 patients visited the emergency room during the study period, of which 2381 patients were over 18 years old and had fever (≥38 °C). We did not exclude fever due to non-infectious diseases from the study because triage nurse cannot determine all causes of fever at the triage stage.

2.2 Definition of study population

The TN determined the KTAS level by combination of KTAS modifier and TN's clinical consideration. For example, even if a patient satisfied three SIRS criteria for which KTAS level 2 would have been recommended, TN assigned the patient to KTAS level 4 according to his or her clinical condition. For this study, the researchers retrospectively calculated the same patient's KTAS level with strict application of SIRS criteria based on their vital records (SIRS-KTAS) (Fig. 1). The two levels of the same patients, TN-KTAS and SIRS-KTAS, were compared to show which one projected better differentiation of severity of patients. In SIRS criteria, patients with a body temperature of <36 °C also meet the body temperature criteria. But we excluded patients with a body temperature of <36 °C because the air temperature in Korea is mostly below zero degrees Celsius, and when arriving in the emergency room, the body temperature is often below 36 degrees due to the cold weather. In addition, we excluded patients with hyperthermia due to external sources, such as saunas or hot weather (42 patients). Two patients who were dead on arrival and 15 patients whose data of disposition or vital signs (heart rate, respiratory rate or body temperature) in ED were missing were also excluded (**Supplementary Fig. 1**).

2.3 Study variables

Demographic characteristics were divided into TN-KTAS and SIRS-KTAS groups and compared age, sex, vital signs and disposition according to KTAS level.

2.4 Clinical outcomes

The primary outcomes were intensive care unit (ICU) admission or death in ED (IADE) rate and general ward admission rate according to the KTAS levels. General ward admission or ICU admission included cases in which the patient was transferred to the general ward or ICU of another hospital. If the transfer-out cases were excluded, it might make the selection bias in admission rate. Death in ED is defined as a patient who was alive at the arrival in ED but, died in the emergency room before admission or transfer-out. The outcomes were set as emergency room treatment results like admission or death in ED, since early triage at emergency room was not to predict the patients' long-term prognosis but was to assess early severity of the patient and urgency of emergency treatment.

2.5 Statistical analysis

To evaluate the measure of agreement between SIRS-KTAS and TN-KTAS, a weighted kappa test was performed. The association of triage level with general ward admission and IADE rate was performed using logistic regression. There were 15 cases that were missing in values about disposition (being discharged, admitted to general ward/ICU or death) or vital signs (heart rate, respiration rate, body temperature) in ED. We excluded the cases because disposition and vital signs are important data, cases without pertaining data were excluded because analysis was impossible without them. For descriptive analysis, medians with interquartile ranges or numbers with percentages were reported. For continuous variables, a Kruskal-Wallis test was performed, and Pearson's chi-squared test was used to analyze categorical variables. Statistical significance was set at $p < 0.05$. All analyses were performed Rex ver. 3.6.0 (RexSoft Inc., Seoul, Korea).

3. Results

During the study period, a total of 31,297 patients over 18 years of age visited the ED, and 2381 patients had fever. Finally, 2322 patients were included in the study population. The proportion of patients at SIRS-KTAS level 2 was 16.0%, which was higher than that of TN-KTAS at 1.8% (**Supplementary Fig. 1**).

For the TN-KTAS, as the severity of levels increased (from level 4 to 2), the proportion of patients older than 65 years increased (level 4, 5.9%; level 3, 30.8%; level 2, 59.5%; $p < 0.001$). However, in SIRS-KTAS, the proportion of patients older than 65 years in level 4 (29.4%) was greater than that of level 3 (16.3%). For mean arterial pressure, level 2 was measured higher than level 3 or 4 in SIRS-KTAS ($p = 0.0068$). This is statistically significant, but it was found that the median values between KTAS severity and mean arterial pressure were not clinically related. In TN-KTAS, there was no statistically significant difference in MAP between levels ($p = 0.6352$). Other vital signs and mentation in both groups showed statistically significant differences ($p < 0.001$ in all). In *post-hoc* study, TN-KTAS level 2 did not show any statistical difference from other levels in heart rate and respiratory rate and body temperature. This means that triage nurse decides level 2 patients not only by vital sign but by other conditions. The disposition in ED showed a statistically significant difference according to the SIRS-KTAS level ($p < 0.001$) and to the TN-KTAS levels ($p < 0.001$) (Table 1).

When comparing the area under the curves (AUCs) of TN- and SIRS-KTAS, TN-KTAS' predictive power for IADE (0.802) was higher than that of SIRS-KTAS (0.7440, $p = 0.0489$). The sensitivity of TN-KTAS (0.9857) was higher than that of SIRS-KTAS (0.5857). We also calculated the AUC of TN-KTAS and SIRS-KTAS for general ward admission. The AUC of TN-KTAS (0.7090) was higher than that of SIRS-KTAS (0.5430, $p < 0.001$). The sensitivity values of TN-KTAS (0.9857, 0.9276) in IAED and general ward admission were higher than those of SIRS-KTAS (0.5857, 0.2217). Considering the purpose of triage, low sensitivity increases the risk of missing severely ill patients, so high sensitivity is essential for patient safety. Therefore, TN-KTAS is superior to SIRS-KTAS to predict the IADE and general ward admission in ED (Fig. 2).

In the logistic regression analysis, for general ward admission and IADE, the odds ratio of level 3 (OR = 0.85, 1.35) was not significantly different from that of level 4 in SIRS-KTAS ($p = 0.1618$, $p = 0.5429$). In contrast, for TN-KTAS, the odds ratio for general ward admission and IADE tended to increase sharply as the KTAS grade increased ($p < 0.001$ in all). In addition, for general ward admission and IADE, the odds ratio of level 2 relative to level 4 was greater for TN-KTAS (OR = 78.163, 672.435) than those for SIRS-KTAS (OR = 2.369, 10.884, Table 2).

4. Discussion

The SIRS is a representative tool used to evaluate infected patients and predict their prognosis [7]. However, no study has verified the validity of the level of severity of the patients determined with SIRS within triage tools such as Canadian Triage and Acuity Scale (CTAS) or KTAS. Two conditions must be met to use SIRS as a reliable triage tool. First, it must be verified that SIRS and triage level is appropriately matched to reflect the severity of emergent patients' condition. Second, it needs to be determined whether SIRS criteria are mechanically applied into the triage level or whether it would be just a reference for the final triage level in addition to TNs' clinical experience and expertise.

For the first problem, this study found that KTAS level matching with strict application of the SIRS criteria (SIRS-KTAS level 2; 16.0%) would be over-triaged relative to the clinical consideration of TNs (TN-KTAS level 2; 1.8%). Only 50.7% of level 2 patients required hospitalization among those classified using SIRS-KTAS level 2 (for TN-KTAS, 83.3%) and only 11.1% were admitted to the ICU (for TN-KTAS, 45.2%). The SIRS criteria is a good tool for evaluating and predicting the severity of infectious disease in patients, but the SIRS criteria in KTAS is required modification because the predictive value in KTAS is low.

In addition, this study has shown that the ability to detect severely ill patients is superior with TN-KTAS, which reflects the opinions of the TN, rather than mechanically applying SIRS criteria. A study showed that KTAS level based on the clinical consideration of TNs in pediatric patients predicted the hospitalization rate or ICU admission rate of children more accurately than simulated-KTAS through strict application of classification based on vital signs [10]. Until now, there have been no study on whether the strict application of vital signs or clinical considerations in adult patients more accurately reflects the patient's condition in the ED. Therefore, this study shows that even in adult patients, the clinical consideration of classifiers makes the KTAS classification more accurate than strict application of SIRS criteria.

It is especially important to accurately determine the initial condition of a patient to use limited ED resources most efficiently [15]. If the number of patients evaluated to be level 2 is large, such as when using the SIRS-KTAS, it is virtually impossible to determine the priority in which patient requires ED resources according to the KTAS level.

Prior studies have evaluated the predictive power of the SIRS criteria itself in patients in the emergency room [7, 16]. However, our study showed that the role of the SIRS criteria in KTAS is important as a reference for the TN's evaluation of final KTAS level predicting the severity of illness in patients. The fact that SIRS-KTAS has inferior predictive value for ED outcomes does not mean that the SIRS criteria cannot be used to identify severely ill patients. This means that further research is necessary to verify the appropriateness of matching between the SIRS criteria and KTAS level or to replace SIRS with other sepsis screening tools in KTAS [17–19].

This study has the strength of evaluating the weaker predictive power of the SIRS-KTAS in severely ill patients during triage, which has not been previously analyzed; however, it has the limitation. First, since this retrospective study depends on review of charts that were originally not designed to collect data for research, some information is bound to be missing. Selection and recall biases also affect the results and reasons for differences in treatment between patients and

TABLE 1. Demographic characteristics according to KTAS levels classified by SIRS- and TN-KTAS.

Characteristics	Total	SIRS-KTAS level			*p*-value	TN-KTAS level			*p*-value
		Level 2	Level 3	Level 4		Level 2	Level 3	Level 4	
	(N = 2322)	(N = 371)	(N = 1508)	(N = 443)		(N = 42)	(N = 1465)	(N = 815)	
Age									
18–64 (yr)	1798 (77.4%)	223 (60.1%)	1262 (83.7%)	313 (70.7%)	<0.001	17 (40.5%)	1014 (69.2%)	767 (94.1%)	<0.001
≥65 (yr)	524 (22.6%)	148 (39.9%)	246 (16.3%)	130 (29.4%)		25 (59.5%)	451 (30.8%)	48 (5.9%)	
Sex					0.4817				0.6635
Male	979 (42.2%)	166 (44.7%)	633 (42.0%)	180 (40.6%)		15 (35.7%)	616 (42.0%)	348 (42.7%)	
Female	1343 (57.8%)	205 (55.3%)	875 (58.0%)	263 (59.4%)		27 (64.3%)	849 (58.0%)	467 (57.3%)	
Vital sign									
MAP (mmHg)	91.0 (82.0, 100.0)	93^{a}* (82.5, 103)	92^{b} (82, 101)	90^{ab} (81, 98)	0.0068	92.5 (69.0, 105.5)	91.0 (82.0, 100.0)	92.0 (83.0, 100.0)	0.6325
HR (/min)	102.0 (92.0, 112.0)	106.0^{a} (99.0, 118.5)	105.0^{b} (98.0, 114.0)	84.0^{ab} (78.0, 88.0)	<0.001	106.5 (95.0, 126.3)	103.0^{a} (92.0, 114.0)	100.0^{a} (93.0, 109.0)	<0.001
RR (/min)	18.0 (18.0, 20.0)	22.0^{ab} (22.0, 22.0)	18.0^{a} (18.0, 20.0)	18.0^{b} (18.0, 20.0)	<0.001	20.0 (18.0, 21.0)	20.0^{a} (18.0, 20.0)	18.0^{a} (18.0, 20.0)	<0.001
BT (°C)	38.6 (38.2, 39.1)	38.7^{a} (38.2, 39.3)	38.7^{b} (38.3, 39.2)	38.3^{ab} (38.1, 38.8)	<0.001	38.8 (38.2, 39.6)	38.7^{a} (38.2, 39.6)	38.5^{a} (38.2, 38.9)	<0.001
Mentation					<0.001				<0.001
Alert	2245 (96.7%)	294 (79.3%)	1508 (100%)	443 (100%)		17 (40.5%)	1414 (96.5%)	814 (99.9)	
Verbal response	46 (2.0%)	46 (12.4%)	0 (0.0%)	0 (0.0%)		8 (19.1%)	38 (2.6%)	0 (0.0%)	
Pain-response	29 (1.3%)	29 (7.8%)	0 (0.0%)	0 (0.0%)		16 (38.1%)	12 (0.8%)	1 (0.1%)	
Unresponsive	2 (0.1%)	2 (0.5%)	0 (0.0%)	0 (0.0%)		1 (2.4%)	1 (0.1%)	0 (0.0%)	
Disposition					<0.001				<0.001
Discharge	1589 (68.4%)	183 (49.3%)	1097 (72.8%)	309 (69.8%)		7 (16.7%)	816 (55.7%)	766 (94.0%)	
Ward	663 (28.6%)	147 (39.6%)	387 (25.7%)	129 (29.1%)		16 (38.1%)	599 (40.9%)	48 (5.9%)	
ICU or Death	68 (3.0%)	41 (11.1%)	24 (1.6%)	5 (1.1%)		19 (45.2%)	50 (3.4%)	1 (0.1%)	

*BT: body temperature; HR: heart rate; ICU: intensive care unit; KTAS: Korean Triage and Acuity Scale; MAP: mean arterial pressure; RR: respiratory rate; SIRS: systemic inflammatory response syndrome; TN: triage nurse. *Groups with statistically significant differences are labeled with the same letter; "a" or "b".*

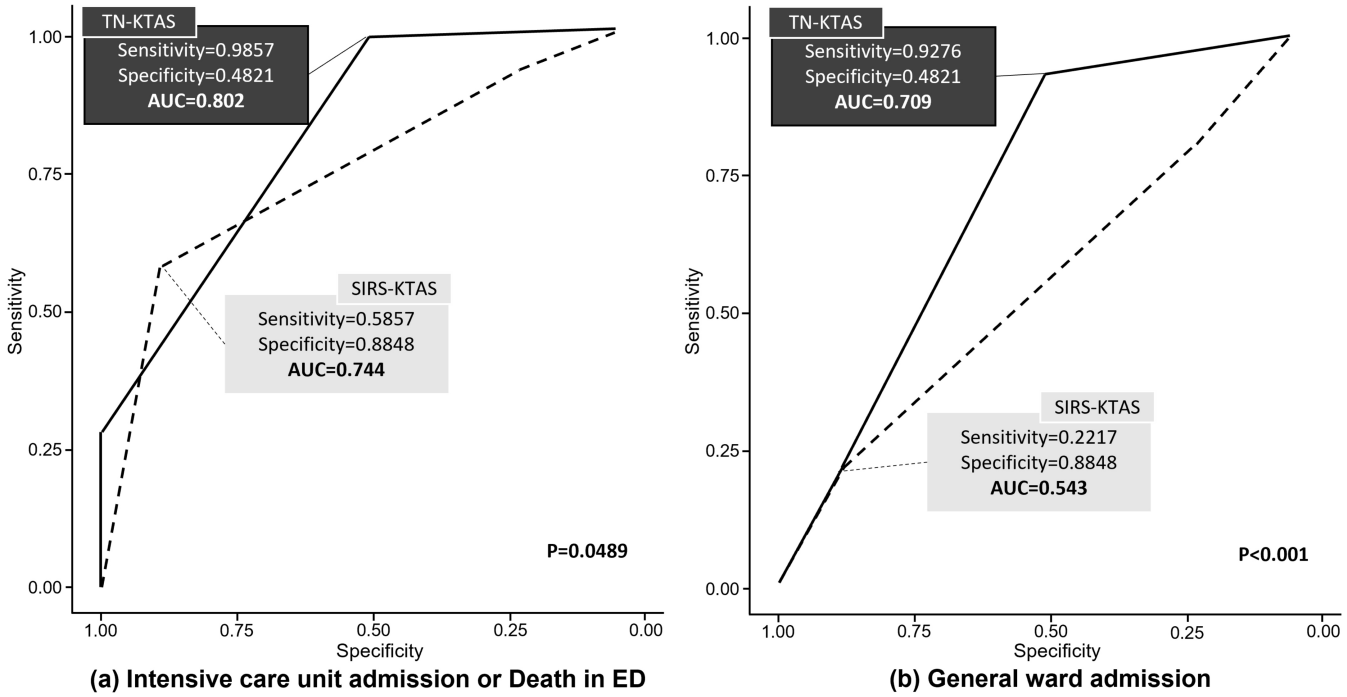

FIGURE 2. Receiver operating characteristic curve of SIRS-KTAS and TN-KTAS predicting. (a) Intensive care unit admission or death in ED and (b) general ward admission. ED: emergency department; KTAS: Korean Triage and Acuity Scale; SIRS: systemic inflammatory response syndrome; TN: triage nurse.

TABLE 2. Odds ratio of general ward admission and Intensive Care Unit (ICU) admission or death in ED by SIRS- and TN-KTAS.

KTAS Levels	Total number	General ward admission		*p*-value	ICU admission or death in ED		*p*-value
		Number (%)	Odds Ratio (95% CI)		Number (%)	Odds Ratio (95% CI)	
SIRS-KTAS							
Level 4	443	134 (30.3)	reference		5 (1.1)	reference	
Level 3	1508	411 (27.3)	0.85 (0.67, 1.07)	0.1618	24 (1.6)	1.35 (0.51, 3.57)	0.5429
Level 2	371	188 (50.7)	1.92 (1.43, 2.59)	<0.001	41 (11.1)	13.85 (5.38, 35.66)	<0.001
Level 3	1508	411 (27.3)	reference		24 (1.6)	reference	
Level 2	371	188 (50.7)	2.28 (1.78, 2.91)	<0.001	41 (11.1)	10.24 (6.04, 17.35)	<0.001
TN-KTAS							
Level 4	815	48 (6.0)	reference		1 (0.1)	reference	
Level 3	1465	599 (42.3)	11.71 (8.59, 15.97)	<0.001	50 (5.8)	46.94 (6.47, 340.59)	<0.001
Level 2	42	16 (70.0)	36.48 (14.32, 92.90)	<0.001	19 (73.1)	2079.14 (243.61, 11,744.83)	<0.001
Level 3	1465	599 (42.3)	reference		50 (5.8)	reference	
Level 2	42	16 (70.0)	3.11 (1.27, 7.62)	0.0128	19 (73.1)	44.30 (17.79, 110.31)	<0.001

CI: confidence interval; ED: emergency department; KTAS: Korean Triage and Acuity Scale; SIRS: systemic inflammatory response syndrome; TN: triage nurse.

lost follow ups can often not be ascertained and may lead to bias. However, this study minimized the selection bias, including all fever patients who visited the emergency room for one year, and eliminated the selection bias of clinical results by including transfer-out patients in the emergency room. Second, the ED experience of TN is not included when analyzing the effects of the clinical determination of TNs. Although the TN has at least one year of emergency room experience, and is properly qualified by KTAS training course, it can be expected that difference of TN's ED experience could affect the triage results. In the future, it will be necessary to study the factors influencing the clinical decision of the TN. Third, we could not rule out the possibility that external factors such as crowding influenced the triage results. If there are many patients at the same in ED, there may not be sufficient time for triage, and the possibility of this lowering the validity of the triage result cannot be ruled out. However, since KTAS is a triage scale with a simple and objective algorithm for selecting main symptoms and considerations, this impact is also thought to have been minimized. Lastly, the present study was conducted in a single tertiary hospital center, which may limit the generalizability of the results. However, we believe that our study highlights important discussion points for future studies, supporting a more accurate triage scale for patients.

5. Conclusions

This study found that the severity of illness in patients can be more accurately predicted when the clinical consideration of the TN is reflected, rather than mechanically applying the SIRS criteria. Information not included in the SIRS criteria is speculated to have influenced the classification decisions of TNs. Eventually, future studies will need to develop criteria within the triage scale to provide more accurate information for patients to TNs, and high-quality education and training for them will be continuously required.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study are available on reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

JP—designed the research study. JP, HJ and DK—performed the research. JP and HJ—analyzed the data. HJ and DK—wrote the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

We obtained the Institutional Review Board of our university Seoul Hospital (SCHUH 2021-02-008) for data analysis of electronic medical record and it was collected. We obtained the written consent for data collection.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://oss.signavitae.com/mre-signavitae/article/1777222490954579968/attachment/Supplementary%20material.docx.

REFERENCES

[1] Iserson KV. Ethics, personal responsibility and the pandemic: a new triage paradigm. The Journal of Emergency Medicine. 2022; 62: 508–512.

[2] Ennis JS, Riggan KA, Nguyen NV, Kramer DB, Smith AK, Sulmasy DP, *et al*. Triage procedures for critical care resource allocation during scarcity. JAMA Network Open. 2023; 6: e2329688.

[3] Heslin SM, Viccellio P. Overcrowding, triage, and care rationing. Urban Emergency Medicine (pp. 184–190). 1st edition. Cambridge University Press: United of Kingdom. 2023.

[4] AlShatarat M, Rayan A, Eshah NF, Baqeas MH, Jaber MJ, AL-Bashtawy M. Triage knowledge and practice and associated factors among emergency department nurses. SAGE Open Nursing. 2022; 8: 237796082211305.

[5] Park J, Lim T. Korean triage and acuity scale (KTAS). Journal of The Korean Society of Emergency Medicine. 2017; 28: 547–551.

[6] Beveridge R. The Canadian emergency department triage and acuity scale: a new and critical element in health care reform. Journal of Emergency Medicine. 1998; 16: 507–511.

[7] Gando S, Shiraishi A, Abe T, Kushimoto S, Mayumi T, Fujishima S, *et al*. The SIRS criteria have better performance for predicting infection than qSOFA scores in the emergency department. Scientific Reports. 2020; 10: 8095.

[8] Bone RC, Balk RA, Cerra FB, Dellinger RP, Fein AM, Knaus WA, *et al*. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. Chest. 1992; 101: 1644–1655.

[9] Evans L, Rhodes A, Alhazzani W, Antonelli M, Coopersmith CM, French C, *et al*. Surviving sepsis campaign: international guidelines for management of sepsis and septic shock 2021. Intensive Care Medicine. 2021; 47: 1181–1247.

[10] Sun J, Chung H, Jang H, Kim S, Lee Y, Park J. Validation of systemic inflammatory response syndrome criteria without white blood cell count in Korean triage and acuity scale. Journal of The Korean Society of Emergency Medicine. 2019; 30: 232–238.

[11] Lee B, Kim DK, Park JD, Kwak YH. Clinical considerations when applying vital signs in pediatric Korean triage and acuity scale. Journal of Korean Medical Science. 2017; 32: 1702.

[12] Moon S-H, Shim JL, Park K-S, Park CS. Triage accuracy and causes of

mistriage using the Korean triage and acuity scale. PLOS ONE. 2019; 14: e0216972.

[13] Levis-Elmelech T, Schwartz D, Bitan Y. The effect of emergency department nurse experience on triage decision making. Human Factors in Healthcare. 2022; 2: 100015.

[14] Hwang S, Shin S. Factors affecting triage competence among emergency room nurses: a cross-sectional study. Journal of Clinical Nursing. 2023; 32: 3589–3598.

[15] Lee JY, Oh SH, Peck EH, Lee JM, Park KN, Kim SH, *et al*. The validity of the Canadian triage and acuity scale in predicting resource utilization and the need for immediate life-saving interventions in elderly emergency department patients. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2011; 19: 68.

[16] Usman OA, Usman AA, Ward MA. Comparison of SIRS, qSOFA, and NEWS for the early identification of sepsis in the Emergency Department. The American Journal of Emergency Medicine. 2019; 37: 1490–1497.

[17] Oduncu AF, Kıyan GS, Yalçınlı S. Comparison of qSOFA, SIRS, and NEWS scoring systems for diagnosis, mortality, and morbidity of sepsis in emergency department. The American Journal of Emergency Medicine. 2021; 48: 54–59.

[18] Ruangsomboon O, Boonmee P, Limsuwat C, Chakorn T, Monsomboon A. The utility of the rapid emergency medicine score (REMS) compared with SIRS, qSOFA and NEWS for predicting in-hospital mortality among patients with suspicion of sepsis in an emergency department. BMC Emergency Medicine. 2021; 21: 2.

[19] Wang C, Xu R, Zeng Y, Zhao Y, Hu X. A comparison of qSOFA, SIRS and NEWS in predicting the accuracy of mortality in patients with suspected sepsis: a meta-analysis. PLOS ONE. 2022; 17: e0266755.

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