A Survey on Critical Care Resources and Practices in Low- and Middle-Income Countries

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ABSTRACT

Background: Timely and appropriate care is the key to achieving good outcomes in acutely ill patients, but the effectiveness of critical care may be limited in resource-limited settings.

Objectives: This study sought to understand how to implement best practices in intensive care units (ICU) in low- and middle-income countries (LMIC) and to develop a point-of-care training and decision-support tool.

Methods: An internationally representative group of clinicians performed a 22-item capacity-and-needs assessment survey in a convenience sample of 13 ICU in Eastern Europe (4), Asia (4), Latin America (3), and Africa (2), between April and July 2012. Two ICU were from low-income, 2 from low-middle-income, and 9 from upper-middle-income countries. Clinician respondents were asked about bed capacity, patient characteristics, human resources, available medications and equipment, access to education, and processes of care.

Results: Thirteen clinicians from each of 13 hospitals (1 per ICU) responded. Surveyed hospitals had median of 560 (interquartile range [IQR]: 232, 1,200) beds. ICU had a median of 9 (IQR: 7, 12) beds and treated 40 (IQR: 20, 67) patients per month. Many ICU had ≥1 staff member with some formal critical care training (n = 9, 69%) or who completed Fundamental Critical Care Support (n = 7, 54%) or Advanced Cardiac Life Support (n = 9, 69%) courses. Only 2 ICU (15%) used any kind of checklists for acute resuscitation. Ten (77%) ICU listed lack of trained staff as the most important barrier to improving the care and outcomes of critically ill patients.

Conclusions: In a convenience sample of 13 ICU from LMIC, specialty-trained staff and standardized processes of care such as checklists are frequently lacking. ICU needs-assessment evaluations should be expanded in LMIC as a global priority, with the goal of creating and evaluating context-appropriate checklists for ICU best practices.

The need for intensive care is increasing worldwide [1,2]. In high-income countries, critically ill patients are routinely treated in intensive care units (ICU) by specialized physicians, nurses, and support staff. This healthcare model is expensive and often cannot be effectively transferred into low- and middle-income countries (LMIC) [3,4]. In contrast, the majority of the world's population lives in LMIC, with a disproportionately high burden of critical and life-threatening illness, resulting in unacceptably high mortality rates from potentially treatable conditions [5]. Despite this, there are limited data on critical care resources and practices in resource-limited countries [6]. Lack of human resources, adequate specialty training, equipment, and infrastructure all present barriers to safe and effective use of life-saving interventions in these settings [3,7]; however, the relative contributions of these factors toward ICU care in LMIC are not known. In addition, lack of standardized, evidence-based approaches to care may preclude optimal delivery of critical care in LMIC ICU settings. The use of checklists has previously been shown to improve adherence to processes of care and to decrease complications in a variety of ICU settings [8–12]. To facilitate timely and improved best-practice delivery and a reduction in preventable death and complications in critically ill patients, we plan to develop a simple evidence-based electronic decision support tool: CERTAIN (Checklist for Early Recognition and Treatment of Acute Illness). As a first step, we performed a web-based capacity-and-needs assessment of 13 ICU.

METHODS

We conducted a cross-sectional survey in a convenience sample of 13 hospitals with whom we have previously collaborated: 4 from Eastern Europe (2 in Serbia, 2 in Bosnia and Herzegovina); 4 from Asia (China, India, Mongolia, and Turkey); 3 from Latin America (Mexico,

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Panama, and Dominican Republic); and 2 from Africa (Rwanda). The survey was conducted between April and July 2012. Two hospitals were from low-income countries, 2 from low-middle-income countries, and 9 from upper-middle-income countries according to World Bank classification (Table 1) [13]. One physician at each participating center was contacted by an e-mail that explained the purpose of the study and provided a link to the web-based survey. Participants were asked 22 questions about ICU bed capacity, patient characteristics, human resources, available medications and equipment, education, and processes of care (Online Appendix), based on a previously published survey [14]. The ability to access resources and equipment was classified as easy, neither easy nor difficult, and difficult based on perception of the study participants. The study was exempt from institutional board review. Respondents provided consent to participate in the survey. Descriptive statistics were used to describe all survey domains.

RESULTS

ICU capacity and common causes of death

All centers (Table 1) responded to the survey (1 clinician per ICU, 100% response rate). Hospitals had a median of 560 (interquartile range [IQR]: 232, 1,200) beds. The median number of ICU beds was 9 (IQR: 7, 12) and ICU treated a median of 40 (IQR: 20, 67) patients per month. The average ICU/hospital bed ratio was approximately 1.6% (9:560). The approximate average age of critically ill patients was 51 to 60 years in 7 hospitals, 4 hospitals reported average age $\leq$50 years, and 2 hospitals reported average age of >60 years. Ten hospitals were exclusively funded by government funds and 1 by private/industry funds; 2 hospitals were supported by >1 source. All hospitals delivered care to patients in their local language, and 2 hospitals in Africa also delivered care in English and French. Six ICU (46%) listed sepsis as the most common cause of death, with road traffic trauma as the most common cause of death in 2 ICU (15%). The most common cause of death at each of the remaining ICU differed: ischemic heart disease; stroke; conditions leading to emergency operations; nutritional diseases; and diseases of the respiratory system. The major causes of death reported by each ICU are listed in Table 2.

ICU staffing and access to educational materials

Each ICU surveyed was staffed with both physicians and nurses, and 1 hospital was additionally staffed with physician's assistants and 1 with nurse's assistants. In 1 hospital, additional care was provided by patients' family and friends. Nine ICU (69%) were staffed with physicians who specialized in critical care; 9 (69%) had $\geq$1 physician certified in the Advanced Cardiac Life Support course; and 7 (54%) were staffed with $\geq$1 physician who had completed the Fundamental Critical Care Support course. Eight (61%) employed nurses with formal critical care training.

The availability of ICU staff, medications, and equipment are presented in Figures 1 and 2. Seven hospitals (54%) reported use of any kind of checklists. Five hospitals (38%) reported use of some checklists during daily rounds and 5 (38%) during ICU admission; only 2 ICU (15%) used any checklist to formulate and communicate the plan of care for acute resuscitation. Ten hospitals (77%) reported easy access to medical textbooks, 7 (54%) to medical journals, and 8 (61%) to continuing health education; 9 (69%) had reliable internet access. Eight hospitals (61%) reported easy access to consultation with other institutions for additional specialist input.

TABLE 1. Characteristics of participating hospitals

City	Country	Income	Hospital Beds (n)	ICU Beds (n)	Average Age of Critically Ill Patients (yrs)
Sremska Kamenica	Serbia	Upper-middle-income	300	5	51–60
Santo Domingo	Dominican Republic	Upper-middle-income	75	12	51–60
Mexico City	Mexico	Upper-middle-income	150	18	41–50
Ankara	Turkey	Upper-middle-income	1,200	11	51–60
Banja Luka	Bosnia and Herzegovina	Upper-middle-income	1,200	8	51–60
Belgrade	Serbia	Upper-middle-income	1,200	60	51–60
Chitre	Panama	Upper-middle-income	165	8	71–80
Sarajevo	Bosnia and Herzegovina	Upper-middle-income	1,800	6	31–40
Beijing	China	Upper-middle-income	1,000	12	61–70
Ulaanbaatar	Mongolia	Lower-middle-income	520	9	51–60
Rourkela	India	Lower-middle-income	660	11	51–60
Butare	Rwanda	Low-income	450	5	41–50
Kigali	Rwanda	Low-income	560	9	21–30

ICU, intensive care unit.