World Journal of Critical Care Medicine

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World J Crit Care Med 2022 May 9; 11(3): 169-177

DOI: 10.5492/wjccm.v11.i3.169

ISSN 2220-3141 (online)

ORIGINAL ARTICLE

Observational Study

Critical care practices in the world: Results of the global intensive care unit need assessment survey 2020

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Specialty type: Critical care medicine

Provenance and peer review: Invited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification
Grade A (Excellent): 0
Grade B (Very good): B, B, B
Grade C (Good): 0
Grade D (Fair): 0
Grade E (Poor): 0

P-Reviewer: Lopes-Junior LC, Brazil; Sánchez JIA, Colombia

Received: September 3, 2021
Peer-review started: September 3, 2021
First decision: December 2, 2021
Revised: December 11, 2021
Accepted: March 6, 2022
Article in press: March 6, 2022
Published online: May 9, 2022

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Abstract

BACKGROUND

There is variability in intensive care unit (ICU) resources and staffing worldwide. This may reflect variation in practice and outcomes across all health systems.

AIM

To improve research and quality improvement measures administrative leaders can create long-term strategies by understanding the nature of ICU practices on a global scale.

METHODS

The Global ICU Needs Assessment Research Group was formed on the basis of diversified skill sets. We aimed to survey sites regarding ICU type, availability of staffing, and adherence to critical care protocols. An international survey 'Global ICU Needs Assessment' was created using Google Forms, and this was distributed from February 17th, 2020 till September 23rd, 2020. The survey was shared with ICU providers in 34 countries. Various approaches to motivating healthcare providers were implemented in securing submissions, including use of

emails, phone calls, social media applications, and WhatsApp™. By completing this survey, providers gave their consent for research purposes. This study was deemed eligible for category-2 Institutional Review Board exempt status.

RESULTS

There were a total 121 adult/adult-pediatrics ICU responses from 34 countries in 76 cities. A majority of the ICUs were mixed medical-surgical [92 (76%)]. 108 (89%) were adult-only ICUs. Total 36 respondents (29.8%) were 31-40 years of age, with 79 (65%) male and 41 (35%) female participants. 89 were consultants (74%). A total of 71 (59%) respondents reported having a 24-h in-house intensivist. A total of 87 (72%) ICUs were reported to have either a 2:1 or ≥ 2:1 patient/nurse ratio. About 44% of the ICUs were open and 76% were mixed type (medical-surgical). Protocols followed regularly by the ICUs included sepsis care (82%), ventilator-associated pneumonia (79%); nutrition (76%), deep vein thrombosis prophylaxis (84%), stress ulcer prophylaxis (84%), and glycemic control (89%).

CONCLUSION

Based on the findings of this international, multi-dimensional, needs-assessment survey, there is a need for increased recruitment and staffing in critical care facilities, along with improved patient-to-nurse ratios. Future research is warranted in this field with focus on implementing appropriate health standards, protocols and resources for optimal efficiency in critical care worldwide.

Key Words: Intensive care unit; Critical care; Global; Survey; Intensive care unit survey; Intensive care unit needs

Core Tip: Intensive care unit (ICU) practices are variable across the world. Most common admitting diagnoses for ICUs worldwide are similar to Western reporting in literature. We aimed to survey sites regarding ICU type, availability of staffing, and adherence to critical care protocols. There is variable protocol penetration for processes of care in ICUs. Future research is warranted in this field with focus on implementing appropriate health standards, protocols and resources for optimal efficiency in critical care worldwide.

Citation: Nawaz FA, Deo N, Surani S, Maynard W, Gibbs ML, Kashyap R. Critical care practices in the world: Results of the global intensive care unit need assessment survey 2020. *World J Crit Care Med* 2022; 11(3): 169-177

URL: https://www.wjgnet.com/2220-3141/full/v11/i3/169.htm

DOI: https://dx.doi.org/10.5492/wjccm.v11.i3.169

INTRODUCTION

Critical care is defined by varying practices across countries worldwide. This is affected by multi-factorial trends in epidemiology, finance, and cultural and human resources that in turn influence patient outcomes[1].

Intensive care units (ICUs) are at the center of diverse practices in health systems around the world. Their needs are dictated by hierarchical arrangements, resource designation, patient demographics, and health practices, including the allied goals of health providers[2]. With a necessity for standardization deemed essential for efficiency and high-quality patient care, it is vital to understand the context of epidemiological variability, resource accessibility, and local health practices[3] in such sophisticated settings. Moreover, the current understanding and comparison of clinical practices, guidelines, equipment, and facilities available in different countries can help identify potential areas of quality improvement *via* protocol development and enhancement of unified care delivery. Current literature on this topic can be found in developed countries[4,5]; however, it is significantly limited in multinational settings[6-8] on a global level.

We aimed to delineate the critical care practices that are found worldwide and their characteristics, including staffing, ICU resources, and adherence to protocols. This study sets a novel benchmark in sharing insights on key areas of critical care by highlighting the state of ICUs across different countries and understanding the trends in contemporary health systems. By defining gaps in knowledge, resources, and protocols, this study can facilitate the development of best practice strategies and thereby

lay a strong foundation for critical care provision worldwide[9].

MATERIALS AND METHODS

Study design

This was a cross-sectional, multinational, survey-based study. We proposed the formation of a multidisciplinary, diverse team of skilled researchers who established the "Global ICU Needs Assessment Research Group".

A questionnaire was developed under the guidance of this research group with the goal of evaluating most common patient presentations, and resource needs in terms of ICU equipment and assisting technology.

Study variables

Furthermore, we asked about other variables, such as the availability of intensivists, residents, fellows, 12-h in-house intensivists, and patient/nurse ratio, along with other demographics of those surveyed, such as their level of qualification, duration of clinical experience, and overall expertise in this field. It was also deemed crucial to include outcome variables, such as mechanical ventilation (MV) duration, MV mortality, ICU length of stay, ICU mortality, and sepsis mortality as well. Using a pilot study approach, we implemented this strategy within a randomized group of ICU clinicians before proceeding with the main study phase. This was done for internal validation purposes in the form of a survey shown in the digital supplement.

Sample of convenience was done. Intensivists were contacted using social media platforms and personal networking and *via* critical care societies. The survey was designed using Google™ forms online and sent out from February 17th, 2020 to 23rd September, 2020, to critical care professionals in 34 countries worldwide (Figure 1). The need for regular follow-ups and motivation within critical care professionals was a vital factor to this study. This was achieved by leveraging various online platforms, such as e-mail and social media applications including WhatsApp™[20].

Using a diverse set of researchers, critical care physicians, and digital platforms, a sample of 122 ICUs was acquired through this questionnaire.

Statistical analyses

The responses were presented as stratified data in the form of mean, with standard deviation, or median with interquartile range. It was also deemed necessary to include relevant pictographic presentation of this data.

Descriptive statistical analysis was used after obtaining eligibility for category-2 Institutional Review Board exempt status.

ICU practices at a given healthcare facility, including details about the respondents and demographics of the facility. The survey asked about the state of the ICU being open or closed, type of patients receiving care, number of ICU beds, protocols implemented for efficient practice.

RESULTS

The respondents of this survey primarily reflected a young adult population, with the respondents of this survey primarily reflected a young adult population with the greatest proportion 31-40 years old and males representing the majority, n = 79 (65%) with an average ICU experience of 3 years. Moreover, consultants were the main constituents of the survey respondents at n = 89 (74%), followed by residents from post-graduate year 3 and above (18, 15%). The ICU settings were mostly designed as a mixed medical-surgical environment (92, 76%) in academic teaching hospitals (38, 32%) with an average of 16 (interquartile range 11-20) beds. Furthermore, the ICUs were commonly open type, (53, 44%) (Table 1).

The need for intensivists and nurses to lead critical care is noted worldwide[1]. The analysis showed a patient/nurse ratio of 2:1 being implemented in the majority (55%) of the ICU units, and only (10%) of responders were following a 1:1 nursing care approach. Moreover, 34% of ICUs, which typically functioned at 2:1 patient/nurse ratios, transferred to 1:1 for complicated cases. There was also a significant number of ICUs (20, 16.5%) working with more than a 2:1 patient/nurse ratio. It is also noteworthy that a vast majority of the ICUs (101, 84%) were led by certified intensivists with 24-h intensivists deployed in 71 (59%) of the ICUs for optimal patient care. Other notable providers were residents/fellows/medical students active in 101 (84%) ICU units (Table 2).

Critical care was driven by protocols that were followed within all ICU facilities. There was a strong predominance of protocols for Advanced Cardiac Life Support (93%), glucose control (89%), stress ulcer prophylaxis (84%), deep vein thrombosis (DVT) prophylaxis (84%) and sepsis care (82%). The protocols least reported included palliative care/end of life (44%), acute lung injury (55%), transfusion restriction (59%), hypothermia after cardiac arrest (61%), and delirium (67%) (Table 3).

Table 1 Demographic variables

Demographic variables	Responses in % (*n* = 121)
Age (yr)	
31-40	29.8
41-50	23.1
20-30	23.1
> 50	24.0
Gender	
Male	65.3
Female	34.7
Intensive care unit experience (yr)	
< 10	50.4
10-20	35.5
21-30	9.9
> 30	4.1
Designation	
Consultant staff	73.6
Resident-PGY-3 and above	14.9
Resident-PGY-1	5.0
Resident-PGY-2	6.6
Intensive care unit specialty wise distribution	
Mixed medical-surgical	76.0
Medical	7.4
Others	16.6
Institution type	
Private/non-academic	16.5
Government hospital (tertiary care)	19.8
Academic teaching hospital	31.5
Corporate teaching hospital	8.2
Other	0.9
Number of intensive care unit beds	
< 11	28.1
11-20	31.4
21-30	23.1
> 30	17.4
Intensive care unit type	
Open	43.8
Closed	56.2

PGY-3: Post-graduate year 3.

The sample population was analyzed across a total 121 adult/adult-pediatrics ICU responses from 34 countries in 76 cities. Distribution of the respondents was spread amongst North America (41.3%), Asia (30.5%), Europe (18.2%), Africa (5.8%), South Africa (2.6%) and Oceania (1.6%) (Figure 1).

Table 2 Clinical resource parameters

Clinical resource parameters	Responses in % (*n* = 121)
Patient/nurse ratio (*n*)	
Usually 2:1 (for complicated patients 1:1) (*n* = 41)	33.9
2:1 (*n* = 26)	21.5
> 2:1 (*n* = 20)	16.5
1:1 (*n* = 31)	25.6
No fixed patient/nurse (*n* = 3)	2.5
24 h in-house intensivist (*n* = 71)	58.7
Certified intensivist (*n* = 101)	83.5
Residents/fellows/medical students rotate through or cover intensive care units along with staff intensivists (*n* = 101)	83.5

Table 3 Critical care protocols self-reporting

High (%)		Medium (%)		Low (%)	
Glucose control	89.3	Daily interruption of sedation	69.4	Palliative care/end of Life	43.8
Advanced cardiac life support	93.4	Acute coronary syndrome	81.0	Delirium	66.9
Deep vein thrombosis prophylaxis	83.5	Acute lung injury	54.5	Early mobility	68.6
Stress ulcer prophylaxis	83.5	Transfusion restriction	58.7	Hypothermia after cardiac arrest	61.2
Severe sepsis	81.7				
Ventilator-associated pneumonia bundle	78.5				
Nutrition	76.0				

The most common diagnoses for patients admitted into the ICU settings in this study included sepsis (88%), respiratory failure (88%) and heart failure (55%), as shown in Table 4.

The average ICU mortality (*n* = 36) assessed in this survey was 14% (interquartile range 2-40); ICU length of stay (*n* = 41) was 5.2 d (interquartile range 2-21); mechanical ventilation (MV) duration (*n* = 34) was 4.3 d (1-15); MV patient mortality (*n* = 27) was 20% (1-64) and sepsis mortality (*n* = 27) was at 21% (5-70) across the survey respondents (Table 5).

DISCUSSION

In a multi-national study that evaluates the critical care practices of 121 ICUs in 34 countries, the majority of the centers were from mixed medical-surgical or medical practices, with consultants comprising the majority of respondents. The most common diagnoses included sepsis/septic shock and respiratory failure. The largest proportion of responders were young adult males who identified as intensivists, suggesting that this field is expanding to include more learners who are early in their training.

Considering that this was a multinational study, it is important to note that local practices and resources may vary between different regions. A lack of resources may limit the total number of beds available, or even result in a lower number of monthly admissions[10] in a given center relative to other regions. Because financial resources may influence how patients are triaged or how the healthcare organization is structured[11], it is important to keep this in mind when evaluating multi-center data from different countries.

The predominant diagnosis in the ICU was sepsis. Studies show that sepsis has a mortality rate varying from 13% to 39%[12]. The second most common diagnosis was respiratory failure, with studies indicating a mortality rate of 26.2%[13]. Both sepsis and respiratory failure followed the same trend that is observed in country-specific ICU studies[14]. Considering that the mortality rates of both diseases are so high, it is imperative that ICUs are equipped with the resources and training to achieve best practice guidelines[15].

Many of the reported surveys were from individuals in mixed medical-surgical ICUs that were closed in nature and had 24-h intensivists. Additionally, the greatest number of the respondents reported

Table 4 Common diagnoses

Common diagnoses	No	% of intensive care unit
Sepsis or septic shock	106	87.6
Respiratory failure	106	87.6
Heart failure	67	55.4
Post-operative observation	68	56.2
Poisoning	15	12.4
Head trauma	37	30.6
Renal failure	46	38.0
Alcohol withdrawal	13	10.7
Epilepsy or uncontrolled seizures	18	14.9
Chronic obstructive pulmonary disease exacerbation	37	30.6
Hypertension	15	12.4
Cardiogenic shock	37	30.6
Electrolyte imbalance	20	16.5
Hypotension or hypovolemic shock	44	36.4
Heat stroke	4	3.3

Table 5 Critical care outcomes

Variables	Outcome
Intensive care unit mortality (response n =36)	14%
Intensive care unit length of stay, in days (response n = 41)	5.2
Mechanical ventilation mortality (response n = 27)	19.5%
Mechanical ventilation duration, in days (response n = 34)	4.3
Sepsis mortality (response n = 27)	21.2%

having 11-20 beds in the ward. Most of these centers were within academic or privately-owned hospitals. Although it is believed that ICUs with more beds will achieve better optimal care, it is important to consider that more money shifted towards ICUs will limit funding to other departments [16]. This predominantly impacts areas of low-resource settings, which is why the median ICU beds in low-income countries is 8[7]. Closed ICUs are associated with better outcomes, such as shorter ICU stay and decreased ICU costs[17]. North America is reported to have the lowest amount of closed ICUs (63%), with Western Europe having the highest (89%) (17). Since closed ICUs require an intensivist working on site, more and more ICUs are now including a 24-h intensivist, which can lead to decreased risk of in-hospital death and rate of complications[1].

Respondents most often reported a patient/nurse ratio of 2:1, which flexed to 1:1 for complicated patients. In a study by Sakr *et al*[1] it was reported that a patient/nurse ratio of more than 1.5:1 was associated with a higher risk of in-hospital death. Adequate care in ICUs requires proper staffing of nurses. This can greatly impact patient outcomes, especially if there are limited nurses available to provide care[1]. A high patient/nurse ratio can result in more mistakes being made due to a stressful work environment and fatigue[18]. It is imperative that adequate staffing is provided to ICUs to best provide patient care in an optimized environment.

Kredo *et al*[19] noted that evidence-informed best practice guidelines are imperative to optimizing patient care. A multifaceted, team-based approach in the ICU is the best way of reinforcing these guidelines and developing strategies that can better manage the patient or prevent complications[15]. In our survey, we found that a majority of centers are able to follow best practice guidelines related to glucose control, advanced cardiac life support, DVT prophylaxis, and stress ulcer prophylaxis. However, challenges exist with protocols related to palliative care, acute lung injury, and transfusion restriction. It is important to address barriers to guideline adherence, which can differ from region to region. Some commonly reported barriers include lack of knowledge[20] or needing effective leadership to promote adoption of guidelines[21].

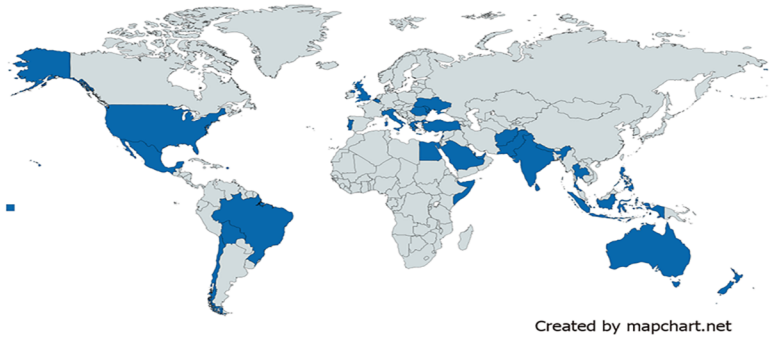

Figure 1 The survey was designed using Google™ forms online and sent out from February 17th, 2020 to 23rd September, 2020, to critical care professionals in 34 countries worldwide. Created by mapchart.net.

Strengths

The strengths of this study include being one of the first multinational surveys to collect data from 34 countries during the pandemic of the century[22]. Having more regions participate in a survey like this is beneficial because it provides a snapshot of the ICU statistics in that area. A multi-center design allows for a broader range of data representing the resources of each area *vs* a single center study. These data can be used to evaluate current ICU resources and limitations worldwide and can therefore help administration create designs to optimize care for patients who are in the critical care unit. Such multi-national collaborations would lead to robust data collection during pandemic and peace times[23-25].

Limitations

Our study has several limitations. First, since our primary recruitment method was through social media and networking at critical care societies, we may be missing out on data from remote areas or sites that did not see our recruitment invitation online. Second, as we had only 34 countries represented, a larger sample size from different geographical locations would allow us to understand the needs of the ICU in those regions better. Recall bias is also a factor in survey studies, as participants may not be able to fill in all the information as accurately as possible. Additionally, since this survey was filled out during the year of the coronavirus disease 2019 pandemic, ICUs may have been impacted or changed very drastically to meet the needs of their community. Therefore, the reported results may not accurately reflect ICU data prior to the pandemic. A final limitation to our study is that we did not stratify our data into geographical regions to evaluate differences from region to region. Further research could aim to delineate this data.

CONCLUSION

This international, multi-dimensional, needs-assessment survey reflects a need for increased recruitment and staffing in critical care facilities, along with improved patient-to-nurse ratios. Multi-center ICU data are imperative in designing future critical care delivery models that reflect the needs of the patient and address barriers to their care. Understanding current trends in health systems helps us develop quality improvement interventions that can lead to better outcomes in patients.

ARTICLE HIGHLIGHTS

Research background

There is variability in intensive care unit (ICU) resources and staffing worldwide. This may reflect variation in practice and outcomes across all health systems.

Research motivation

By understanding the nature of ICU practices on a global scale, administrative leaders can create long-term strategies for improved research and quality improvement measures.

Research objectives

We aimed to delineate the critical care practices that are found worldwide and their characteristics, including staffing, ICU resources, and adherence to protocols.

Research methods

An international survey 'Global ICU Needs Assessment 2020' was created using Google Forms, and this was distributed from February 17th, 2020 till September 23rd, 2020. The survey was shared with ICU providers in 34 countries.

Research results

There were a total 121 adult/adult-pediatrics ICU responses from 34 countries in 76 cities. A majority of the ICUs were mixed medical-surgical (92, 76%). 108 (89%) were adult-only ICUs. Total 36 respondents (29.8%) were 31-40 years of age, with 79 (65%) male and 41 (35%) female participants. 89 were consultants (74%). A total of 71 (59%) respondents reported having a 24-h in-house intensivist.

Research conclusions

Based on the findings of this international, multi-dimensional, needs-assessment survey, there is a need for increased recruitment and staffing in critical care facilities, along with improved patient-to-nurse ratios.

Research perspectives

Future research is warranted in this field with focus on implementing appropriate health standards, protocols and resources for optimal efficiency in critical care worldwide.

FOOTNOTES

Author contributions: Nawaz FA, Deo N and Kashyap R prepared the first draft of this manuscript and analyzed the results; Surani S, Maynard W, Gibbs ML and Kashyap R reviewed, edited, and approved the final manuscript.

Institutional review board statement: The study was reviewed and approved by the Mayo Clinic Institutional Review Board.

Informed consent statement: Informed consent was waived by the the Mayo Clinic Institutional Review Board.

Conflict-of-interest statement: There are no conflicts of interest to report.

Data sharing statement: No additional data are available.

STROBE statement: The authors have read the STROBE Statement—checklist of items, and the manuscript was prepared and revised according to the STROBE Statement—checklist of items.

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S-Editor: Wang JJ
L-Editor: A
P-Editor: Wang JJ

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