A survey of pediatric intensive care services in Turkey

Tolga F. Köroğlu, Seçkin Atasever, Murat Duman
Department of Pediatrics, Dokuz Eylul University Faculty of Medicine, İzmir, Turkey

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The aim of this study was to describe and assess the structure, organization, and staffing of pediatric intensive care services in Turkey. A survey was sent to major university and government hospitals. Out of the 40 hospitals stating to provide pediatric intensive care, 34 responded to the survey (85% response rate). In the majority (81.2%) of hospitals, pediatric intensive care was provided in single room units or within the pediatric ward. Unit size ranged from 1-16 beds with an average of 6.8±4.2 operational beds per unit. Much of the equipment and a sufficient number of specialists for pediatric intensive care unit (PICU) care were present in the surveyed hospitals. However, only 12 units had a pediatric intensivist on staff and few had special PICU nurses. Many hospitals in Turkey already have various equipment and specialists needed to support pediatric intensive care. Expansion of services and improved care could be achieved if more pediatric intensivists and nurses could be provided and services concentrated in fully equipped tertiary centers.

Key words: intensive care units, pediatric, structure, organization, management, staffing.

The goal of pediatric intensive care medicine is the surveillance and support of vital system functions in critically ill or injured children, and their eventual restoration to health[1]. Throughout the past four decades, the science of pediatric intensive care has progressed significantly. Rapid advances in technology and knowledge have made this progress possible. Pediatric intensive care units (PICUs) are regarded as making a substantial contribution to the health of children in developed countries[2]. Furthermore, the availability of pediatric intensive care is regarded as a reflection of the quality of a country's pediatric medical care[3].

Descriptions of resources and organizational aspects are considered to constitute a first step in evaluating the adequacy and efficiency of pediatric intensive care in a country or region. Several organizational aspects of PICU services are very important, affecting quality of care and ICU outcome. Concentration of resources in tertiary centers, regionalization of care, and employment of full-time intensivists, among others, can help improve quality of care and outcome[4-8]. Nipshagen et al.[9] performed a study to assess and compare the structure, organization, management and staffing of PICUs in Europe. Similar studies were done in Spain[3], the United Kingdom[4], and the United States[10].

Approximately 40% of Turkey's 71 million population is under 18 years of age. When compared to development of other pediatric subspecialties in our country, establishment of PICUs occurred relatively late and many children received care in adult ICUs instead of specialized PICUs. However, there is a rapidly growing interest in this field. Young pediatricians as well as administrators increasingly see the importance of such services, and rapid expansion of PICU services has occurred in recent years.

This study was carried out to delineate the characteristics of PICUs and the services which they perform in Turkey. Since this subspecialty is in a relatively early state of development, it is hoped that characterization of pediatric intensive care services and their adequacy will guide further planning and expansion of services.

Material and Methods

To identify hospitals providing PICU services, the chief of pediatrics at all university and government hospitals with pediatric residency

programs or listed as pediatric hospitals were contacted via fax or telephone. The faxed message questioned whether their hospital did provide "pediatric intensive care services", and requested the name of a contact person (pediatrician) who could respond to a survey.

For the purposes of this survey, "pediatric intensive care" was defined as the ability to provide critical care support to pediatric patients under direction of physicians who have received primary training in pediatrics. Considering there is no formal critical care training in Turkey, a physician with primary training in pediatrics who has received any amount of intensive care training by way of rotations and has been working for at least two years in this field was regarded as a "pediatric intensivist". There are no combined pediatric-neonatal ICUs in this country, and neonatal intensive care services, much better developed and more widely available, were specifically excluded. Services provided by adult ICUs to children were also not investigated.

During the first half of 2005, a questionnaire was sent by electronic mail to designated physicians at hospitals identified during the initial screening. The objective of the questionnaire was to acquire as much information about pediatric intensive care services as possible. The questionnaire was designed to collect information on unit characteristics, hospital facilities, pathology of patients admitted, age range admitted, number of beds, and ICU personnel.

A second correspondence was sent by electronic mail if no response was received by one month. Physicians not responding by two months were contacted by telephone at least twice, and a printed questionnaire was sent by post with return stamped envelopes.

To minimize burden on respondents, questions about medical activities were designed to capture information for a single day (i.e. one-day "snapshot"), a method used previously[11].

Results

Of the 66 hospitals initially identified, 40 hospitals stated that they provide pediatric intensive care; 34 responded to the survey (response rate: 85%). All hospitals previously known by the Turkish Society of Pediatric Emergency Medicine and Intensive Care to have a PICU responded to the survey. Hospitals not providing pediatric intensive care stated that they transfer pediatric patients either to other hospitals (44%) or to adult ICUs (56%).

Almost half (48%) of PICUs in Turkey were established within the last five years. Several centers not having a PICU expressed plans to open one within the next 12-24 months, and several hospitals reported ongoing construction of improved facilities for their existing PICUs. Of 34 hospitals, 26 (76%) were university-affiliated.

The PICU was an administratively distinct unit in 28% of the hospitals. Many PICUs shared equipment and/or rooms with the pediatric ward (26 units) or the pediatric emergency department (2 units). In 17 hospitals (50%), the PICU consisted of a single room. Only six (17.6%) hospitals possessed a unit consisting of various rooms. In five (14.7%) hospitals, intensive care was provided within the pediatric ward, usually by bringing the necessary equipment (i.e., ventilator, monitor) to the bedside.

The average number of beds in the PICUs was 6.7±3.9 (range 1-16), with 196 beds available nationally. The hospital's average bed number was 625±521 (80-2500) with 133±104 (20–500) pediatric beds.

Therapeutic or diagnostic modalities available in the PICU within the hospital are presented in Table I.

Table I. Available Therapeutic or Diagnostic Modalities in PICUs/Hospitals Surveyed

Therapeutic or diagnostic modality available in each PICU	Availability
Conventional mechanical ventilation	100%
Vital signs monitor	100%
Echocardiography	100%
EEG	100%
Portable X-ray	100%
Peritoneal dialysis	87.5%
Computed tomography	84.4%
Pediatric rigid bronchoscope	74.2%
Type and cross-match within 1 hr	71.9%
Magnetic resonance imaging	71.9%
Hemodialysis	65.6%
Pediatric endoscopy	61.3%
Cardiac catheterization laboratory	59.4%
Operating room available within 30 min	48.3%
Veno-venous hemofiltration	37.5%
Pediatric flexible bronchoscopy	35.5%

PICU: Pediatric intensive care unit.
EEG : Electroencephalography.

PICU Staffing

The number of nurses per PICU was 4.6±5.0 (range 0-15); in 46.3% of hospitals, nurses from pediatric wards cross-covered the unit. During daytime hours, 2.5±1.4 nurses were present in the unit, while 1.7±0.8 nurses covered the unit overnight and on weekends.

Only 12 (35%) PICUs had a full-time intensivist on staff. Average experience of intensivists was 5.3±3.3 years (range: 0.4-12). Since there is no formal training in pediatric critical care medicine available in Turkey, three intensivists had received formal fellowship training in pediatric critical care medicine in developed countries (1 physician 24 months, and 2 others 6 months each). Another four physicians had spent 4-12 months observing in PICUs in developed countries. Ten of the intensivists had also done 1-12 month-long rotations in other Turkish PICUs and/or adult ICUs. Time spent by intensivists in various routine activities included: patient care, 48.9%; administrative affairs, 22.3%; educational activities, 16.3%; and research 13.0%. In most hospitals, the intensivists also routinely had additional duties outside the ICU, including: serving as attending on the general pediatric ward, emergency department or outpatient clinic (56.3%); pre- and post-graduate medical education (66.7 %), and administrative duties outside the PICU (66.7%).

In all hospitals, the unit was covered 24 hours/day, 7 days a week by licensed physicians. In teaching hospitals, this was by a pediatric resident, usually in post-graduate year 1-3. Many hospitals had several physicians/residents covering the unit. Pediatric intensivists --where present—were covering the PICU on a 24 hours/day, 7 days a week schedule with call from home. Availability of various consultative specialists and sub-specialists is given in Table II.

Table II. Staff Available 24 Hours Daily for Consultations

Specialist/subspecialist	Percentage present in hospitals
Specialists	
Pediatric surgeon	93.8%
Anesthesiologist	87.5%
Neurosurgeon	78.1%
Otorhinolaryngologist	78.1%
Orthopedist	78.1%
Plastic surgeon	62.5%
Cardiovascular surgeon	62.5%
Pediatric sub-specialists	
Pediatric cardiologist	78.1%
Pediatric hematologist	78.1%
Pediatric nephrologist	71.9%
Pediatric allergist	68.8%
Neonatologist	68.8%
Pediatric endocrinologist	65.6%
Pediatric oncologist	59.4%
Pediatric gastroenterologist	50%
Pediatric pulmonologist	25%

Patient Care Activity

Patient census at time of survey was 186 (occupancy rate: 94.8%). Of these patients, 72 were intubated (38.7%). Nineteen hospitals provided data on admissions. The mean number of pediatric ICU admissions for 2004 was 307±253 (20–887). Total admissions for 2004 were 5836. The number of admissions per bed was 30. Of the treated patients, 32 (17.8%) were on a ventilator for more than 14 days. Sixteen units provided data on mortality. The overall estimated mortality rate was 14.6±8.6% (range 3-37%). Diagnoses of patients in the unit on the day of survey are presented in Table III.

General pediatric surgical patients were admitted to the PICU in only 12 hospitals (35.3%). Only nine (26.5%) PICUs routinely

Table III. PICU Patient Primary Diagnoses (Cross-sectional, on day of survey)

Diagnosis	Percentage of patients
Lower respiratory tract infection and/or respiratory insufficiency	37.7%
Central nervous system dysfunction and/or infection	17.6%
Congenital cardiac disorder	10%
Sepsis	8.6%
Post-operative patients	4.2%
Hypoxic-ischemic encephalopathy	3.8%
Other	8.1%

admitted patients with head trauma. Although open heart surgery was performed in 21 of the surveyed hospitals, just one unit was routinely admitting pediatric post-operative cardiac patients.

The survey responders' suggestions for improved pediatric critical care services were (in order of priority): 1) more pediatric intensivists (41.9%), 2) more nurses (32.3%), 3) more equipment/better facilities (25.8%), and 4) more residents (9.7%).

Discussion

Contrary to other pediatric subspecialties, progress in pediatric critical care in Turkey started relatively late. Almost half of the PICUs have been established in the last five years, mostly with the enthusiastic efforts of individual physicians. Currently, a significant number of PICUs in Turkey are located in three large cities. Ankara, the capital, has eight hospitals providing pediatric intensive care. İzmir and İstanbul each have four hospitals with PICUs and the remaining 16 PICUs are located in various cities throughout the country. Interestingly, while all university and government teaching hospitals in Ankara and İzmir have PICU services, only 4 out of 14 teaching and university hospitals in İstanbul have PICUs. Therefore, PICU bed to pediatric population ratio for İstanbul (1:268,000) is much lower than e.g., İzmir (1:30,000). We estimate that more children in İstanbul are cared for in the abundant adult ICUs in that city. Furthermore, some children in İstanbul are also admitted to adult ICUs in private hospitals, which is much less likely in other parts of the country. Where pediatric ICU services are not available, children needing critical care are admitted to adult ICUs or are transferred to other hospitals.

The average PICU consists of 6-7 beds, but some hospitals have only 1-2 beds, and only one unit has 16 beds. Many centers provide PICU services in shared spaces, single rooms or within the general pediatric ward with inadequate resources. The present condition implies that, despite recent progress, many hospitals still consider it sufficient to provide a mechanical ventilator and vital signs monitor in order to provide pediatric intensive care. Guidelines for PICU design and levels of care have been published[21] and could be used to improve facilities and functioning of units.

The presence of many PICUs with low bed numbers also suggests that services could be concentrated further. Studies suggest that substantial reductions in mortality could be achieved if children who needed critical care were admitted to a tertiary PICU instead of non-tertiary pediatric units or mixed adult units[2,4,5,7]. Regionalization of pediatric intensive care may have significant benefits on patient outcome and resource utilization[6,7,12]. Countries such as Australia, which have implemented completely regionalized pediatric intensive care services, have achieved very good results, albeit PICU bed/population ratios are one-third of that in the United States[4].

Most PICUs in Turkey are not multidisciplinary, i.e. they do not routinely admit surgical patients. In this study, only 4.2% of patients were post-operative surgical patients. This is contrary to the practice in most other developing and developed countries[10,13,14]. Admission of medical and surgical patients to one unit is believed to concentrate expertise and achieve better resource utilization, assuring financial viability. Adaptation of this practice could lead to more efficient use of resources.

Presence of a pediatric intensivist (and a fellowship program) is important in reducing mortality[8,15,16]. However, there are only few intensivists, and except in one hospital, all pediatric intensivists work alone. The lack of intensivists and the heavy burden on the present ones have many negative implications. It is obvious that their number needs to be increased to benefit PICU care. In fact, the government is planning on accepting pediatric intensive care as a subspecialty of pediatrics in the near future, making possible the establishment of PICU training programs.

A shortage of nurses in the PICUs exists. Several units do not have special PICU nurses, and those units that do have nurse-patient ratios of approximately 1:4.4. Low nurse-patient ratios are known to increase nosocomial infection rates and patient mortality[17]. However, many hospitals are not able to staff more nurses since --similar to many other countries-- there is a nursing shortage in Turkey.

A significant number of patients in the PICU have chronic disorders and are ventilator-dependent. At the time of the survey, nearly 18% of patients were being ventilated for

more than 14 days. The absence of home ventilation programs in Turkey makes it virtually impossible to discharge a ventilator-dependent pediatric patient. Only through individual physician's efforts and after overcoming many bureaucratic obstacles can some patients be discharged home. Insistence by pediatric pulmonologists and intensivists may facilitate progress on this issue. Home ventilation programs need to be developed and supported by health care financing agencies. On the other hand, legal and cultural constrains limit the possibility of "withholding" or "withdrawing" treatment significantly, creating problems with the number of available beds.

The average PICU mortality rate is relatively high when compared with published United States or European studies[3,9,10], but studies from developing countries including South America, India and South Africa have reported mortality rates between 18-32%[13,18,19]. It is possible that population differences may account for some of these mortality differences; however, a major factor such as malnutrition has not been found to be associated with mortality[13]. Since the equipment and techniques in some of these developing country PICU studies are similar to developed nation PICUs, it is likely that differences in care practices are very important[20]. It is also known that skill and availability of nurses and physicians may be more important to outcome than the availability of technology[15].

There are several factors that may play a role in the mortality rate in Turkey. First of all, despite important progress in recent years, facilities, equipment and staff are still inadequate in most units. Most PICUs still have no intensivists. This inevitably translates into higher mortality figures. Furthermore, several factors specific to this country may play a role: 1) Surgical patients have significantly lower mortality than medical patients. The infrequent admission of surgical patients to our PICUs may increase their average mortality rate. 2) Many patients who have terminal, incurable illness are nevertheless admitted to the PICU, since their primary physicians are not comfortable following them elsewhere.

Although our study is based on a questionnaire and we do not claim that the data represents the total of pediatric intensive care services performed in our country, we consider that our results are an accurate reflection of the organization of PICU services in Turkey.

In conclusion, pediatric intensive care will become an increasingly important part of hospital care as patients admitted to the hospital are sicker on average than before. Results of this study may help guide future planning of PICU services in Turkey. Interestingly, many of the hospitals surveyed in this study possess much of the equipment and a sufficient number of specialists and subspecialists to provide PICU services. Together with the rapidly increasing interest in pediatric intensive care, this may lead to a rapid expansion of services and improved care, especially if more pediatric intensivists and nurses could be provided and services concentrated.

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REFERENCES

1. Downes JJ. The historical evolution, current status, and prospective development of pediatric critical care. Crit Care Clin 1992; 8: 1-22.
2. Shann F. Effectiveness and efficiency in pediatric intensive care. In: Tibboel D, van der Voort E (eds). Intensive Care in Childhood: A Challenge to the Future. Update in Intensive Care and Emergency Medicine. Vol 25. Berlin: Springer; 1996: 133-145.
3. Lopez-Herce J, Sancho L, Martinon JM. Study of paediatric intensive care units in Spain. Spanish Society of Paediatric Intensive Care. Intensive Care Med 2000; 26: 62-68.
4. Pearson G, Shann F, Barry P, et al. Should paediatric intensive care be centralised? Trent versus Victoria. Lancet 1997; 349: 1213-1217.
5. Pollack MM, Alexander SR, Clarke N, et al. Improved outcomes from tertiary center pediatric intensive care: a statewide comparison of tertiary and nontertiary care facilities. Crit Care Med 1991; 19: 150-159.
6. Watson RS. Location, location, location: regionalization and outcome in pediatric critical care. Curr Opin Crit Care 2002; 8: 344-348.
7. Tilford JM, Simpson PM, Green JW, Lensing S, Fiser DH. Volume-outcome relationships in pediatric intensive care units. Pediatrics 2000; 106: 289-294.
8. Pollack MM, Katz RW, Ruttimann UE, Getson PR. Improving the outcome and efficiency of intensive care: the impact of an intensivist. Crit Care Med 1988; 16: 11-17.

9. Nipshagen MD, Polderman KH, DeVictor D, Gemke RJ. Pediatric intensive care: result of a European survey. Intensive Care Med 2002; 28: 1797-1803.
10. Odetola FO, Clark SJ, Freed GL, Bratton SL, Davis MM. A national survey of pediatric critical care resources in the United States. Pediatrics 2005; 115: e382-386.
11. Groeger JS, Guntupalli KK, Strosberg M, et al. Descriptive analysis of critical care units in the United States: patient characteristics and intensive care unit utilization. Crit Care Med 1993; 21: 279-291.
12. Pearson G, Barry P, Timmins C, Stickley J, Hocking M. Changes in the profile of paediatric intensive care associated with centralisation. Intensive Care Med 2001; 27: 1670-1673.
13. Earle M Jr, Martinez Natera O, Zaslavsky A, et al. Outcome of pediatric intensive care at six centers in Mexico and Ecuador. Crit Care Med 1997; 25: 1462-1467.
14. Khilnani P, Sarma D, Singh R, et al. Demographic profile and outcome analysis of a tertiary level pediatric intensive care unit. Indian J Pediatr 2004; 71: 587-591.
15. Pollack MM, Cuerdon TT, Patel KM, et al. Impact of quality-of-care factors on pediatric intensive care unit mortality. JAMA 1994; 272: 941-946.
16. Pollack MM, Patel KM, Ruttimann E. Pediatric critical care training programs have a positive effect on pediatric intensive care mortality. Crit Care Med 1997; 25: 1637-1642.
17. Tucker J. Patient volume, staffing, and workload in relation to risk-adjusted outcomes in a random stratified sample of UK neonatal intensive care units: a prospective evaluation. Lancet 2002; 359: 99-107.
18. Singhal D, Kumar N, Puliyel JM, Singh SK, Srinivas V. Prediction of mortality by application of PRISM score in intensive care unit. Indian Pediatr 2001; 38: 714-719.
19. Jeena PM, Wesley AG, Coovadia HM. Admission patterns and outcomes in a paediatric intensive care unit in South Africa over a 25-year period (1971-1995). Intensive Care Med 1999; 25: 88-94.
20. Slonim AD, Magnuson WG, Pollack MM. Lessons from international comparisons of pediatric critical care. Crit Care Med 1997; 25: 1445-1446.
21. Rosenberg DI, Moss MM. Guidelines and levels of care for pediatric intensive care units. Crit Care Med 2004; 32: 2117-2127.