

Guidelines on critical care services and personnel: Recommendations based on a system of categorization of three levels of care*

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Objectives: To describe three levels of hospital-based critical care centers to optimally match services and personnel with community needs, and to recommend essential intensive care unit services and personnel for each critical care level.

Participants: A multidisciplinary writing 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).

Data Sources and Synthesis: Relevant medical literature was accessed through a systematic Medline search and synthesized by the ACCM writing panel, a multidisciplinary group of critical care experts. Consensus for the final written document was reached through collaboration in meetings and through electronic communication modalities. Literature cited included previously

written guidelines from the ACCM, published expert opinion and statements from official organizations, published review articles, and nonrandomized, historical cohort investigations. With this background, the ACCM writing panel described a three-tiered system of intensive care units determined by service-based criteria.

Conclusions: Guidelines for optimal intensive care unit services and personnel for hospitals with varying resources will facilitate both local and regional delivery of consistent and excellent care to critically ill patients. (Crit Care Med 2003; 31:2677–2683)

KEY WORDS: intensive care unit guidelines; intensive care levels; intensive care services; intensive care personnel; hospital care levels

Intensive care units (ICUs) vary significantly from hospital to hospital with respect to structure, services provided, personnel and their level of expertise, and organizational characteristics. These variations are based on economic and political factors unique to each hospital's internal dynamics and external environment. Accordingly, the characteristics of an ICU may depend on the population served, the services provided by the hospital and by neighboring hospitals, and the subspecialties of physicians on the hospital's

staff. In addition, a hospital may choose to segregate ICU patients into areas based on diagnosis, acuity of illness, prognosis, or age.

Large medical centers frequently have multiple ICUs or critical care centers separated and defined by specialty or subspecialty practices. Examples include cardiothoracic surgical ICUs, trauma ICUs, coronary care units, and neurologic/neurosurgical ICUs. Small hospitals may have only one intensive care unit designed to care for a large variety of critically ill patients including adult and

pediatric populations. The use of intermediate care or step-down units in some hospital settings may provide a more efficient distribution of resources for patients whose critical illness requires less use of monitoring equipment and staffing than a high-acuity ICU.

Although the types and variety of ICUs may differ from hospital to hospital, all ICUs have the responsibility to provide services and personnel that ensure optimal care to critically ill patients. Recently, outside influence has been applied for hospitals to document their commitment to high-quality care. The Leapfrog Group, representing a consortium of Fortune 500 Companies, has organized to demand that hospitals which service their employees and their families adopt proven safety measures. The organization of this group was prompted by a report from the Institute of Medicine documenting a high rate of preventable medical errors in American hospitals (1, 2). The Leapfrog Group now collaborates with the Center for Medicare and Medicaid Services (formerly Health Care Financing

***See also p. 2709.**

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Administration), the U.S. Department of Health and Human Services, and the Joint Commission for Accreditation of Hospitals. The measures recommended by this group were based on published studies and have special relevance with respect to care within the ICU. They include a) computerized physician order entry to reduce medication errors (3); b) referral of complex or highly specialized patients to hospitals with documented experience and ability (4); and c) intensive care unit staffing by physicians trained in critical care medicine (5–7).

The present document describes the partitioning of critical care units or centers into levels determined by resources available to the hospital. It attempts to update similar guidelines written by the American College of Critical Care Medicine (ACCM) and published in *Critical Care Medicine* in 1999 (8). An updated literature review and a consensus opinion of experts in the field of critical care medicine were used for this revision. Although some hospitals will be able to provide comprehensive care to a broad spectrum of patients and others to only limited populations of patients, the expectation is that care provided will be of high quality. It is also an expectation that hospitals within a region collaborate to avoid redundancy of highly specialized and costly services.

Partitioning hospital care into levels (levels I–IV), developed by the American College of Surgeons (ACS), has had a major impact on trauma centers in this country. Multiple studies have shown that the process of describing trauma centers according to resource-dependent levels has led to improvements in outcome, including mortality rate and hospital length of stay (9–18). Achieving an ACS level I designation has been costly for some centers (19, 20). However, one recent study documented a decrease in estimated hospital costs in addition to improved outcome in a hospital that was in the process of achieving ACS level I classification (18). Another group reported that the process of achieving ACS trauma designations enhanced the partnering between a university (level I) and community (level II) hospital and facilitated the use of resources (21).

In these current, revised ACCM guidelines, participating writing panel experts included physicians, nurses, pharmacists and pharmacologists, respiratory therapists, and other important hospital sup-

port personnel. Practice models and clinical roles recommended by the ACCM were incorporated (22). Efforts were made to address current expectations from organizations and regulating agencies with a commitment to healthcare services.

Some restructuring of levels of care was made to reflect current trends in ICU organization. Comprehensive critical care centers with and without academic missions were structured to provide optimal, state-of-the-art care to their specific populations. High-quality care is also essential for hospitals with limited resources. These hospitals require the ability to provide care to patients with basic critical care needs (e.g., during an initial stabilization period) and may be able to manage patients with problems that do not require highly specialized equipment or expertise. However, these units are required to have resources and guidelines for the transfer of specialized or complex patients to an appropriate comprehensive critical care center. Minimum standards for interhospital transfers have been published by the ACCM (23).

The recommendations that follow apply to hospitals with primarily adult critical care facilities. Hospitals caring for critically ill children should comply with separate guidelines outlining service and personnel requirements published by the Society of Critical Care Medicine in collaboration with the American Academy of Pediatrics (24).

DEFINITION OF LEVELS OF CARE

It is recommended that all hospitals determine the level of critical care services offered in keeping with their mission and goals as well as regional needs for this service. Three levels of care are proposed to accommodate university medical centers, large community hospitals, and small hospitals with limited critical care capabilities.

1. Level I critical care: These critical care centers have ICUs that provide comprehensive care for a wide range of disorders requiring intensive care. They require the continuous availability of sophisticated equipment, specialized nurses, and physicians with critical care training. Support services including pharmacy services, respiratory therapy, nutritional services, pasto-

ral care, and social services are comprehensive. Although most of these centers fulfill an academic mission in a teaching hospital setting, some may be community hospital based.

2. Level II critical care: Level II critical care centers have the capability to provide comprehensive critical care but may not have resources to care for specific patient populations (e.g., cardiothoracic surgery, neurosurgery, trauma). Although these centers may be able to deliver a high quality of care to most critically ill patients, transfer agreements must be established in advance for patients with specific problems (23). The intensive care units in level II centers may or may not have an academic mission.
3. Level III critical care: Hospitals that have level III capabilities have the ability to provide initial stabilization of critically ill patients but are limited in the ability to provide comprehensive critical care. These hospitals require written policies addressing the transfer of critically ill patients to critical care centers that are capable of providing the comprehensive critical care required (level I or level II) (23). These facilities may continue to admit and care for a limited number of ICU patients for whom care is routine and consistent with hospital and community resources.

Cooperation between hospitals and professionals within a given region is essential to ensure that appropriate numbers of level I, II, and III units are designated. A duplication of services may lead to underutilization of resources and underdevelopment of skills by clinical personnel, and it may be costly. State and federal governments should be encouraged to enforce the appropriate distribution of critical care services within a region and to participate in the development of referral and transfer policies. Standards for interfacility transfers have been delineated in a collaborative publication by the Society of Critical Care Medicine and the American Association of Critical Care Nurses (23). In these standards, reference is made to federal and local laws.

HOSPITAL RESOURCES FOR LEVEL I, II, AND III CRITICAL CARE CENTERS

Level I Critical Care Centers

- I. Medical staff organization
 - A. A distinct critical care organizational entity (department, division, section, or service) exists.
 1. Privileges (both cognitive and procedural) for physicians practicing critical care medicine (25) are approved by the Medical Staff Credentials Committee based on previous training and experience as defined by the medical staff.
 2. A section of the medical staff bylaws delineates the regulations governing the granting of critical care privileges and monitoring the critical care activities of privileged staff.
 3. Budgetary activities relating to unit function, quality assurance, and utilization review are conducted jointly by members of the medical, nursing, pharmacy, and administrative staff.
 4. A critical care representative serves on the Medical Staff Executive Committee.
 - B. The critical care services for the center are led by a critical care physician who meets the definition of an intensivist (22) and who has the appropriate time, expertise, and commitment to oversee the care of critically ill patients within the hospital.
 - C. ICU patient management is directed by a staff level physician who fulfills all of the following:
 1. Is privileged by the medical staff to have clinical management responsibility for critically ill patients.
 2. Has board certification in critical care medicine.
 3. Sees the patient as often as required by acuity but at least twice daily.
 4. Is either the patient's attending physician or a consultant who provides direct management of critically ill patients.
 - D. ICU medical staff members should participate on the institution's bioethical committee.
- II. Organization of ICUs
 - A. A physician director who meets guidelines for the definition of an intensivist (22) is required.
 - B. Specific requirements for the unit director include the following:
 1. Training, interest, and time availability to give clinical, administrative, and educational direction to the ICU.
 2. Board certification in critical care medicine.
 3. Time and commitment to maintain active and regular involvement in the care of patients in the unit.
 4. Expertise necessary to oversee the administrative aspects of unit management including formation of policies and procedures, enforcement of unit policies, and education of unit staff.
 5. The ability to ensure the quality, safety, and appropriateness of care in the ICU.
 6. Availability (either the director or a similarly qualified surrogate) to the unit 24 hrs a day, 7 days a week for both clinical and administrative matters.
 7. Active involvement in local and/or national critical care societies.
 8. Participation in continuing education programs in the field of critical care medicine.
 9. Hospital privileges to perform relevant invasive procedures.
 10. Active involvement as an advisor and participant in organizing care of the critically ill patient in the community as a whole.
 11. Active participation in the education of unit staff.
 12. Active participation in the review of the appropriate use of ICU resources in the hospital.
 - C. A nurse manager is appointed to provide precise lines of authority, responsibility, and accountability for the delivery of high-quality patient care. Specific requirements for the nurse manager include the following:
 1. An RN (registered nurse) with a BSN (bachelor of science in nursing) or preferably an MSN (master of science in nursing) degree.
 2. Certification in critical care or equivalent graduate education.
 3. At least 2 yrs experience working in a critical care unit.
 4. Experience with health information systems, quality improvement/risk management activities, and healthcare economics.
 5. Ability to ensure that critical care nursing practice meets appropriate standards (22).
 6. Preparation to participate in the on-site education of critical care unit nursing staff.
 7. Ability to foster a cooperative atmosphere with regard to the training of nurses, physicians, pharmacists, respiratory therapists, and other personnel involved in the care of critical care unit patients.
 8. Regular participation in ongoing continuing nursing education.
 9. Knowledge about current advances in the field of critical care nursing.
 10. Participation in strategic planning and redesign efforts.
- III. Physician availability
 - A. Several studies have suggested that a full-time hospital staff intensivist improves patient care and efficiency as summarized in a recent review (22, 26).
 - B. Ideally, 24-hr in-house coverage should be provided by intensivists who are dedicated to the care of ICU patients and do not have conflicting responsibilities.
 - C. If this ideal situation is not possible, 24-hr in-house coverage by experienced physicians (board-eligible/certified surgeons, internists, anesthesiologists, or emergency medicine physicians) who are not intensivists is acceptable when there is appropriate backup and supervision. This arrangement requires an intensivist to be on call and physically present in the hospital within 30 mins for complex or unstable patients.
 - D. The intensivist should be able to return >95% of pages within 5 mins and ensure that a Fundamental Critical Care Support (FCCS) course-trained physician or physician extender (see *E*) reaches the ICU patient within 5 mins (2).
 - E. Physicians (staff and/or fellows) or physician extenders covering the critical care units in-house should have advanced airway management skills and Advanced Cardiac Life

- Support qualifications. Training in the FCCS course sponsored by the Society of Critical Care Medicine (27) is highly desirable.
- F. Ideal intensivist-to-patient ratios vary from ICU to ICU depending on the hospital's unique patient population. Hospitals should have guidelines for these ratios based on acuity, complexity, and safety considerations.
 - G. The following physician subspecialists should be available and be able to provide bedside patient care within 30 mins:
 1. General surgeon or trauma surgeon
 2. Neurosurgeon
 3. Cardiovascular surgeon
 4. Obstetric-gynecologic surgeon
 5. Urologist
 6. Thoracic surgeon
 7. Vascular surgeon
 8. Anesthesiologist
 9. Cardiologist with interventional capabilities
 10. Pulmonologist
 11. Gastroenterologist
 12. Hematologist
 13. Infectious disease specialist
 14. Nephrologist
 15. Neuroradiologist (with interventional capability)
 16. Pathologist
 17. Radiologist (with interventional capability)
 18. Neurologist
 19. Orthopedic surgeon
- IV. Nursing availability—see also (22) for the definition of a critical care nurse and (28) for Trauma Center Critical Care Unit nursing requirements
 - A. All patient care is carried out directly by or under supervision of a trained critical care nurse.
 - B. All nurses working in critical care should complete a clinical/didactic critical care course before assuming full responsibility for patient care.
 - C. Unit orientation is required before assuming responsibility for patient care.
 - D. Nurse-to-patient ratios should be based on patient acuity according to written hospital policies.
 - E. All critical care nurses must participate in continuing education.
 - F. An appropriate number of nurses should be trained in highly specialized techniques such as renal replacement therapy, intra-aortic balloon pump monitoring, and intracranial pressure monitoring.
 - G. All nurses should be familiar with the indications for and complications of renal replacement therapy.
 - V. Respiratory care personnel requirements
 - A. Respiratory care services should be available 24 hrs a day, 7 days a week.
 - B. An appropriate number of respiratory therapists with specialized training must be available to the unit at all times. Ideal levels of staffing should be based on acuity, using objective measures whenever possible.
 - C. Respiratory care therapists should follow guidelines specified in Appendix 5 of the ACCM's consensus report: "Critical Care Delivery in the Intensive Care Unit: Defining Clinical Roles and the Best Practice Models" (22).
 - D. Therapists must undergo orientation to the unit before providing care to ICU patients.
 - E. The therapist must have expertise in the use of mechanical ventilators including the various ventilatory modes.
 - F. Proficiency in the transport of critically ill patients is required.
 - G. Respiratory therapists should participate in continuing education and quality improvement related to their unit activities.
 - VI. Pharmacy services requirements (29–32): Critical care pharmacy and pharmacist services are essential in the ICU. A position paper on recommendations for these services has been published by the ACCM and the American College of Clinical Pharmacy (29).
 - A. A "ready to administer" (unit dose) drug distribution system, intravenous admixture services (2), and at a minimum a medication information system or computerized physician order entry (3) are essential.
 - B. The ability to supply immediate medications and admixtures in a timely fashion is essential. A critical care pharmacy satellite is desirable for at least part-time coverage, but full-time coverage is optimal (29).
 - C. A medication use system that creates and maintains patient medication profiles, interfaces with patient laboratory data, and alerts users to drug allergies, maximum dose limits, and drug-drug and drug-food/nutrient interactions is essential (29).
 - D. Registered pharmacists, dedicated to the ICU, should be available to evaluate all drug therapy orders, review and maintain medication profiles, monitor drug dosing and administration regimens, evaluate adverse reactions and drug/drug interactions, give drug and poison information, and provide recommendation on cost containment issues (22, 29).
 - E. Availability of a clinical pharmacist dedicated to the ICU with a specialized role in activities such as critical care therapeutics, nutritional support formulations, cardiorespiratory resuscitation therapeutics, and clinical research projects is desirable (29).
 - F. Pharmacists should participate regularly on rounds with the intensivist and the critical care team, provide drug therapy-related education to critical care team members, and take part in multidisciplinary quality activity committees (29, 30).
 - G. Pharmacists should implement and maintain policies and procedures related to safe and effective use of medications in the ICU (29).
 - H. It is essential that the pharmacist have the qualifications and competence necessary to provide pharmaceutical care in the ICU. This may be achieved by a variety of means including advanced degrees, residencies, fellowships, or other specialized practice experience (29).
- VII. Other personnel: A variety of other personnel may contribute significantly to the efficient operation of the ICU. These include unit clerks, physical therapists, occupational therapists, advanced practice nurses, physician assistants, dietary specialists, and biomedical engineers.
 - VIII. Laboratory services
 - A. A clinical laboratory should be available on a 24-hr basis to provide basic hematologic, chemistry, blood gas, and toxicology analysis.
 - B. Laboratory tests must be obtained in a timely manner, immediately in some instances. "STAT" or "bedside" laboratories adjacent to the ICU or rapid transport systems (e.g., pneumatic tubes) provide an optimum and cost-effective setting for obtaining selected laboratory tests in a timely manner (33,

34). Point-of-care technology may be used to obtain rapid laboratory results (35, 36).

IX. Radiology and imaging services: Transport to distant non-ICU sites for radiologic procedures has been shown to be associated with changes in physiologic status that required corrective therapeutic intervention in 68% of patients (37). Therefore, guidelines for intrafacility transfer should be followed for radiologic procedures performed distant from the ICU bedside (24). The following diagnostic and therapeutic radiologic procedures should be immediately available to ICU patients, 24 hrs per day.

- A. Portable chest radiographs affect decision making in critically ill patients. They lead to therapeutic changes in 66% of intubated patients and 23% of nonintubated patients (38).
 - B. Interventional radiologic capabilities should be available including invasive arterial and venous diagnostic and therapeutic techniques, percutaneous access to the renal collecting system and biliary tract, percutaneous gastrostomy, and percutaneous drainage of fluid collections.
 - C. Computed tomography and computed tomography angiography.
 - D. Duplex Doppler ultrasonography.
 - E. Magnetic resonance imaging and magnetic resonance angiography.
 - F. Echocardiography (transthoracic and transesophageal).
 - G. Fluoroscopy.
- X. Services provided in unit: An ICU has the capability of providing monitoring and support of the critically ill patient. To do, so the ICU is prepared to provide the following:
- A. Continuous monitoring of the electrocardiogram (with high/low alarms) for all patients (39).
 - B. Continuous arterial pressure monitoring (invasive and noninvasive).
 - C. Central venous pressure monitoring.
 - D. Transcutaneous oxygen monitoring or pulse oximetry for all patients receiving supplemental oxygen.
 - E. Equipment to maintain the airway, including laryngoscopes and endotracheal tubes.
 - F. Equipment to ventilate, including

ambu bags, ventilators, oxygen, and compressed air.

- G. Emergency resuscitative equipment.
 - H. Equipment to support hemodynamically unstable patients, including infusion pumps, blood warmer, pressure bags, and blood filters.
 - I. Beds with removable headboard and adjustable position, specialty beds.
 - J. Adequate lighting for bedside procedures.
 - K. Suction.
 - L. Hypo/hyperthermia blankets.
 - M. Scales.
 - N. Temporary pacemakers (transvenous and transcutaneous).
 - O. Temperature monitoring devices.
 - P. Pulmonary artery pressure monitoring.
 - Q. Cardiac output monitoring.
 - R. Continuous and intermittent dialysis and ultrafiltration.
 - S. Peritoneal dialysis.
 - T. Capnography.
 - U. Fiberoptic bronchoscopy.
 - V. Intracranial pressure monitoring.
 - W. Continuous electroencephalogram monitoring capability.
 - X. Positive and negative pressure isolation rooms.
 - Y. Immediate access to information: medical textbooks and journals, drug information, poison control centers, personnel phone and paging numbers, personnel schedules, patient laboratory and test data, and medical record information.
- XI. ICU policies and procedures: The following must be available to all ICU personnel and must be updated yearly. Many of these areas have been addressed by Guidelines and Practice Parameters Committee of the ACCM (40).
- A. Admission and discharge criteria and procedures.
 - B. Policies for intra- and interfacility transport (23).
 - C. A total quality management/continuous quality improvement program is required that addresses safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity as outlined by the Institute of Medicine (41). Programs should specifically address appropriate Agency for Healthcare Research and Quality indicators (42).

D. A list of hospital staff who are privileged for procedures/skills used in the ICU.

- E. End-of-life policies (e.g., documentation of “do-not-resuscitate” orders).
 - F. Guidelines for determining brain death.
 - G. Organ donation protocols.
 - H. Restraint and sedation protocols.
- XII. Telemedicine capability: The ability to operate regional ICUs through telemedicine capabilities (eICUs, virtual ICUs) is desirable (43).

Level II Critical Care Centers

Level II Centers are unable to provide critical care for specific areas of expertise. For example, level II centers may lack neurosurgical expertise, a cardiac surgical program, or a trauma program. Nevertheless, these centers provide comprehensive critical care for their unique patient population. Therefore, with exception of services and personnel in the areas of expertise that they lack, these centers have the same organizational structures as outlined for level I centers. These centers require policies and procedures that address transport to a level I center when appropriate (23). Criteria for transfer should be specific and readily available to hospital personnel so that delays in definitive care are avoided.

Level III Critical Care Centers

Because level III centers are limited in their ability to provide comprehensive critical care, their usually small intensive care units focus on the stabilization of patients before transfer to a comprehensive critical care center (level I or II). As a result, the guidelines outlined previously for level I and II centers, although desirable, are not always applicable. Level III centers require an on-site physician 24 hrs/day who can manage emergencies, can secure the airway, can establish rapid intravenous access, is qualified in Advanced Cardiac Life Support, and, if not subspecialty trained in critical care medicine, has taken the FCCS course (27). It is desirable that level III centers address the frequency with which these educational activities are updated. It is common and acceptable for emergency physicians, anesthesiologists, general internists, and general surgeons to fulfill this role. A critical care trained nurse and respiratory therapist should be available

on site, 24 hrs per day. Essential pharmacy services should be provided. With the exception of highly specialized services, basic services for stabilizing, monitoring, and treating critically ill patients (section X, A–O) should be available. Detailed transport policies and expertise in the transport of patients are essential for these centers (23). Although new and in need of additional validation, telemedicine-driven ICU care should be considered as a surrogate for on-site intensivist-driven care (43).

Academic Vs. Nonacademic Critical Care Centers

Level I and II centers may have an academic mission through affiliation with a medical school, nursing school, or other health services educational programs. The critical care physician and nursing leadership as well as pharmacists and respiratory therapists of these centers require sufficient protected time to participate in scholarly activity (clinical and/or basic research, case reports) and to foster an environment of critical thinking. They should have the appropriate knowledge and teaching skills to participate in on-site education of critical care nursing staff, physicians in training, and staff physicians. Nonacademic centers should maintain a commitment to remaining current with changes in the field of critical care. They should encourage and provide protected time for all critical care personnel to participate in continuing education activities and maintain current certification in appropriate areas of expertise.

Open Vs. Closed ICUs

Some critical care centers define their ICUs as “open” or “closed” or a combination of both types of units. In the open system, although nursing, pharmacy, and respiratory therapy staff are ICU based, the physicians directing the care of the ICU patient may have obligations at a site distant from the ICU such as outpatient and inpatient areas and the operating room. They may or may not choose to consult an intensivist to assist in management. In some of these ICUs, critical care consultation is mandatory for all patients. In the closed system, care is provided by an ICU-based team of critical care physicians, nurses, pharmacists, respiratory therapists, and other health professionals. A variety of studies re-

ported in the literature have documented more favorable outcomes when ICU patients are managed in a closed system compared with an open system. These studies should be interpreted cautiously (44).

Regardless of the type of system used, the ACCM recommends that the intensivist and the ICU patient's primary care physician and consultants proactively collaborate in the care of all patients. In both systems, an intensivist must be given the authority to intervene and directly care for the critically ill patient in urgent and emergent situations. Ideally, all orders regarding an ICU patient's care should be channeled through a unit-based intensivist (and his or her physician or physician extender team if applicable) to ensure optimal care and to minimize redundant or conflicting approaches to care. If these principles are followed, the distinctions between open and closed units and the divisive implications associated with the use of these terms wither away.

Intermediate (Step-Down, Transitional) Care Units

These types of units may be useful and are dependent on types of patients served by the hospital, types of staff available to manage patients in these units, and geographic realities of the hospitals' intensive care unit areas. They have advantages and disadvantages depending on whether they are freestanding in a hospital area distant from the ICU, adjacent to the ICU, or integrated within the ICU (45). Intermediate care units may not be appropriate for all critical care centers. Guidelines have been published by the ACCM regarding criteria for admission to these units (46).

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