

National Surgical, Obstetric, and Anesthesia Planning Intervention Toolkit

A Resource from the Program in Global Surgery and Social Change, Harvard Medical School

Domain: Improving capacity in intensive care units (ICUs) and critical care in low- and middle-income-countries (LMICs)

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Brief Synopsis

The need for improved capacity and scale-up of intensive care units (ICUs) in low- and middle-income countries (LMICs) is critical, as described by several recent reviews. Despite this, interventions to improve critical care in LMICs are still few. Several international intensive care societies have developed guidelines for basic requirements, in which they provide recommendations for planning, designing, and implementing intensive care units to meet the standards for different levels of care. However, these are not adapted to a LMIC context, and might not be directly applicable to a low-resource setting. Some countries, including India, have developed and implemented national guidelines for ICU standards and critical care management. Interventions to enhance capacity in ICUs or critical care include training programs, ranging from short courses to international multidisciplinary educational programs. There appears to be strong evidence around this type of intervention to strengthen the capacity of providers. Further, some international partnerships between high-income and low-income countries have been established to enhance capacity through training, exchanges, and advocacy. Many local initiatives, such as implementation of checklists and treatment guidelines, have been undertaken to enhance safety and quality of care. These, however, have not always showed improved patient outcomes. Lastly, several attempts to implement telemedicine in ICUs have been done showing good results on patient safety and outcome. However, to our knowledge, these interventions have only been attempted in high-income settings.

Guidelines

1. **India** has developed its own national guidelines for **planning and designing an intensive care unit**. These guidelines were published in 2010 and are developed to provide recommendations for rural as well as urban ICUs, including for teaching hospitals. Their recommendations include guidelines on planning and set-up, such as ICU level, number of beds, design of central nursing stations and equipment, but also on support systems (communication, environmental planning, human resource development, research, data collection, documentation, and record standards).

Reference: Medicine ISoCC. ICU Planning and Designing in India – Guidelines 2010. 2010;2.

2. Although not specific to LMICs, **European Society of Intensive Care Medicine's (ESICM) Working Group on Quality Improvement** provides comprehensive recommendations on basic requirements for intensive care units.
Reference: Valentin A, Ferdinande P. Recommendations on basic requirements for intensive care units: structural and organizational aspects. *Intensive care medicine*. 2011;37(10):1575-87.
3. **UK Critical Care societies** have developed core standards and guidelines for ICUs. Standards apply to all units capable of looking after Level 2 or Level 3 critically ill patients. The guidelines include recommendations on structure, processes and activities, including staffing, equipment, specific conditions, and data collection.
References:
Medicine JSCwtFoIC. Core Standards for Intensive Care Units. 2013;1. Guidelines for the Provision of Intensive Care Services found at <GPICS.pdf>.
4. A multidisciplinary panel of professionals with expertise in the clinical practice of critical care medicine working under the direction of the **American College of Critical Care Medicine (ACCM)** have developed guidelines on critical care services and personnel, based on a system of categorization of three levels of care.
Reference: Haupt MT, Bekes CE, Brill R, Carl LC, Gray AW, Jastremski MS, et al. Guidelines on critical care services and personnel: Recommendations based on a system of categorization of three levels of care. *Crit Care Med*. 2003;31(11):2677-83.

Interventions

1. Multimodal international partnerships to strengthen ICU capacity, with focus on capacity building and long-term engagement.

Reference: Ulisubisya M, Jörnvall H, Irestedt L, Baker T. Establishing an Anaesthesia and Intensive Care partnership and aiming for national impact in Tanzania. *Globalization and Health*. 2016;12(1):7.

Web link: <http://www.mkaic.org/> <http://www.lifesupportfoundation.org/>

Type: International partnership; initially facility-based, but now expanding to include more hospitals.

Intervention description:

The Muhimbili-Karolinska Anesthesia & Intensive Care Collaboration (MKAIC) was founded in 2008. Partnership activities include training courses, bilateral exchanges, and research projects. Training courses are offered to nurses, physicians, and non-physician clinicians, focusing on management of critically ill patients and patients undergoing surgery in resource limited environments. They are based on standardized ABC-care with emphasis on teamwork, communication, and systematic preparation. Further, with help from the Life Support Foundation, they have funded equipment, and helped develop and implement new routines and guidelines at the hospital's ICU.

Outcome: [Results from 2014] 350 doctors and nurses, including staff from surrounding hospitals, have been trained in providing critical care. Knowledge has increased by 30% as measured by pre/post training course tests (unpublished results). Almost 40 bilateral exchanges have been conducted. Checklists for obstetric anesthesia, intensive care, and post-operative care have been implemented. Pulse oximeters and other equipment were introduced and implemented. The hospital's number of residents in Anesthesia and Intensive Care has increased from one to nine. Effect on care, including mortality, is not yet known but is currently being studied.

Organization: MKAIC; Muhimbili-Karolinska Anesthesia & Intensive Care Collaboration (Muhimbili National Hospital (MNH), Dar es Salaam, Tanzania and Karolinska University Hospital, Stockholm, Sweden); Life Support Foundation

Cost: Not known. Foundation-supported

Considerations: The long-term, sustainable focus of this type of partnership allows system-wide capacity building. Gaining understanding of the local context and need allows for the partnership to engage in regional or national systems. The biggest challenge for this partnership, as for many other long-term collaborations, is to secure sufficient long-term funding, and to scaling up this resource-intensive partnership. Further, outside the infrastructure needed for the ICU and hospital in general, reliable Internet access is needed to ensure satisfactory communication between partners.

2. Training courses

Intervention: Multinational ICU training program

Reference: Haniffa R, Lubell Y, Cooper BS, Mohanty S, Alam S, Karki A, et al. Impact of a structured ICU training programme in resource-limited settings in Asia. PLoS One. 2017;12(3):e0173483.

Web link: <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0173483#sec014>
See **Supplement 1** for full description of training course and

Type: International partnership; facility-based

Intervention description:

A 2-3-week course for ICU physicians and nurses with practical bedside teaching. Training program consists of six modules focused on basic tenets of intensive care and is analogous to the continuing professional training for doctors and nurses carried out in high-income countries. Each module consists of 2-3 weeks of short classroom lectures in the morning, complemented by extensive bedside teaching. Modules include basic care for the critically ill patient; care on admission and in emergency situations; shock and its treatment; feeding, glucose control and monitoring; care beyond the initial phase; and other issues, depending on local demand and observed deficiencies.

Outcome: Mortality, length of ICU stay, duration of mechanical ventilation, vasoactive drug days and antibiotic days all decreased in two out of three sites.

Organization: **The ICU Training in South Asia Group**. The course was delivered by trainers affiliated to following departments and institutions: Groningen; Amsterdam; Landeskliniken Salzburg, Austria; Amsterdam; The Netherlands; Belgium; Seattle, USA; and UK. For full list of trainers, please see Supplement 1.

Cost: Unknown

Considerations: If no such advanced training exists in an LMIC, this type of collaborative partnership can be an effective place to start. High travel costs and a limited number of units and personnel who can be reached are barriers for scaling up this model. A more sustainable and scalable program should focus on creating local trainers within these countries, to provide a “train the trainer” model.

Intervention: Short-term fundamental critical care course, Kenya

Reference: Macleod JB, Jones T, Aphivantrakul P, Chupp M, Poenaru D. Evaluation of fundamental critical care course in Kenya: knowledge, attitude, and practice. J Surg Res. 2011;167(2):223-30.

Web link: <http://www.sccm.org/>

Type: Facility-based

Intervention description:

The Society of Critical Care Medicine’s Fundamental Critical Care Course (FCCS), used in America to train non-intensivist health care personnel to provide basic and initial care to critically ill or injured patients, was implemented in two rural hospitals in Kenya. This 4-day, low-cost course was taught to 100 nurses, clinical officers (health care professionals with training commensurate with physician assistants), and medical doctors (general practitioner level). The course focuses on patient assessment, treatment, and equipment utilization, e.g. mechanical ventilation and procedural skills and consisted of didactic lectures, taught through group discussion and skill stations. The core content of the course was adapted to reflect the local disease prevalence and equipment resources.

Outcome: Almost all participants improved their post-test knowledge score, assessed by a Multiple Choice Question (MCQ) examination consisting of 40 standardized questions developed by the Society for Critical Care Medicine and given in all FCCS courses, and additional eight questions reflecting the emphasized areas in this particular course. Confidence levels to perform clinical scenarios and procedures were evaluated after the course, and showed an overall improvement especially among doctors. Impact on patient outcomes was not evaluated.

Organization: Society of Critical Care Medicine

Cost: Unknown (reported “low-cost”). Funded by Society of Critical Care Medicine's Critical Care Education and Research Foundation (SCCM-CCERF).

Considerations: Although these short-term educational interventions could be criticized for not being a sustainable solution to a systematic problem, it allows a larger number of staff to learn some of the basic but life-saving skills without drawing human resources away from an already

resource-constrained hospital. Further, this course is low-cost and allows the content to be adapted to the local needs and context, with potential to be disseminated globally. There is an additional need for continuing medical education, or refresher courses to maintain knowledge and skills.

3. Usage of telemedicine to enhance ICU capacity and safety

Intervention: Implementation of telemedicine in a high-income country ICU

References:

1. Lilly CM, Cody S, Zhao H, Landry K, Baker SP, McIlwaine J, et al. **Hospital mortality, length of stay, and preventable complications among critically ill patients before and after tele-ICU reengineering of critical care processes.** *Jama.* 2011;305(21):2175-83.
2. Dharmar M, Romano PS, Kuppermann N, Nesbitt TS, Cole SL, Andrada ER, et al. **Impact of critical care telemedicine consultations on children in rural emergency departments.** *Crit Care Med.* 2013;41(10):2388-95.

Type: Facility-based

Intervention description:

Telemedicine for ICUs have the potential to enable shorter response times to alarm and abnormal laboratory values, more rapid initiation of life-saving therapies, and higher rates of adherence to critical care best practices, especially in rural areas where specialist workforce may be limited. The off-site team in this intervention included a specialized intensivist who reviewed the care of individual patients, performed real-time audits of best practice adherence, performed workstation-assisted care plan reviews for patients admitted at night, monitored system-generated electronic alerts, audited bedside clinician responses to in-room alarms, and intervened when the responses of bedside clinicians were delayed and patients were deemed physiologically unstable. The off-site team had the ability to communicate with bedside clinicians or directly manage patients by recording clinician orders for tests, treatments, consultations, and management of life-support devices.

Outcome: The tele-ICU intervention was associated with lower hospital and ICU mortality, and shorter hospital and ICU lengths of stay, as well as lower rates of complications.

Organization: University of Massachusetts Memorial Critical Care Operations Group

Cost: Unknown

Considerations: Although telemedicine has been used in other contexts in LMICs, the intervention described here is implemented in a HIC setting and may not be directly translatable to a low-resource context. Implementing telemedicine to support critical care requires a strong and reliable national Telecommunication system, uninterrupted power supply, and regular technical maintenance. Further, it usually requires a high initial investment cost. However, other studies have indicated an improvement in quality of care using telephone consultations, which might be more feasible in some low-resource settings². Furthermore, these interventions provide

a model for decentralizing ICU care for rural settings with an opportunity to consult with an academic medical center on more complex care.

4. Other facility-based interventions

Intervention: Implementation of checklists and daily care goals during multidisciplinary rounds in a Brazilian ICU.

References:

1. **Cavalcanti AB, Bozza FA, Machado FR, Salluh JI, Campagnucci VP, Vendramim P, et al. Effect of a Quality Improvement Intervention With Daily Round Checklists, Goal Setting, and Clinician Prompting on Mortality of Critically Ill Patients: A Randomized Clinical Trial. *Jama*. 2016;315(14):1480-90.**
2. **Writing Group for the C-ICUI, the Brazilian Research in Intensive Care N, Cavalcanti AB, Bozza FA, Machado FR, Salluh JI, et al. Effect of a Quality Improvement Intervention With Daily Round Checklists, Goal Setting, and Clinician Prompting on Mortality of Critically Ill Patients: A Randomized Clinical Trial. *JAMA*. 2016;315(14):1480-90.**

Web link: <http://www.bricnet.org/>

Type: Facility-based

Intervention description:

A daily checklist, targeting nutrition, analgesia, antibiotics, sedation, venous thromboembolism prophylaxis, screening for sepsis, central lines and/or Foley management, and respiration, was developed and implemented together with a checklist for daily care goals and clinician prompting at Brazilian ICUs. Videos with material on how to use the checklist were available for all health professionals in the ICU.

Outcome: No improvement in mortality was seen, however the intervention improved adherence to several care processes.

Organization: Brazilian Research in Intensive Care Network (BRICnet)

Cost: Unknown

Considerations: See below.

Intervention: Introduction of vital sign detected therapy protocol

Reference: Baker T, Schell CO, Lugazia E, Blixt J, Mulungu M, Castegren M, et al. Vital Signs Directed Therapy: Improving Care in an Intensive Care Unit in a Low-Income Country. *PLoS One*. 2015;10(12):e0144801.

Web links: <http://www.mkaic.org/>
<http://www.lifesupportfoundation.org/>

Type: Facility-based

Intervention description:

A context-adapted protocol for vital sign detected therapy was implemented at a Tanzanian national referral hospital. The protocol includes assessment of heart rate, airway, blood pressure, respiratory rate, conscious level, saturation, and body temperature, and is complemented by treatment suggestions if danger signs are recorded.

Outcome: Acute treatment of all danger signs at admission increased after implementation. Overall mortality was unchanged; however, mortality in some patient groups decreased after implementation of the protocol.

Organization: MKAIC; Muhimbili-Karolinska Anaesthesia & Intensive Care Collaboration (Muhimbili National Hospital (MNH), Dar es Salaam, Tanzania and Karolinska University Hospital, Stockholm, Sweden); Life Support Foundation

Cost: This was a low-cost intervention: no new personnel were employed; no new equipment or medicines were introduced, and the training was conducted by staff working pro bono.

Considerations: Protocols to identify and treat at-risk patients using vital signs has been implemented in many parts of the world, and some have been shown to decrease mortality. However, results have been ambiguous and such protocols need to be adjusted to local needs and resources. Further, they need to be accompanied by guidelines on how to use and respond to them. *For general considerations on implementation of ICU guidelines or protocol, see below.*

Considerations on implementation of guidelines or protocol to improve ICU capacity and quality of care in LMICs: Studies assessing checklists or clinician prompting have found contradictory results. Many attempts to implement international guidelines and recommendations in LMIC settings have been made; however, these need to be adjusted to be context-appropriate, considering things such as resource availability, including staffing and equipment. Further, staff must be educated on how to use and apply such protocols or guidelines. Further, you need buy-in from decision makers or influential hospital staff to ensure adherence.

Additional Resources:

1. Murthy S, Leligidowicz A, Adhikari NK. Intensive care unit capacity in low-income countries: a systematic review. PLoS One. 2015;10(1):e0116949.
2. Meaney PA, Topjian AA, Chandler HK, Botha M, Soar J, Berg RA, et al. Resuscitation training in developing countries: a systematic review. Resuscitation. 2010;81(11):1462-72.
3. Riviello ED, Letchford S, Achieng L, Newton MW. Critical care in resource-poor settings: lessons learned and future directions. Crit Care Med. 2011;39(4):860-7.
4. Murthy S, Adhikari NK. Global health care of the critically ill in low-resource settings. Ann Am Thorac Soc. 2013;10(5):509-13.
5. Baker T. Critical care in low-income countries. Tropical medicine & international health: TM & IH. 2009;14(2):143-8.