

## Current Statement of Intensive Care Units in Turkey: Data obtained from 67 Centers

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## Abstract

**OBJECTIVES:** We aimed to obtain information about the characteristics of the ICUs in our country via a point prevalence study.

**MATERIAL AND METHODS:** This cross-sectional study was planned by the Respiratory Failure and Intensive Care Assembly of Turkish Thoracic Society. A questionnaire was prepared and invitations were sent from the association's communication channels to reach the whole country. Data were collected through all participating intensivists between the October 26, 2016 at 08:00 and October 27, 2016 at 08:00.

**RESULTS:** Data were collected from the 67 centers. Overall, 76.1% of the ICUs were managed with a closed system. In total, 35.8% (n=24) of ICUs were levels of care (LOC) 2 and 64.2% (n=43) were LOC 3. The median total numbers of ICU beds, LOC 2, and LOC 3 beds were 12 (8-23), 14 (10-25), and 12 (8-20), respectively. The median number of ventilators was 12 (7-21) and that of ventilators with non-invasive ventilation mode was 11 (6-20). The median numbers of patients per physician during day and night were 3.9 (2.3-8) and 13 (9-23), respectively. The median number of patients per nurse was 2.5 (2-3.1); 88.1% of the nurses were certified by national certification corporation.

**CONCLUSION:** In terms of the number of staff, there is a need for specialist physicians, especially during the night and nurses in our country. It was thought that the number of ICU-certified nurses was comparatively sufficient, yet the target was supposed to be 100% for this rate.

**KEYWORDS:** Intensive care unit, point prevalence, survey

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## INTRODUCTION

The intensive care unit (ICU) is a special and separately staffed and equipped self-contained area of a hospital dedicated to the management of patients with life-threatening illnesses, injuries, and complications and monitoring of potentially life-threatening conditions. Critical care is provided in these specialized units with sophisticated equipment and educated staff and for this reason staff to patient ratio is very important for the care of these kind of patients with multiple organ failure [1-4]. The aims of an ICU are both to monitor and support the impaired and failed vital functions in critically ill patients with illnesses exhibiting a potential threat to life to perform adequate diagnostic measures and medical or surgical therapies to improve the outcome [2]. The characteristics of ICUs show variability at different centers worldwide. This variability is influenced by factors such as hospital characteristics, levels of staff training, and economic and political factors [5]. Although we have strict quality criteria as determined by the Ministry of Health for all types of care [4], structural, technical, and personal differences still occur. There are various types of hospitals in Turkey such as university, training, and research, and state or private hospitals. In some centers, there are multiple ICUs in the same or different locations of the hospital. Therefore, as the Respiratory Failure and Intensive Care Assembly of the Turkish Thoracic Society (TTS), we planned a 1-day point prevalence study to obtain information about the characteristics of different types of ICUs in our country.

## METHODS

The study was cross-sectional. Data were obtained by a survey that was shared with several communication channels (e-mail/social interaction platforms) with the members of the TTS who were actually working in an ICU. The survey included

61 questions (Figure 1) about the unit's physical infrastructures, technical possibilities, applicable interventional procedures, properties of staff, and working conditions of the unit. The type of the ICU, the levels of care (LOC), the number of hospital and ICU beds, the ICU working system, and the total number of ventilator and transport ventilators were asked in the survey. In addition, information about the number of physicians and nurses during the day and night (total and per patient) was obtained. The diagnostic and therapeutic facilities of the units including hemodialysis, echocardiography, and fiberoptic bronchoscopy (FOB) were recorded. The study was performed between October 26, 2016 at 08:00 and October 27, 2016 at 08:00. Data were collected via post or online from each center. Ethics Committee Approval was obtained from the Ethics Committee for Non-invasive Researches of Çukurova University School of Medicine on October 7, 2016 (number 57). Each participant was informed by e-mail and there was no need informed consent.

### Statistical Analysis

Descriptive analysis was used to define the characteristics of the centers. The statistical analyses were conducted using the

SPSS (Statistical Package for the Social Sciences) version 21.0 (IBM Corp.; Armonk, NY, USA). Continuous data were expressed as medians with 25<sup>th</sup>-75<sup>th</sup> percentiles and compared with data from the Mann-Whitney U test. Categorical data were expressed as numbers with percentages and compared with data from the Fisher's exact test. A  $p < 0.05$  was considered as statistically significant.

### RESULTS

In total, 77 centers replied to the invitation of the study. However, ten of them were excluded because of their unavailability on the study day. Overall, data were collected from 67 centers. Most of the ICUs were located in the university hospitals and training and research hospitals ( $n=29$ , 43% and  $n=22$ , 33%, respectively) (Figure 2). General ( $n=21$ , 31.3%), medical ( $n=18$ , 26.9%), and respiratory ICUs ( $n=15$ , 22%) were the main units that participated in the study (Figure 3). Most of the units were managed in a closed system (76.1% vs. 23.9%). Intensive care specialists existed in 23 out of the 67 (34.3%) centers, mostly in training hospitals. There was at least one specialist on duty in 47 out of the 67 (70.1%) centers.

**Table 1.** General physical characteristics of ICUs

	Median	25%-75%
No. of hospital beds, n	600	400-1000
No. of ICU beds, n	12	8-23
No. of active ICU beds	11	6-21
No. of ventilators	12	7-21
No. of NIV mode (+)	11	6-20

ICU: intensive care unit; NIV: non-invasive ventilation

**Table 2.** Characteristics of ICUs according to the levels of care

	Level 2 ICU n=24	Level 3 ICU n=43	p
No. of hospital beds	488 (350-600)	750 (460-1009)	0.009
No. of ICU beds	14 (10-25)	12 (8-20)	0.31
No. of full beds	12 (8-21)	11 (7-20)	0.53
No. of doctors	3 (1-4)	4 (2-7)	0.018
No. of patients per doctor during the day	8 (3.2-11.7)	3.1 (2-6)	0.002
No. of patients per doctor during the night	14 (8-25)	13 (9-19)	0.72
No. of certified nurses	6 (2-10)	5 (2-8)	0.641
No. of patients per nurse during the day	3 (2.5-3)	2.5 (2-3.1)	0.206
No. of patients per nurse during the night	3 (3-3.3)	3 (2.5-3.3)	0.488
No. of allied health personnel during the day	3 (2-4)	4 (2-6)	0.044
No. of allied health personnel during the night	2 (1-3)	2 (1-3)	0.59

ICU: intensive care unit

Table 1 shows the general physical conditions in the ICUs. The median numbers of hospital beds and ICU beds were 600 (400-1000) and 12 (8-23), respectively. According to the LOC, 35.8% ( $n=24$ ) of the centers were LOC 2 and 64.2% ( $n=43$ ) were LOC 3. The median numbers of beds in LOC 2 and LOC 3 were 14 (10-25) and 12 (8-20), respectively. At the relevant date, the bed occupancy rate was 88%. The median numbers of ventilators and non-invasive ventilation modes were 12 (7-21) and 11 (6-20), respectively. Transport ventilator was present in 58 centers (86.6%). A total of 80.6% of the units had at least one isolation room with a median number of 2 (1-4), and 26.9% had a room with negative pressure. Hemodialysis was the most commonly available therapeutic technique (85.1%) followed by FOB (71.6%) (Figure 4).

Figure 5 shows the distribution of physicians in different hospitals. Other physicians such as those practicing internal medicine and chest physicians were present in other hospitals, whereas only an anesthesiologist existed in private hospitals.

There was no significant difference between LOC 2 and LOC 3 ICUs in terms of the median number of physicians ( $n=3$  (1-4) vs.  $n=4$  (2-7),  $p=0.018$ ). Among LOC, there was a significant difference in the number of patients per doctor during the day (8 (3.5-11.7) vs. 3.1 (2-6),  $p=0.003$ ), whereas there was no difference during the night (14 (8-25) vs. 13 (9-19),  $p=0.63$ ) between LOC 2 and LOC 3.

The National Certification Corporation (NCC) certificated nurse rate was 88.1%, and there was no statistical difference between LOC 2 and LOC 3 ICUs ( $n=6$  (2-10) vs.  $n=5$  (2-8),  $p=0.641$ ). The number of patients per nurse during the day and night in both the levels of ICUs was insignificant ( $n=3$  (2.5-3) and  $n=2.5$  (2-3.1),  $p=0.206$  vs.  $n=3$  (3-3.3) and  $n=3$  (2.5-3.3),  $p=0.488$ ). There was a statistical difference between LOC 2 and LOC 3 ICUs in the median number of patients per allied health personnel during the day ( $n=3$  (2-4) vs.

1. Institution / Hospital name:

2. ICU type: General Internal Surgical Respiratory Anesthesia and reanimation Other :

3. Total number of beds in your hospital:

4. Total number of beds in your ICU and level:

5. Number of active beds used in your ICU:

6. Number of inpatient in your ICU at the time of the study:

7. Number of patients discharged from ICU at the relevant date:

8. Number of died patients in your ICU at the relevant date:

9. ICU working system: OPEN  CLOSED

10. Number of full bed at the time of the study:

11. Number of isolation room:

12. Is there negative pressure room? YES  NO

13. Number of negative pressure room:

14. Total number of active ventilator in your ICU:

15. If there is number of ventilator with NIV mod:

16. Is there transport ventilator? YES  NO

17. Number of doctor in your ICU during working hours:

18. The number and type of physicians involved:

19. Are the doctors a specialist or an intensive care specialist?

20. Do you have a specialist doctor on duty? YES  NO

21. What is the number the specialist doctor on duty ?

22. Is there an on call guard in your ICU?

23. Total number of physicians per bed in working hours in your ICU:

24. Total number of physicians per bed in during night in your ICU:

25. Total number of nurses per bed during day in your ICU:

26. Total number of nurses per bed during night in your ICU:

27. Number of certified nurse in your ICU:

28. Total number of assistant health staff during day in your ICU:

29. Total number of assistant health staff during night in your ICU:

30. Do you use hemodialysis in your ICU? YES  NO

31. If applicable, number of hemodialysis at the relevant date:

32. Do you have continue veno-venous hemodiafiltration in your ICU? YES  NO

33. If applicable, the number of venous venous hemodiafiltration:

34. Is plasmapheresis applied to your intensive care unit? YES  NO

35. If applicable, the number of plasmapheresis:

36. Do you have ECMO in your ICU? YES  NO

37. If applicable, the number of ECMO:

38. Do you have echocardiography in your ICU? YES  NO

39. If there is, the number of case that performed echocardiography:

40. Do you have ultrasound in your ICU? YES  NO

41. Do you have bronchoscopy? YES  NO

42. If applicable, the number of bronchoscopy:

43. What are the reasons for bronchoscopy;

44. The number of tracheotomy in your ICU:

45. Which method was used for tracheotomy PERCUTANOUS  SURGICAL

46. The branch of the physician who opens the tracheostomy: INTENSIVE CARE SPECIALIST/FELLOW  OTHER

47. The reason for the opening of the tracheostomy:

48. Number of patients who underwent weaning test on the day of your ICU:

49. Number of successful weaning patients in your ICU on the study day:

50. Number of extubated patients in your ICU on the study day:

51. Is PICCO applied in your intensive care unit? YES  NO

52. Number of cases applied to PICCO at the relevant date:

53. Is hypothermia applied in your ICU? YES  NO

54. Number of cases and reasons for hypothermia on the study day:

55. Are the liver support systems available in your ICU? YES  NO

56. Number of cases in which the liver support system was applied at the relevant date:

57. Is physiotherapy applied in your ICU? YES  NO

58. Number of physiotherapist:

59. Number of cases under physiotherapy on the study day:

60. Is high-flow oxygen therapy applied in your intensive care unit?

61. If yes, the number of cases applied at the relevant date:

Figure 1. Survey form

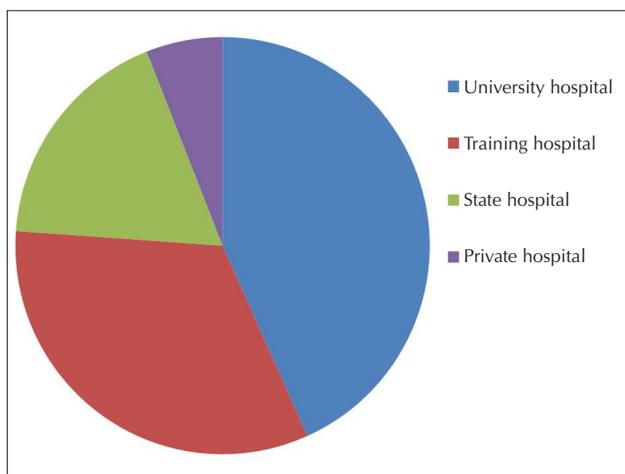


Figure 2. Types of hospitals

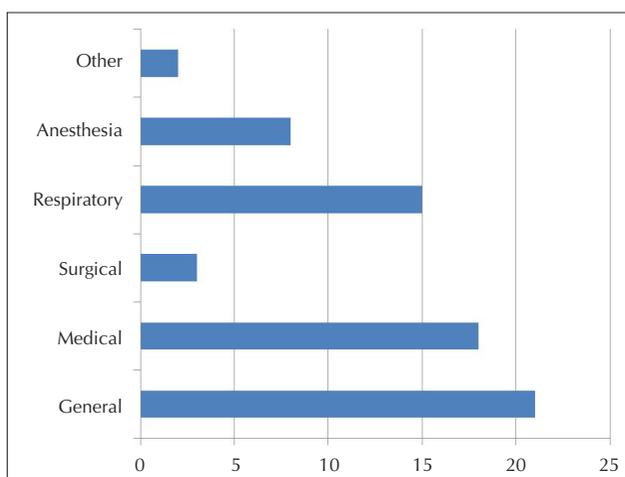


Figure 3. Types of ICU

$n=4$  (2-6),  $p=0.044$ ), whereas there was no difference during the night ( $n=2$  (1-3) vs.  $n=2$  (1-3),  $p=0.59$ ) (Table 2). Overall, 77.6% of the ICUs had a physiotherapist, and there was no statistical difference in the median number of physiotherapists in both levels of ICUs ( $n=1$  (1-2) vs.  $n=1$  (1-2),  $p=0.83$ ).

## DISCUSSION

This is the first national survey to evaluate the characteristics of ICUs in Turkey. We have shown that ICUs in Turkey have a great variability in terms of physical, technical, and staffing conditions. A significant number of ICUs still require technical and staff support to improve health care services. The bed occupancy rate was relatively high compared with that in the literature (70%-75%) [6].

In our study, most of the centers (76.1%) were managed in a closed system according to the modern literature, indicating favorable outcomes [5]. In a closed system ICU, patients are believed to have better care, and this is associated with improved outcomes and a more efficient use of ICU resources [7].

The number of staff required was quite variable in our survey. The number of staff could be calculated by taking into account several factors including the number of beds, occupancy rate, LOC, and clinical, research, and teaching workload.

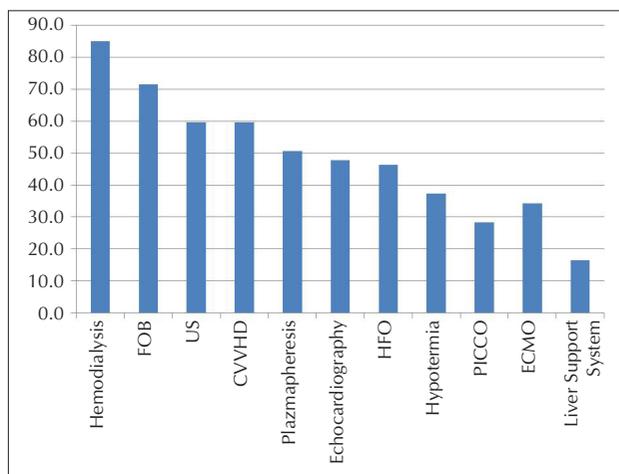


Figure 4. Technical opportunities and implemented interventional procedures in ICUs

FOB: fiberoptic bronchoscopy; US: ultrasound; HFO: high flow oxygen; CVVHD: continuous venovenous hemodialysis; ECMO: extracorporeal membrane oxygenation

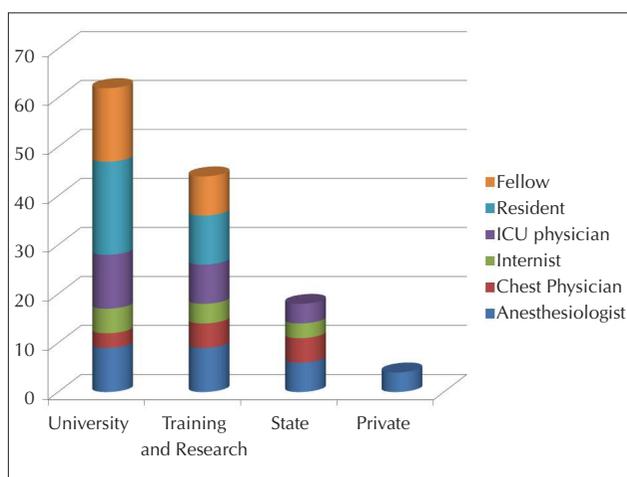


Figure 5. Characteristics of physicians in different hospitals

However, it should be emphasized that an ICU is a 24-hour and 7-day continuous working unit with high LOC. According to several studies, an ICU should accommodate a minimum of at least six beds with 8-12 beds considered as the maximum number [2,8-11]. The Ministry of Health of Turkey recommends at least four beds for LOC 2 and 6 beds for LOC 3 in our country [4]. In the present study, the median numbers of ICU beds were 12 (8-23) in all ICUs, 14 (10-25) in LOC 2, and 12 (8-20) in LOC 3. Over the years, critical care medicine has evolved in terms of structure, process, and outcome in many countries. During that time, unlike a decrease in the total number of hospital beds, the number of ICU beds has increased [9,12]. For every 100 hospital beds, 1-4 ICU beds are recommended [1]. As a matter of fact, the ratio of the number of ICU beds to hospital beds was suggested as 5%-10% [2,8,10,11,13]. In this study group, this ratio was found to be 2%, which is lower than recommended. LOC 2 represents patients requiring monitoring and pharmacological and/or device-related support for only one acutely failing vital organ system with a life-threatening character. LOC 3 represents patients with multiple (two or more) acute vital organ failure with an immediate life-threatening character. These patients depend on pharmacological and device-related organ sup-

port such as hemodynamic support, respiratory assistance, or renal replacement therapy [14-16]. In the present study, most of the ICUs (n=43, 64.2%) were LOC 3, and the bed occupancy rate was 88% at the time of the study.

In many studies, there is paucity of conclusive data about ICU physician staffing. Although most people agree on the idea that intensivists should provide care for critically ill patients, the optimal intensivist/patient ratio is unknown [17]. The intensivist/patient ratio is likely to be influenced by several factors such as the patients' acute severity of illness and comorbidity, case mix, available human support, and non-human resources. In a study conducted, the impact of intensivist/bed ratio (1 to 7.5, 9.5, 12, and 15) was evaluated, and there was no statistically significant difference in mortality among the four groups. However, a 1/15 intensivist/bed ratio was associated with a longer ICU length of stay. Although no specific ratio was stated, a higher numbers of patients per intensivist may have some negative impacts on patient care and should be avoided [18]. In the present study, the number of patients per physician was compatible in LOC 2 ICUs, whereas the same was incompatible in LOC 3 ICUs during the day and night, showing heterogeneity between the units.

The number of ICU nurses necessary to provide appropriate care and observation is calculated according to the LOC in the ICU [2,6,19]. Many aspects of staffing may differ across ICUs and are fundamental to the definition of an ICU bed in some regions. One of the standards for critical care nursing concerns the nurse to patient ratio [3,20]. It is notable that adverse patient outcomes have been associated with more patients per nurse, including complication rates, length of stay, and even risk-adjusted mortality [21]. Some studies suggested that there is an association between nurse staffing and hospital-acquired pneumonia, sepsis, shock, cardiac arrest, longer than expected length of stay, and mortality [22,23]. The literature documents the nurse to patient ratios as ranging from 1/1 to 1/4 for care of critically ill patients [3]. According to the standards of the Australian College of Critical Care Nurses and the British Association of Critical Care Nurses, a 1/1 ratio is recommended for patients receiving mechanical ventilation [24,25]. Recent comprehensive literature reviews have further validated the relationship between ICU nurse staffing and patient outcomes, confirming that a higher level of registered nursing staff to patient ratio (1/1 or 1/2) relates to the improved safety and better outcomes for patients [26]. The Ministry of Health of Turkey sets the standard nurse to patient ratio as 1/3 for LOC 2 and 1/2 for LOC 3 [4]. In the present study, this ratio was not found to be compatible in LOC 3 ICUs for the day and night. Although the NCC certified nurse rate was relatively high in the study, the ideal number should be 100%; therefore, the certification programs and education of the nurses should be continued.

The present study has several limitations. First, this was a cross-sectional study that only shows the results of one day. Although it can be concluded that some of the results including the bed occupancy rate may differ day by day, most of the results including the number of beds, staff, or equipment will be the same. In addition, our results may also be interpreted as a real representation of the ICUs in Turkey. Second, owing

to the multicenter nature of the study, some of the data collection was not performed uniformly. However, being a large multicenter report including units from 33 cities from all regions of the country, we believe that it represents the whole country. To the best of our knowledge, this is the widest study that evaluates the conditions of the ICUs in Turkey. Our results may reflect the ICU profile in Turkey with significant heterogeneity in terms of both infrastructural and staffing conditions. This could also be considered as strengthening the communication between ICUs, determining the common shortcomings, and making it possible for more multicenter researches to be conducted together in the future.

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**Informed Consent:** N/A

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