ORIGINAL ARTICLE

Observational Study

Critical care practice in India: Results of the intensive care unit need assessment survey (ININ2018)

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Abstract

BACKGROUND
A diverse country like India may have variable intensive care units (ICUs) practices at state and city levels.

AIM
To gain insight into clinical services and processes of care in ICUs in India, this would help plan for potential educational and quality improvement interventions.

METHODS
The Indian ICU needs assessment research group of diverse-skilled individuals was formed. A pan- India survey "Indian National ICU Needs" assessment (ININ 2018-I) was designed on google forms and deployed from July 23rd-August 25th, 2018. The survey was sent to select distribution lists of ICU providers from all 29 states and 7 union territories (UTs). In addition to emails and phone calls, social medial applications-WhatsApp™, Facebook™ and LinkedIn™ were used to remind and motivate providers. By completing and submitting the survey, providers gave their consent for research purposes. This study was deemed eligible for category-2 Institutional Review Board exempt status.

RESULTS
There were total 134 adult/adult-pediatrics ICU responses from 24 (83% out of 29) states, and two (28% out of 7) UTs in 61 cities. They had median (IQR) 16 (10-25) beds and most, were mixed medical-surgical, 111(83%), with 108(81%) being adult-only ICUs. Representative responders were young, median (IQR), 38 (32-44) years age and majority, *n* = 108 (81%) were males. The consultants were, *n* = 101 (75%). A total of 77 (57%) reported to have 24 h in-house intensivist. A total of 68 (51%) ICUs reported to have either 2:1 or 2≥:1 patient:nurse ratio. More than 80% of the ICUs were open, and mixed type. Protocols followed regularly by the ICUs included sepsis care, ventilator- associated pneumonia (83% each); nutrition (82%), deep vein thrombosis prophylaxis (87%), stress ulcer prophylaxis (88%) and glycemic control (92%). Digital infrastructure was found to be poor, with only 46 % of the ICUs reporting high-speed internet availability.

CONCLUSION
In this large, national, semi-structured, need-assessment survey, the need for improved manpower including; in-house intensivists, and decreasing patient-to-nurse ratios was evident. Sepsis was the most common diagnosis and quality and research initiatives to decrease sepsis mortality and ICU length of stay could be prioritized. Additionally, subsequent surveys can focus on digital infrastructure for standardized care and efficient resource utilization and enhancing compliance with existing protocols.

Key words: Intensive care unit; Critical care; India; Survey; Intensive care unit survey; Intensive care unit needs

Core tip: Intensive care unit (ICU) practices are variable in a vast country like India. Most common admitting diagnosis for ICU is similar to Western reporting in literature. There is variable protocol penetration for processes of care in ICU.

INTRODUCTION

Critical care practices vary worldwide and are a reflection of varying epidemiology and existing financial and human resources. Patient outcomes in these centers can vary dramatically due to the influence of interlinked, multiple factors[1].

A diverse country like India, may have variable intensive care units (ICUs) practices in various states, which can be due to differences in; hierarchical arrangements, allocation of resources, patient backgrounds, cultural and clinical practices, and goals or objectives of the caregivers[2]. Although it is imperative to have standardized care of practice to minimize variations and maximize the quality of care delivered to the patients, it is essential to paint a picture in the backdrop keeping in mind the epidemiological context, resource availability, and local practices[3]. In addition, it is crucial to identify and evaluate variables like prevalent clinical practices, protocols, a range of service, human resources and facilities available on a national level to bring forth a prototype which will help in quality control and unification of the care delivery. Studies have been done in developed countries[3,4], and a few more describe the practices in a multinational setting[5-7] but the information is scarce in an Indian setting[2].

Our study aimed to gain insight into clinical services, prevalent practices, processes of care and patient outcomes in ICUs across different regions of India. Studying and analyzing these patterns can potentially help prioritize quality improvement interventions, educate practicing physicians and, create a framework for further studies to fill in the knowledge gap, to further strategize best care practices and act as a paradigm for critical care delivery.

MATERIALS AND METHODS

This was a cross-sectional pan-India survey-based study. We created a multidisciplinary, diverse team of qualified individuals who constituted the "Indian ICU needs assessment research group".

A questionnaire was designed to assess the ICU clinical practices prevalent in the institution followed by the study of the demographics of the institution and the surveyor. Questions were asked regarding the ICU being closed or open, group and type of patients catered to, number of ICU beds, protocols followed in the ICU setting, top diagnoses of the admitted patients, and availability of critical care equipment and technology. Moreover, human resource demographics were explored through variables such as the presence of certified intensivists, residents/fellows, 24-h in-house staff intensivists, patient: Nurse ratio, age of the surveyor, gender, level of training, and years of experience. Outcome variables included average ICU length of stay, mechanical ventilation duration, ICU mortality, sepsis mortality and, mechanical ventilation patient mortality. The functionality of the survey was tested as a pilot among a random group of critical care physicians prior to implementation for internal validity. A sample of the survey is depicted in the E-supplement.

A database of intensivists was identified through critical care societies, social media, and personal networks. The team carried out the study through a survey from July 23rd to August 25th, 2018, through an anonymous questionnaire designed on a Google™ form online and distributed to the critical care providers in 29 states and 7 Union territories (UTs) of India (Figure 1). Various platforms like electronic mail (e-mail), social media applications such as WhatsApp™, Facebook™ and LinkedIn™,

were used for dispatching the form and to reach out to potential collaborators for reminder and motivation.

A convenient sample of 134 ICUs was collected through the survey, and the data collected is presented as mean, with standard deviation, or median with interquartile range. Pictorial and graphical representation of the relevant data was done.

For analysis purposes, we divided India into 6 zones (Figure 2), on the basis of administrative divisions mainly – North, South, West, East, Central, Northeast[8]. Descriptive statistical analysis was used.

By completing and submitting the survey, providers gave their consent to provide pertinent information for research purposes. This study was deemed eligible for category-2 Institutional Review Board exempt status.

RESULTS

Representation
Our analysis was based on total 134 adult/adult-pediatrics ICU responses. They represented 61 cities of 24 states, and two UTs of India. The response rate was 83% states and 28% of UTs. Region-wise sample distribution revealed that 39 (29%) of entries belonged to the Northern region, whereas South Indian cities contributed to 34 (25%) entries. Thirteen (10%) from the Central; 25 (19%) from West; while 18 (13%) entries belonged to East and North-East, contributed 5 (4%) of the total of 134 entries.

Demographics
A vast majority of responders in the survey were young adults, median (IQR), 38 (32-44) years age and predominantly, n = 108 (80%) were males, with a median clinical ICU experience of 8.5 (IQR, 4-14) years. Likewise, most of the responses came from consultants, n = 101 (75%), followed by residents (PGY-3 and above), n = 19 (14%). Most of them were working in mixed medico-surgical ICUs, n = 111(83%) in private academic hospitals, n = 50 (37%) with median (IQR) 16 (10-25) beds. Most of the responders were working in open type of ICU setup, 110 (82%), and only 24 (18%) of them in closed ICUs (Table 1 and Figure 3).

Clinical resources
Intensivist and the nurses played a major role in ICU patient care. Most responders (62%), had patient: nurse ratio of 2:1, and only (10%) responders were strictly abiding by 1:1 nursing care. Additionally, 37% of ICUs, which usually had 2:1 patient: nurse ratios, switched to 1:1 for complicated cases. Also, more than 2:1 patient: nurse's ratios were reported in 24% of ICUs. A total of 107 (80%) reported to have ICU staffed by certified intensivists and 77 (58%), had 24 h in-house intensivist coverage to take care of the patients. The majority of ICUs (n = 110, 82%) ICUs had residents/fellows/medical students rotating through or cover ICU along with staff intensivists (Table 2 and Figure 4).

Critical care clinical protocols
The majority of ICUs had glycemic control (92%) protocols, Advanced Cardiac Life Support (89%), deep vein thrombosis prophylaxis (87%), stress ulcer prophylaxis (87%), sepsis care (84%), ventilator-associated pneumonia (84%) and nutrition (83%) protocols. The least reported protocols included palliative care/end-of-life care (50%), delirium assessment and treatment (49%), early mobility (49%) and targeted temperature management after cardiac arrest (45%) (Table 3 and Figure 5).

Digital infrastructure
In spite, of 60 (46%) hi-speed internet availability the digital infrastructure was reported to be limited. Electronic medical records, n = 49 (37%), tele-ICU coverage, n = 28 (21%) and 2-way communication including webcam, n = 21 (16%) were reported (Table 4).

Admitting diagnosis
The self-reported top admitting diagnosis in our survey study was sepsis, closely followed by respiratory failure (Table 5).

Outcomes
The self-reported average ICU mortality (n = 95) was *median* 18% (IQR 11-30); ICU length of stay (n = 112) was 3.5 (4-6) d; mechanical ventilation (MV) duration (n = 98) was *median* 4 (3-5) d; MV patient mortality (n = 77) was 25% (15%-40%) and sepsis mortality (n = 75) was 30% (20%-40%).

Figure 1 Distribution of participating intensive care unit's over India's map[17].

DISCUSSION

Our survey describes some of the critical care practices in a convenient sample of 134 Indian ICUs, and for a better visualization we aimed to cover the whole country, and data was collected from majority of states and some union territories. We found substantial variation in the representation, with minimal participation being observed from North-East region. The majority of the responders of the survey were young adult men, practicing as intensivists, supporting the notion that the country has been training more individuals in critical care, and expanding its health infrastructure.

The Indian subcontinent has variations abound, and each geographical region in the country blending with its own cultural and regional diversity constructs a polychromatic picture. It is only natural for the country to have diversified patient care practices. While being appreciative of the uniqueness this land offers, it is imperative to be vigilant for any disparities which may compromise the delivery of quality and standardized patient care.

Most of the ICUs we surveyed were mixed (medical-surgical) in nature, open in type with an average number of beds of less than 20 per hospital. More than half of them were privately owned, academic-nonacademic institutions. Likewise, elaborating clinical resource parameters, such as a ≤ 2:1 patient-nurse ratio[9], 24-h certified intensivists, and certified intensivists, are associated with better outcomes in intensive care. The majority of Indian ICUs reported having 1 nurse for two or more patients with only few reporting 1:1 patient-nurse ratio. The new finding is that the majority of the ICUs reported having a certified intensivist, and more than half of them had 24 h-in house intensivist coverage.

In a survey-based study done in India covering 400 ICUs, similar results were reported with average age of responders being 30-40 years, number of ICU beds 10-30, and the majority of the ICUs were open type and mixed in nature[2].

The top admitting diagnosis in our study was sepsis, which was reported across an over whelming majority of all the ICUs closely followed by respiratory failure. This follows global trends. For example, an observational study, collecting data from 10096 patients across different countries, observed the most common diagnosis on admission to be sepsis[10].

Recent reports suggest that standardized protocols and best practice guidelines in the treatment of the critically ill patients in the ICU are associated with more favorable outcomes and decreased ICU-related morbidity and mortality. In our survey, self-reported data suggested that the majority of the ICUs across India followed the glycemic control, Advanced Cardiac Life support, deep vein thrombosis prophylaxis, stress ulcer prophylaxis, severe sepsis, ventilator Associated pneumonia bundle, and nutrition protocols. Some of the protocols that still require widespread penetration and awareness in India included palliative care/end-of-life, delirium, early mobility and targeted temperature management after cardiac arrest.

With the advent of digital revolution in India, we also explored the depth of digital coverage in the ICU. Not aligning with the rapid growth observed in other sectors,
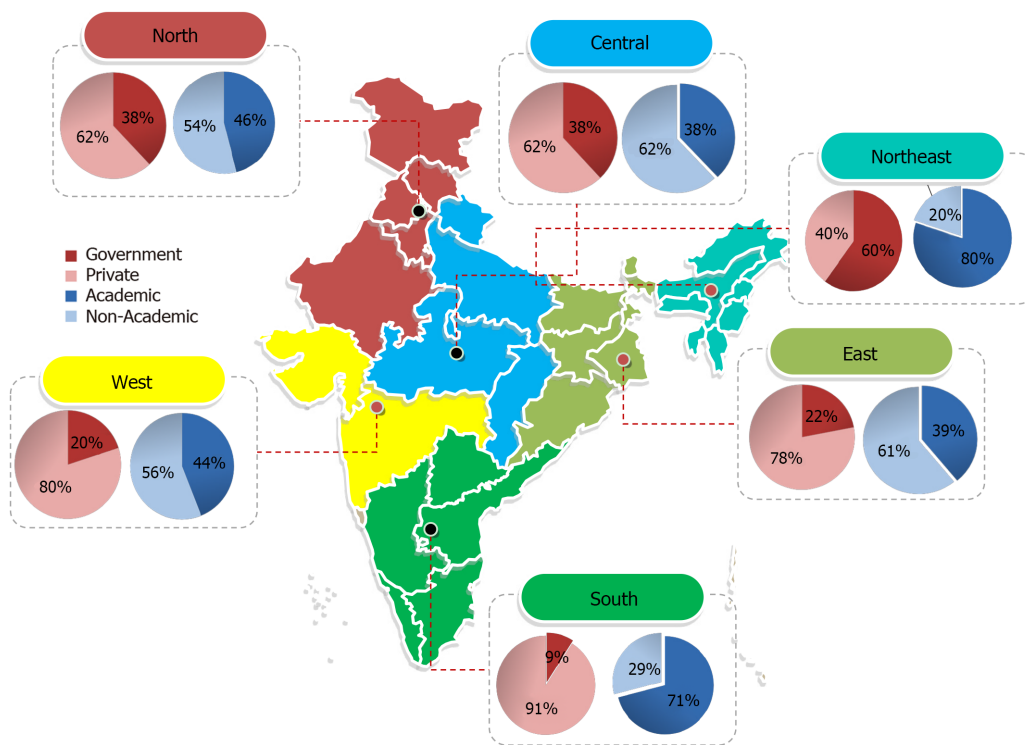
Figure 2 Participating intensive care unit's distribution by administrative divisions of India – North, South, West, East, Central, Northeast- with type of hospital setting.

less than half of the ICUs reported having high-speed internet with even lesser having electronic medical records, tele-ICU coverage and 2-way communication. A survey of ICUs in medium to low income countries documented an average number of beds being around 10 per ICU, almost 70% of the ICUs were staffed with certified intensivists and 69% of the hospitals had a reliable internet access[7]. In a systematic review done 18 years ago in an attempt to identify physician staffing patterns and clinical outcomes in critically ill patients, the ICU mortality rates ranged from 6%-74% in low intensity staffing and 1%-57% in high intensity staffing ICUs[11]. Outcome data in our study was well within the observed range, reflecting that the majority of the ICUs across the country are adhering to the accepted standard of care, although the self-reported outcomes decrease the validity of these results.

In a descriptive study in the United States of ICUs, the average ICU size was 11.7 ± 7.8 beds per unit, and majority of these hospitals had more than one ICU, followed standard of care protocols, had better patient care delivery, as well as better outcomes, as compared to studies done in low and middle income countries[2,12,13].

Our study has several limitations. First, we had no follow up of initial non-responders. We had a limited sample size, and we used a survey that had not been previously validated in the literature. Other limitations included the documentation of self-reported outcomes reporting, which is similar to previously reported survey-based study from one state in India[14,15]. Also, our study had a limited ability from the surveyor's side to ensure correct data entry and eliminate bias. For example, the overall penetration of tele-ICUs systems and EMRs in India is extremely low; but the reported fraction of tele-ICU penetration in our study may be higher due to selection bias. However, the strength of this survey is that the ICU data was retrieved from diverse geographical regions, which increase the external validity of the study. In addition, we were appreciated at Society of Critical Care Medicine 2019 conference abstract presentation[16] about the fact that the functionality of the survey was tested as a pilot among a random group of critical care physicians prior to implementation, which adds to the internal validity.

Understanding the epidemiology of the Indian subcontinent is incredibly complex, due to inherent variability and lack of required infrastructure to carry out such large-scale studies. At best, these trends can be used as building blocks to identify the gaps in the understructure, and identify areas to focus on, for improved financial and human resource investments.

In a large nation, semi-structured need assessment survey, the need for improved manpower including; in-house intensivists and decreasing patient-to-nurse ratios are evident. Quality and research initiatives to decrease sepsis mortality and ICU length

Table 1 Demographic variables

Demographic variables	Responses in % (*n* = 134)
Age (yr)	
30-40	41
40-50	30.6
20-30	17.2
> 50	11.2
Gender	
Male	80.2
Female	19.4
ICU experience (yr)	
< 10	61.9
11-20	28.4
20-30	8.2
> 30	1.5
Designation	
Consultant staff	75.4
Resident- PGY-3 and above	14.1
Resident- PGY-1	6.7
Resident- PGY-2	3.7
Intensive care unit specialty wise distribution	
Mixed medical-surgical	82.8
Medical	8.2
Others	6.7
Surgical	2.2
Institution type	
Private/academic	37.3
Private/non-academic	36.5
Government/academic	14.2
Government/non-academic	11.9
Bed strength	
11-20	36.6
< 10	26.9
21-30	22.4
> 30	14.2
ICU type	
Open	82.1
Closed	17.9

ICU: Intensive care unit.

of stay can be prioritized. Our new theory would be that subsequent surveys can focus on digital infrastructure for standardized care and scarce resources utilization and enhancing the compliance of existing protocols.

Table 2 Clinical resource parameters

Clinical resource parameters	Responses in % (*n* = 134)
Patient: nurse ratio	
Usually 2:1 (for complicated patients 1:1) (*n* = 49)	36.6
2:1 (*n* = 34)	25.4
> 2:1 (*n* = 32)	23.9
1:1 (*n* = 13)	9.7
No fixed patient: nurse (*n* = 6)	4.5
24 h in-house intensivist (*n* = 77)	57.5
Certified intensivist (*n* = 107)	79.9
Residents/fellows/medical students rotate through or cover ICU along with staff intensivists (*n* = 110)	82.1

ICU: Intensive care unit.

Table 3 Critical care protocols self-reporting

High (%)		Medium (%)		Low (%)	
Glucose control	91.8	Daily interruption of sedation	71.6	Palliative care/end of life	50.0
Advanced cardiac life support	88.8	Acute coronary syndrome	68.7	Delirium	48.5
DVT prophylaxis	87.3	Acute lung injury	62.7	Early mobility	48.5
Stress ulcer prophylaxis	87.3	Transfusion restriction	62	Hypothermia after cardiac arrest	44.8
Severe sepsis	83.5				
VAP bundle	83.5				
Nutrition	82.8				

DVT: Deep vein thrombosis.

Table 4 Digital demographics

Digital demographics	Responses in % (*n* = 134)
High speed internet	46
Electronic medical records	37
Tele-ICU Coverage	21
2 – way communication (*e.g.*, webcam)	16

ICU: Intensive care unit.

Table 5 Common diagnoses

Common diagnoses (Dx)	No.	% of ICU
Most common Dx - septic shock	116	86.57
Respiratory failure	108	80.6
Heart failure	58	43.28
Trauma	57	42.54
Post Op	59	44.03
COPD exacerbation	72	53.73
Electrolyte imbalance	39	29.1
Epilepsy or seizure	21	15.67
Renal failure	72	53.73
Hypotension	37	27.61

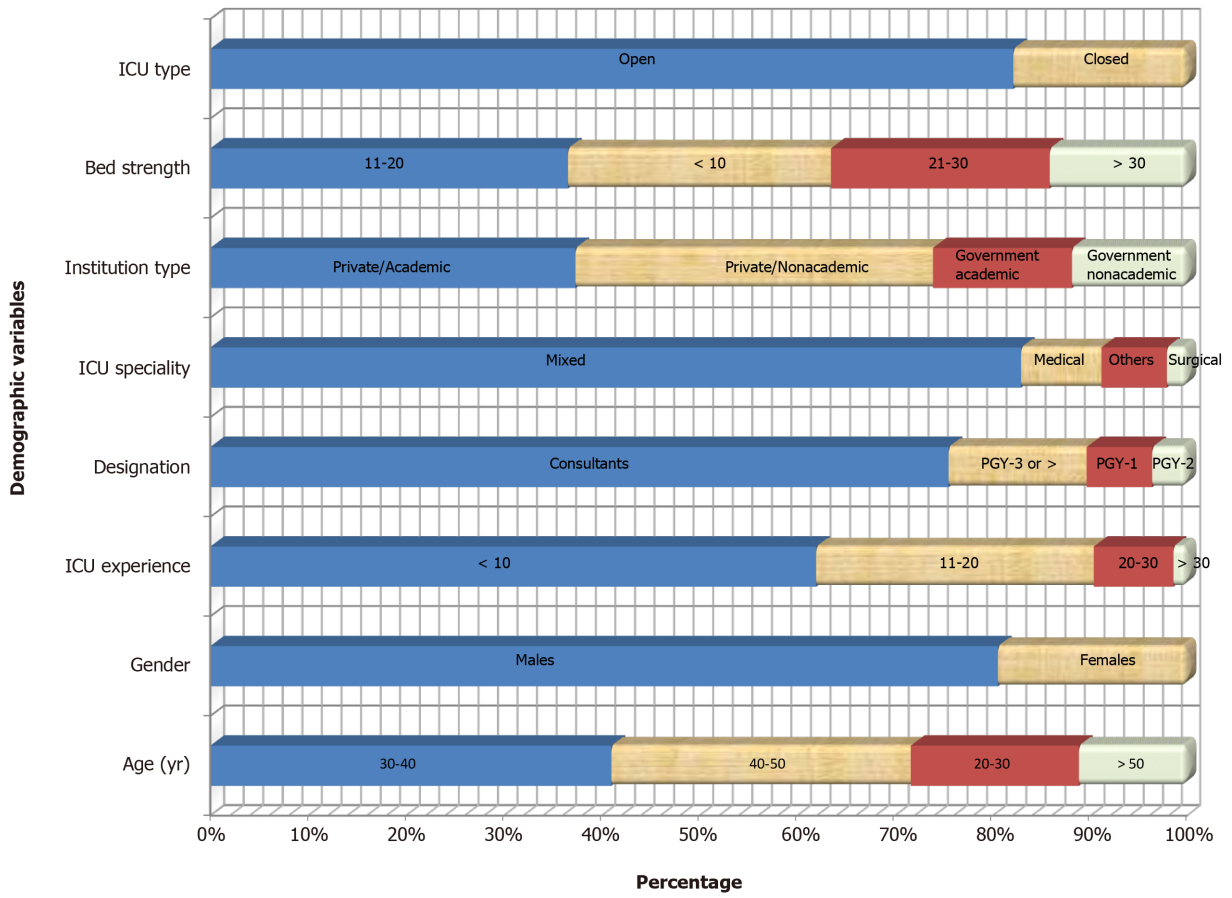| Poisoning/substance abuse		34	25.37

ICU: Intensive care unit.

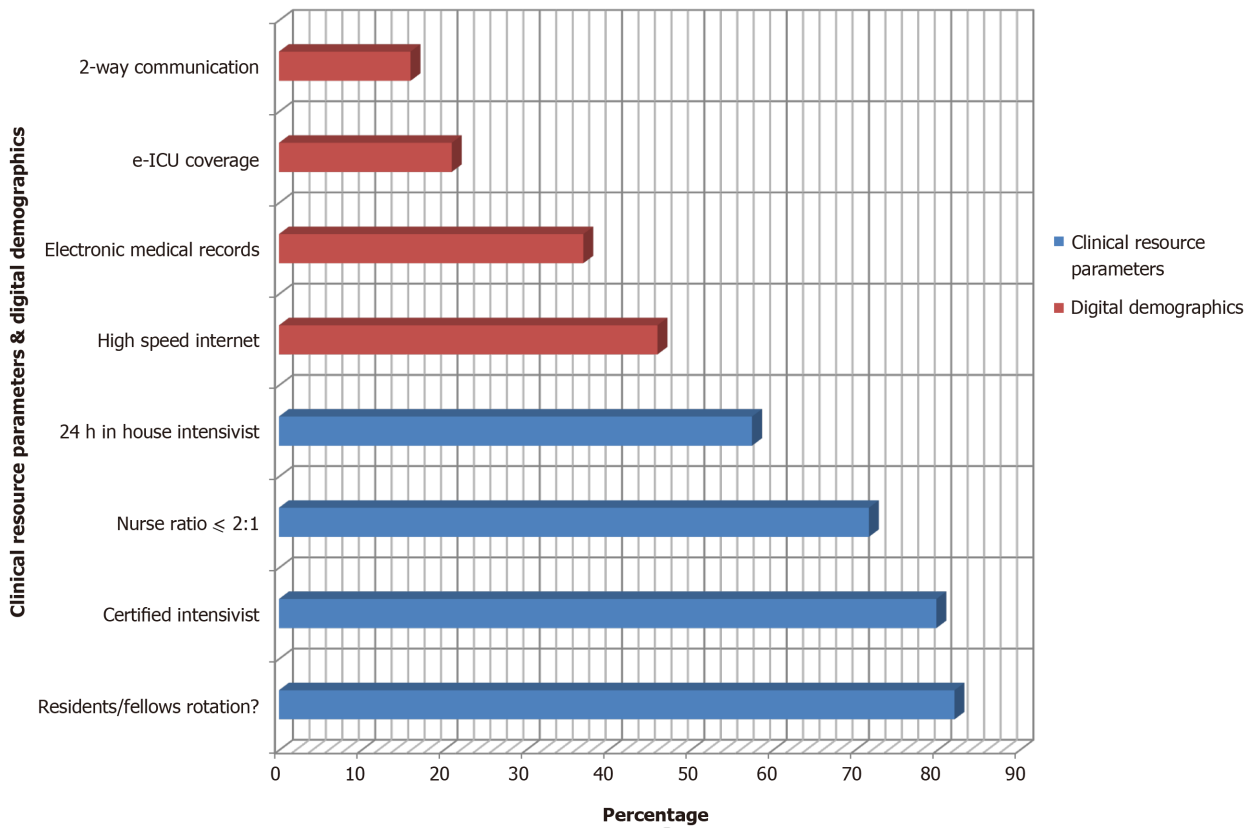**Figure 3 Intensive care unit demographics variables.** ICU: Intensive care unit.

Figure 4 Intensive care unit clinical resource parameters and digital demographics.
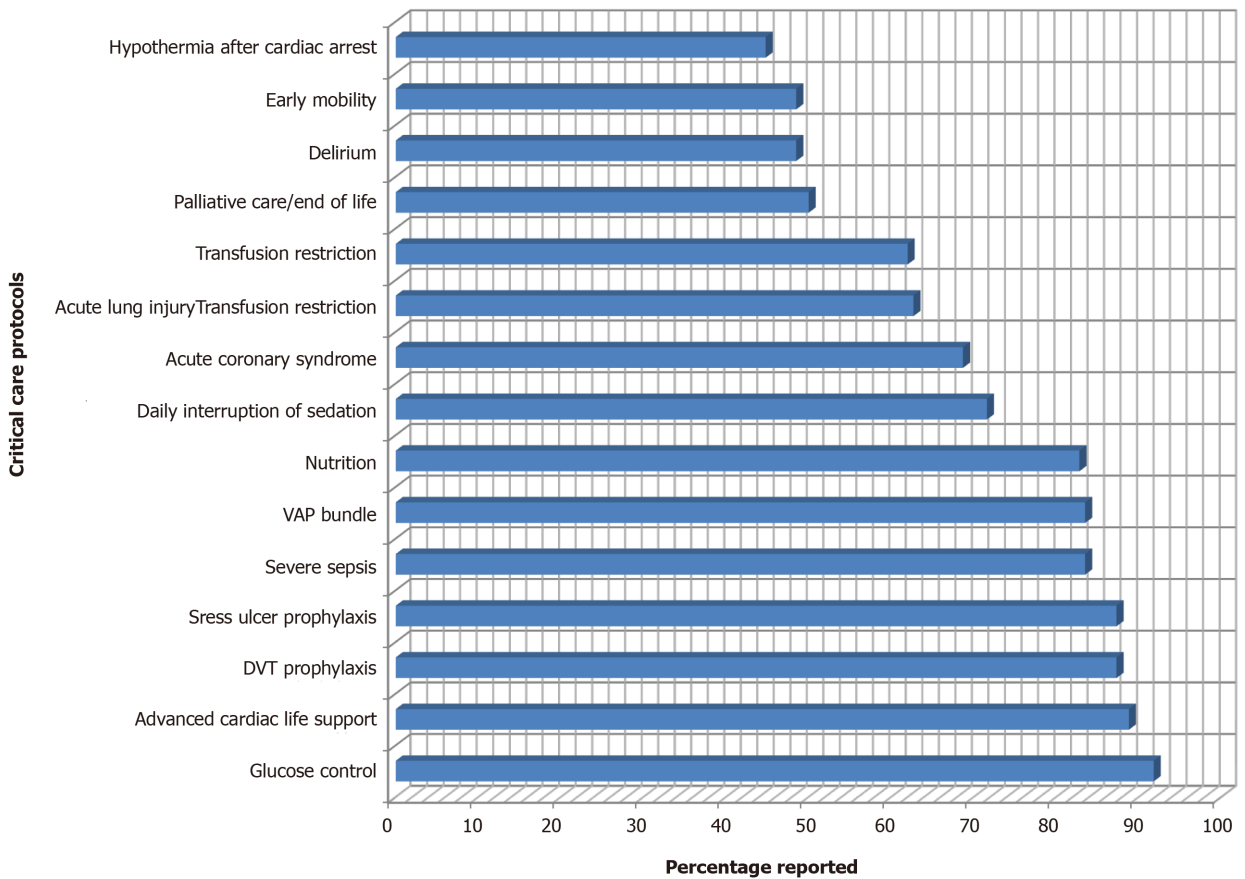

Figure 5 Intensive care unit critical care protocols.

ARTICLE HIGHLIGHTS

Research background

With the modernization of medicine and technology, the population is living longer. The patients presenting in hospital have several co-morbid factors and are critically ill on many instances. The developed countries have come with several protocol and best practices, based on the scientific facts and expert guideline. This has shown to save lives and improve the outcomes. When it comes to developing countries, though progress has been made but not much data or information is available.

Research motivation

There is not much data out there regarding standard of practice, variations in practice, clinical services available in the different region of intensive care unit (ICU). We believe that having that knowledge will help in decreasing the variation and improve henceforth help in improving the patient care.

Research objectives

Study was designed to understand the processes, adherence to the guidelines and clinical services available in ICU in different part of India.

Research methods

This study was cross-sectional pan-India based survey.

Research results

Responses were received from 134 adult/pediatric ICU were received. More than 80% of their ICU was either open or transitional. Digital infra-structure and technology was found to be marginal. More than 80% of them were utilizing sepsis care, ventilator-associated pneumonia bundle, deep venous thrombosis prophylaxis, stress ulcer prophylaxis and glycemic control. They have lower nurse to patient ratio. They also have fewer critical care specialist.

Research conclusions

There is definitely need for improvement in the digital infra-structure, nurse to patient ratio, critical care physician availability.

Research perspectives

Improving the practice gaps can help in improving the patient care, decreasing the hospital and ICU length of stay, decrease in mortality, and improvement in patient outcome.

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