

Emergency service units in Turkey don't have enough resources to implement the one-hour sepsis bundle components and sepsis guidelines recommendations, 238 emergency department directors opinion

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Abstract

Aim: Aim of this study is to investigate whether emergency rooms in Turkey have sufficient resources to treat sepsis patients. Sepsis has a high incidence and can result in multiple organ failure and death within hours if not rapidly intervened. Septic patients, are generally first admitted to the emergency departments. In the management of these patients, it is very important to have well-knowledge team and enough resources.

Materials and Methods: A questionnaire regarding whether education and emergency room resources were sufficient to diagnose and treat sepsis was e-mailed to the directors of emergency department. Data collection took place from December 17, 2019 to December 27, 2019.

Results: The study included 238 participants, of who worked in university hospitals, training and research hospitals, state hospitals, and in private hospitals. The first health care professional to examine emergency patients was a physician in 162 of the hospitals, and a nurse in 76. Sepsis treatment was delayed due to laboratory test delays in 77 hospitals, triage patient non-determinability in 62, and diagnosis delays in 33. Staffing was inadequate, with 54 participants reporting difficulties in reaching an emergency medicine physician, 124 in reaching an infectious disease physician, 203 in reaching a microbiologist, and 125 in reaching an intensive care physician.

Conclusion: Emergency rooms in Turkey suffer from limited resources to properly implement sepsis treatment guidelines and bundles. Resources should be improved.

Keywords: Emergency room; implementation; resources; sepsis bundle; Turkey

INTRODUCTION

Sepsis, a life-threatening syndrome that is caused by a dysregulated host response to severe infection, is estimated to account for between 2% and 6% of all hospital admissions, and to be associated with in-hospital mortality rates of up to 15% (1). The World Health Organization recently estimated, of the 30 million annual cases of sepsis that are recorded worldwide, 6 million result in death, highlighting the high mortality rates that result in the absence of early intervention (2). In Turkey, the mortality rate is 55.7% for severe sepsis, and 70.4% for septic shock in intensive care (3). From an epidemiological standpoint, 70% of sepsis cases are community-acquired from common emergency room diseases; therefore, rapid recognition and treatment of sepsis is paramount in the emergency room setting (4,5). Sepsis findings are often

subtle especially in the elderly and immunosuppressive patients and can be confused with many diseases (6,7). The level of knowledge of the physician who will handle these patients first and the adequacy of the emergency resources are extremely important. This study examines the current state of hospital emergency services infrastructure in Turkey, with a particular focus on the ability of Turkish emergency rooms to implement current recommendations for Survival sepsis campaign guideline and one-hour sepsis bundle.

MATERIAL and METHODS

Study data was collected via an online Turkish language questionnaire regarding infrastructure and personnel requirements for sepsis recognition and treatment: the questionnaire was hosted on the Survey Monkey platform

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(<https://tr.surveymonkey.com/r/DX5879J>). We prepared an 18-question questionnaire (appendix) to investigate whether emergency department conditions are appropriate to implement the one-hour sepsis bundle and sepsis guide recommendations. Four questions were related to the general structure of the clinic, eight questions related to sepsis and five questions related to the minimal needs of the emergency room. Questions about sepsis information were prepared from Surviving sepsis campaign's 1 hour bundle components and 2016 sepsis guide. The minimal needs of the emergency department were also prepared from the emergency department and its resources guidelines (8). The validation of the questionnaire was done by the expert panel created by three intensive care specialists and four emergency professors. Reliability analysis was carried out using cronbach alpha to determine the internal consistency of the questionnaire. Only 8 questions related to sepsis had the defined correct answer in the questionnaire. Cronbach alpha value is 0.72. Email invitations to participate in the study were sent to 238 emergency department directors healthcare professionals who worked in hospital emergency room located in high population cities within Turkey's seven main states through Emergency Medicine Physicians Association in Turkey (ATUDER); 238 of them responded, forming the group of study participants. The detailed study protocol was prepared and sent by link with invitation email to study participants, who were asked to respond

to the questionnaire during the ten days commencing 17th December 2019. The study questionnaire included questions regarding the facilities in hospital emergency rooms and the ability of those emergency rooms to implement guidelines for the diagnosis and treatment of sepsis. The questionnaire asked about difficulties in obtaining resources, and whether it was possible for treating physicians to access the necessary resources within one hour of identifying a case of suspected sepsis: resources were deemed to be "difficult to obtain" if it took longer than one hour to access them (Figure 1).

Ethics

Ethical approval for this study was obtained from the Gaziantep University ethics committee (protocol no: 2019/473). A copy of the ethical approval was given to each study participant (emergency medicine physicians), who completed a written informed consent form prior before their participation in the study.

Statistical Analysis

Statistical analysis included calculations of frequency of accessed material and equipment, percentages of resources and descriptive statistics. Specifically, categorical variables were analyzed using the chi-square test and continuous variables were analyzed using the Student's t-test. All analyses were performed using the SPSS Statistics V022.0 software, and the significance level was set at $P < 0.05$.

Table 1. Demographic Characteristics

	Number of study participants (%)
Hospital Type	
University	127 (53.36%)
Training and Research	75 (31.51%)
Stateowned	31 (13.03%)
Privately owned	5 (2.10%)
Health professional who first examines emergency patients	
Physician	162 (68.06%)
Nurse	76 (31.93%)
Emergency experience of the first health professional to examine patient	
Up to one year	120 (50.42%)
Between one and five years	45(21.63%)
Five years and more	43 (18.07%)
Sepsis recognition tool implementation	
SSC resuscitation bundle	95 (39.92%)
In-house resuscitation bundle	78 (32.77%)
Nothing	65 (27.31%)
Does emergency room use a sepsis recognition algorithm?	
Yes	121 (50.84%)
No	117 (49.16%)
Does the unit provide regular sepsis training?	
Yes	72 (30.25%)
No	166 (69.75%)
Resources that are unobtainable within one hour of sepsis diagnosis	
Laboratory tests required to calculate SOFA score	98 (41.17%)
Culture growth medium	140 (58.82%)
Reasons for delays in sepsis treatment?	
Delayed laboratory results	77 (32.35%)
Non-determinability of triage patients	62 (26.05%)
Delayed sepsis recognition by physician	33 (13.87%)

SSC: Surviving sepsis campaign, SOFA: Sequential Organ Failure Score

RESULTS

Study data was collected from participants who worked at 238 different hospitals (participating hospitals), of which 141 (59.42%) were hospitals with over 500 beds. The participating hospitals were categorized as follows: 127 (53.36%) were university hospitals, 75 (31.51%) were training and research hospitals, 31 (13.03%) were non-university state hospitals, and 5 (2.11%) were private hospitals. Emergency patients were examined first by physician at 162 (68.06%) of the hospitals, and first by nurses at the remaining 76 (31.93%). Moreover, 120 (50.42%) of the healthcare professionals (physician or

nurse) who first examined the emergency patients had up to one year of emergency-healthcare experience, 75 (31.51%) had between one and five years of experience and 43 (18.07%) had over five years of experience. Regarding sepsis management approaches, 95 (39.92%) of the participating hospitals were using resuscitation care bundles designed by the Surviving Sepsis Campaign (SSC), 78 (32.77%) were implementing their own resuscitation bundle, and 65 (27.31%) had not implemented any specifically designed resuscitation bundles. While 121 (50.84%) of the participating hospitals used a sepsis algorithm to detect sepsis, 117 (49.16%) did not.

Table 2. Unobtainable or difficult to access resources

	Number of study participants n (%)
Personnel	
Emergency medicine physician	54 (22.68%)
Infectious disease physician	124 (52.10%)
Microbiologist	203 (85.29%)
Intensive care physician	125 (52.25%)
Laboratory technician	96 (40.33%)
Pharmacist	115 (48.31%)
General practitioner	137 (57.56%)
Nurse	22 (9.24%)
Midwife	159 (66.81%)
Medications	
Third-generation cephalosporin	48 (20.17%)
Fourth-generation cephalosporin	151 (63.45%)
Piperacillin/tazobactam	139 (58.41%)
Carbapenem	137 (57.57%)
Vancomycin/teicoplanin	141 (59.25%)
Linezolid	158 (66.39%)
Macrolide	93 (39.07%)
Tigecycline	176 (73.95%)
Anti-fungals	172 (72.27%)
Anti-HIV medication	225 (94.54%)
Anti-tuberculosis medication	208 (87.39%)
Anti-malarial medication	216 (90.75%)
Fluid and blood product replacement	
Crystalloid	19 (7.98%)
Colloid	107 (44.95%)
Albumin	178 (74.79%)
Erythrocyte suspension	104 (43.69%)
Plasma	105 (44.11%)
Cryo	156 (65.54%)
Vasopressors/positive inotropes	
Noradrenaline	27 (11.30%)
Dopamine	16 (6.72%)
Dobutamine	46 (19.32%)
Adrenaline	8 (3.36%)
Vasopressin	80 (33.61%)
Infusion pump	59 (24.78%)
Blood pressure invasive	189 (79.41%)
Hydrocortisone	73 (30.67%)

HIV: Human immune deficiency

A specific member of staff was responsible for providing regular sepsis training in 72 (30.25%) of the participating hospitals, with no-one specifically assigned to providing sepsis training in 166 (69.75%) of the hospitals. When asked what resources were most difficult to access within the first hour of a suspected sepsis case, 98 (41.17%) participants reported that components of the SOFA score were difficult to access, and 140 (58.82%) participants reported that access to culture growth media was problematic. When asked what is the main reasons for delay in sepsis treatment 77 (31.35%) participants reported late laboratory results, 62 (26.05%) participants reported patient non-determinability in triage and 33 (13.87%)

participants reported delays in physician diagnosis. Further details are given in Table 1. When asked about difficulties they faced when trying to obtain assistance from specific healthcare professionals. 54 (22.68%) participants reported difficulties in reaching an emergency medicine physician, 124 (51.20%) participants reported difficulties in reaching an infectious disease physician, 125 (52.25%) participants reported difficulties in reaching an intensive care physician, and 203 (85.29%) participants reported difficulties in reaching a microbiologist. When asked about problems they encountered when seeking to initiate specific treatments for sepsis ; fourth generation cephalosporin was difficult to obtain for 151 (63.45%)

Table 3. Unobtainable or difficult to access equipment

	Number of study participants n (%)
Sedoanalgesia	
Intravenous-anesthesia	40 (16.81%)
Sedatives	33 (13.86%)
Intravenous-opioids	43 (18.06%)
Oralopioids	187 (78.57%)
Oxygenation	
Peripheral oximeter	53 (22.26%)
Oxygen mask	22 (9.24%)
NIMV	65 (27.31%)
IMV	87 (36.55%)
Catheterization /Nutrition	
Central catheter	60 (25.21%)
Hemodialysis catheter	64 (26.89%)
Enteral nutrition	180 (75.63%)
Laboratory Tests	
aPTT/INR	5 (2.10%)
CRP	21 (8.82%)
Procalcitonin	119 (50.00%)
Cultures	
Bronchoalveolarlavage culture	217 (91.17%)
Urine culture	114 (47.89%)
Blood culture	126 (52.94%)
Catheter culture	148 (62.18%)
Pleural fluid culture	147 (61.76%)
Cerebrospinal fluid culture	143 (60.08%)

NIMV:Non-invasive mechanical ventilation,IMV:Invasive mechanical ventilation, aPTT:Activated partial thromboplastin time, INR: International normalized ratio, CRP:C-reactive protein

participants, piperacillin tazobactam for 139 (58.41%) participants, carbapenem for 137 (57.57%) participants, glycopeptides for 141 (59.25%) participants, antifungals for 172 (72.27%) participants, anti-HIV medications for 225 (95.54%) participants, anti-tuberculosis medications for 208 (87.39%) participants, antimalarial medications for 216 (90.75%) participants, and noradrenaline for 27 (11.30%) participants. More details regarding difficulties in obtaining medications to treat sepsis are given in Table 2. Again, we investigated in the emergency room whether some key medicines used in intensive care patients are

in relatively short supply. 40 (16.81%) participants stated that they had problems reaching intravenous anesthetic drugs, 33 (13.86%) participants had problems reaching sedatives, 43 (18.06%) participants had problems reaching intravenous opioids and 187 (78.57%) participants had problems reaching oral opioids. It is important to ensure oxygenation in sepsis. When we examined the possibilities related to oxygenation, 53 (22.26%) participants stated that they had difficulties in reaching the peripheral oximeter, 22 (9.24%) participants had difficulties in reaching oxygen mask, 65 (27.31%) participants had

difficulties in reaching noninvasive mechanical ventilator and 87 (36.55%) participants had difficulties in reaching invasive mechanical ventilator. When we questioned the sources regarding catheterization and nutrition, 60 (25.21%) participants stated that they could not reach the central catheter, 64 (26.89%) participants could not reach the hemodialysis catheter, and 180 (75.63%) participants stated that they could not reach the enteral nutrition. When we questioned the parameters and cultures that should be looked at for the effectiveness of the treatment and for the purpose of de-escalation, 21 (8.82%) participants could not measure C-reactive protein, 119 (50.00%) participants could not measure procalcitonin, 217 (91.17%) participants could not obtain bronchoalveolar lavage culture, 126 (52.94%) participants could not obtain blood culture and lastly 143 (60.08%) participants stated that they could not get cerebrospinal fluid culture. When we asked the laboratory consumables which were difficult to obtain 126 (52.94%) participants reported that, the blood culture medium, 143 (60.08%) participants fluid culture medium, 119 (50%) participants procalcitonin levels measurement, and 189 (79.41%) participants the material required for the monitoring and measurement of invasive blood pressure. More details regarding difficulties in obtaining laboratory consumables are given in Table 3. 114 participants (47.90%) reported lack of hospital isolation room, and 164 participants (68.91%) reported lack of intensive care facilities within the hospital emergency department. More details regarding sepsis hospital emergency facilities are given in Table 4.

Table 4. Totally unavailable in emergency room

	n (%)
Bedside radiography	139 (58.40%)
Bedside ultrasonography	110 (46.21%)
Bedside echocardiography	118 (49.57%)
Emergency service computed tomography	74 (31.09%)
Emergency service magnetic resonance imaging	160 (67.22%)
Emergency service angiography	218 (91.59%)
Emergency service electrocardiography	3 (1.26%)
Emergency service endoscopy	232 (97.47%)
Emergency service bronchoscopy	234 (98.31%)
Emergency intensive care	164 (68.91%)
Emergency isolation room	114 (47.90%)
Emergency resuscitation room	41 (17.23%)

DISCUSSION

To the best of the authors' knowledge, this is the first national study examining sepsis emergency service infrastructures, focusing on use of sepsis bundles and treatment guidelines in Turkey. This study reveals that some hospital emergency departments in Turkey do not have all of the necessary resources to properly implement

sepsis management guidelines. Most of the study participants worked at large university hospitals: 127 (53.36%) participants worked in university hospitals and 141 (59.24%) of the participating hospitals had more than 500 beds. In the context that sepsis is a complex syndrome that is difficult to diagnose accurately, it is surprising that 76 (31.93%) participants reported that patients were first seen by nurses rather than doctors. There is no currently accepted "gold standard" method or laboratory result that facilitates easy detection of sepsis, and rapid intervention is key to saving the lives of sepsis patients. Recently published recommendations for new sepsis treatment practices cannot always be implemented, especially in countries with limited resources. Although regular training of healthcare professionals who work at the "front-line" of sepsis management is critical (9), only 72 (30.25%) participants reported that their hospital provided regular training and, worryingly, 116 (69.75%) participants reported that no training whatsoever was provided at their hospital. While theoretical specialist knowledge is generally of a high level in developing countries, the translation of theory into practice frequently presents difficulties; these difficulties should be addressed through high quality and regular training of both doctors and nurses (10, 11). Relatively few small or private hospitals participated in this study. It is also interesting to note that 120 (50.42%) participants reported that, in their hospital, the healthcare professional who first examines potential sepsis patients has only one year of emergency care experience. It has been reported that training for sepsis management has a cost corrective effect (12,13). In this context, despite significant increases in healthcare spending since 2002, Turkey remains a country with one of the lowest healthcare expenditures among Organization for Economic Cooperation and Development (OECD) countries. The increasing importance of proper sepsis-related training is highlighted by the high cost of treating sepsis in developing countries with limited resources (14). A number of studies have demonstrated that implementation of SSC guidelines decreases overall mortality, time spent in intensive care units (ICUs), and time spent in hospitals, with an estimated 25% decrease in mortality being attributed to SSC guideline implementation (15,16). Of the 238 hospitals that participated in this study, 95 (39.92%) were implementing an SSC sepsis resuscitation bundle, 78 (32.77%) were implementing their own in-house bundle, and 65 (27.31%) were not implementing any bundle. In a recent study of ICUs in Turkey, by Baykara et al., the authors argued that treatment delays and poor compliance with sepsis treatment guidelines are the probable strongest causes of mortality in ICUs in Turkey (3). However, even when established guidelines are properly disseminated, and their implementation has been actively requested, barriers to implementation persist in countries with limited resources (11,17). There is no currently agreed criterion by which to first diagnose sepsis, and this problem is frequently aggravated in elderly and other immune compromised patients. Typically, emergency medicine physicians should seek to contact the responsible intensive care

physicians and infectious disease physician as soon as possible after detecting a suspected sepsis case (18). Our study showed that, in such cases, 124 participants (52.10%) had had trouble in contacting infectious disease physicians, and 203 participants (85.29%) had had trouble in contacting microbiologists. ICU facilities are required for advanced sepsis management (10). Our study showed that only 114 (47.90%) of the participating hospitals had an isolation room, and 164 (68.91%) did not have emergency room intensive care facilities; these observations explain, at least in part, the insufficient sepsis management in Turkey. Furthermore, 126 participants (52.94%) reported difficulties in performing blood cultures, and 143 (60.08%) reported difficulties in taking cerebrospinal liquid samples in their hospital emergency departments. In the sepsis guidelines, it is recommended that intravenous antibiotic is administered within one hour of sepsis diagnosis and cultures from suspicious sources are taken prior to antibiotic administration (19). In cases of sepsis, delays in antibiotic administration cause linear increases in mortality (20). In this context, this study finds worrying difficulties in obtaining the medications needed to treat sepsis. While sepsis guidelines do not emphasize protocolization and invasive monitoring, they do emphasize frequent clinical evaluation of sepsis patients; this is only possible if there are sufficient numbers of healthcare professionals available in already busy and crowded emergency rooms (19). Indeed, insufficient staffing has been stated as being the most significant barrier to the recognition of sepsis patients in the emergency room setting (21), and difficulties in early sepsis recognition (16). A number of previous studies have shown additional negative consequences from critical patients having long stays in emergency services (22-25).

For example, a recent study of compliance with the SSC resuscitation bundle, whereby 770 patients were examined during the period 2008-2012, revealed a failure to implement the bundle within acceptable timescales (26). It is frequently difficult to physically accommodate patients within current ICU facilities in countries whose health systems have limited resources (17). This is illustrated by a recent study of 94 hospitals in Turkey, where the bed occupancy rate was reported to average 92.7% (3). Similarly, another study into the status of ICUs in Turkey found the average bed occupancy rate of 67 ICUs to be 88% (27). Although ICUs units in Turkey have similar numbers of beds to those in Western European countries, they tend to be occupied with only the most needy patients admitted; this situation is mainly due to a lack of post-ICU care facilities and a legal obligation to support to terminally ill patients. Therefore, in Turkey, most patients that need ICU care begin their treatment in emergency or other hospital departments (3). In a prospective three-month study of 1311 emergency service patients in a university hospital in Turkey, an average time of 459 minutes (7.39 ± 0.73 hours) was needed for diagnosis, and patients stayed for an average time of 2134 minutes (35.29 ± 3.29 hours) in the emergency service department (28). Similarly, in a retrospective

single center study carried out over a one-year period in Turkey, out of the 163,951 patients who visited the emergency service department, 1,210 of them re-visited the same emergency service department within 24-hours, and they stayed in the emergency service department for an average 164.1 minutes (29). It has been shown that emergency service departments and ICU overcrowding negatively affects sepsis patient outcomes due to delays in initiating resuscitation bundle components and antibiotic administration (30,31). Overcrowded emergency services departments cause difficulties in accessing specialist healthcare professionals and obtaining necessary resources. Furthermore, high ICU bed occupancy rates for sepsis patients who are waiting for ICU transfer from emergency service departments. A multifaceted approach, which should include increases in resource allocation and better resource management, is required to resolve these problems (32). For example, multidisciplinary teams of nurses and physicians can help ensure patients are allocated to the most appropriate hospital beds. Early ICU admission of sepsis patients is critical (26), and electronic sepsis alert systems, as well as sepsis screening tools accompanied by early lactate measurements (33,34), are vital tools in the rapid identification of sepsis patients in crowded emergency room settings. There were an astonishing 84,545,429 emergency admissions recorded in hospitals in Turkey during the period January-October 2017. This very high number of emergency admissions, which is more than the total country population, renders practical implementation of current treatment guidelines impossible; radical solutions are required (35).

LIMITATIONS

This large-scale multi-center study suffers from several limitations, which are now discussed. First, study participants were recruited without any systematic randomization; this may have caused population bias. Second, very few study participants worked at private hospitals. Third, the study questionnaire asked for individual opinions from study participants rather than verifiable data from participating hospitals; future studies should seek to verify these opinions with quantifiable data obtained from official hospital records. A wider survey should be performed that also includes data regarding patients with both suspected and confirmed sepsis. To the best of the authors' knowledge at the time of writing, this is the widest questionnaire-based study that investigates emergency service infrastructure and resources in Turkey about sepsis guideline and one hour sepsis bundle implementation.

CONCLUSION

This study highlights difficulties of implementing sepsis emergency treatment guidelines in Turkey. In order to better manage sepsis patients, emergency department conditions must be improved. The causes of the identified difficulties include emergency room overcrowding, insufficient staffing, and limited overall resources. Emergency departments in Turkey must improve their

early diagnosis of sepsis patients, and bed space must be made available in ICUs faster than is currently possible. Additionally, multidisciplinary specialist sepsis teams should be formed in hospital emergency departments, with corresponding increases in the availability and accessibility of resources to treat sepsis.

Competing interests: The authors declare that they have no competing interest.

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