Framing Options for Critical Care in the United States: A Report from the Critical Care Professional Societies

American Association of Critical-Care Nurses
American College of Chest Physicians
American Thoracic Society
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ACKNOWLEDGEMENTS

Chair
Mark A. Kelley, MD
American Thoracic Society
Henry Ford Health System
Detroit, MI

FOCCUS Task Force Members

Derek C. Angus, MB, ChB, FCCM
Society of Critical Care Medicine
University of Pittsburgh Medical Center
Pittsburgh, PA

Donald B. Chalfin, MD, MS, FCCM
Society of Critical Care Medicine
Maimonides Medical Centers
Brooklyn, NY

Edward D. Crandall, PhD, MD
American Thoracic Society
University of Southern California
Los Angeles, CA

David Ingbar, MD, FACCP
American Thoracic Society
University of Minnesota
Minneapolis, MN

Wanda Johanson, RN, MN
American Association of Critical Care Nurses
Aliso Viejo, CA

Justine Medina, RN, MS
American Association of Critical Care Nurses
Aliso Viejo, CA

Curtis N. Sessler, MD, FCCP, FCCM
American College of Chest Physicians
Virginia Commonwealth University Health System
Richmond, VA

Jeffery S. Vender, MD, FCCP, FCCM
American College of Chest Physicians
Evanston Northwest Healthcare
Evanston, IL

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INTRODUCTION

The care of the critically ill patient has become an increasingly important issue in the United States. Critical care accounts for 1% of the gross domestic product (Halpern 1994) and disproportionately effects the elderly population. Over the past thirty years, advances in technology, therapeutics, and monitoring have improved the prognosis of critically ill patients and also led to breakthroughs in complex surgery, cancer treatment, and trauma care.

Meanwhile, there has been increasing public concern over the rise of health care costs in the United States. These costs will escalate even more because of the demographics of the American population. Projections indicate that as the baby boomer generation ages over the next fifteen years, the American health care system will experience a rise in chronic illnesses and hospitalizations. Accompanying these changes will be a predictable increase in the need for critical care treatment. Older patients burdened by more chronic illness have higher utilization of critical care services than their younger counterparts. Thus, the aging population in the United States will increase the demand for critical care unless society explicitly limits access to critical care services.

The value of critical care treatment has been recognized by major purchasers of health care. A group of Fortune 500 companies, organized as a consortium called the Leapfrog Group, has identified areas of care that they believe are highly cost effective. One of their recommendations is that board certified critical care physicians supervise the care for every critically ill patient in the United States. This recommendation is based on literature suggesting that such critical care expertise improves patient outcome (Pronovost 2002).

These social and demographic forces are propelling a demand for critical care services when resources supporting such services are already strained. Most alarming is the projected shortfall in health care professionals within critical care. A severe shortage of pharmacists already exists, accompanied by a growing shortage of critical care nurses. A shortfall of critical care physician specialists has been projected within the next ten years (Angus 2000). These shortages have been aggravated by reductions in professional reimbursement for critical care and continued pressure to reduce health care costs.

Thus, critical care medicine is caught in a “perfect storm” – a growing societal demand fueled by the aging population; pressure from the business community to improve

quality by increasing critical care services; a reduction in critical care professional workforce; and strong economic pressure to reduce health care costs.
The community of critical care health care professionals, represented by the American Thoracic Society, the American College of Chest Physicians, the Society of Critical Care Medicine, and the American Association of Critical Care Nurses, has united to address these challenges. In 2002, this group created a task force called FOCCUS (Framing Options for Critical Care in the United States) that included representatives from each sponsoring society. The task force was charged with assessing the current state of critical care and proposing ways of addressing the critical care crisis.

After analyzing this situation, FOCCUS foresees several certain outcomes. First, the demand for critical care will inexorably accelerate over the next decade. Second, in the current economic climate, a windfall of public or private dollars will not be available to match this demand. Third, without major corrective action, the supply of health care professionals in critical care will be static, at best, and, therefore, fall short of projected needs.

From this analysis, the FOCCUS task force has concluded that to prevent a national crisis, the organization of critical care delivery needs fundamental redesign. Asking the current workforce to work harder or even adding modest resources at the current delivery system will not solve the problems. Critical care delivery, which has evolved over the last three decades, requires major reorganization, innovative technology, and more effective use of current professional talent.

This paper provides the background and overview of the key issues that led to these conclusions. The FOCCUS report also recommends specific actions by its parent societies. These efforts will require collaboration among the critical care profession, the medical community, health care purchasers, and public policy makers. While many of these proposals are controversial, they will stimulate the constructive dialogue and innovation necessary to meet the increasing demands for critical care in the United States.

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PUBLIC POLICY ISSUES FOR CRITICAL CARE

Society generally recognizes the benefits provided to the critically ill patient by qualified critical care personnel and organized intensive care services. These benefits include improved survival, fewer complications, shorter lengths of stay, more efficient triage, and reduced cost of care. However, these outcomes have occurred in an evolutionary fashion without public policy planning. Now that the United States faces a crisis in critical care delivery, the time has come for more explicit organization of this important resource. The challenges are as follows:

Critical Care Should Be Defined More By Patient Need And Acuity And Less By Geographic Site

Critical care services are conventionally defined as those within the confines of the intensive care unit (ICU). However, patient need often extends beyond the ICU walls, including the hospital floor, the emergency department, and even in the pre-hospital setting. Research has shown that the survival of septic patients can be improved by rapid treatment in the emergency department prior to transfer to the ICU (Rivers 2001). Critically ill patients have better outcomes when medical emergency teams promptly evaluate patients who manifest signs and symptoms consistent with critical illness (Hillman 2001, Bristow 2000). This concept is now undergoing a large multi-center clinical trial throughout Australia. At the other end of the spectrum, some patients in critical care units may not belong there. Such patients may require only simple monitoring or a level of nursing care that is demanding but cannot be classified as intensive care. The ideal system would meet the needs of the critically ill patient as defined by disease severity rather than by location alone.

While Physician Expertise Is Important, The Role Of The Critical Care Team Needs More Emphasis

Many recent policy discussions and literature (Pronovost 2002) have focused on the benefit of the intensivist* on patient outcome and resource utilization. However, critical care is a multidisciplinary service that requires the coordinated efforts of many health care providers, such as critical care nurses, pharmacists and pharmacologists, respiratory therapists, and physician assistants. Studies have demonstrated reduced mortality and other quantitative improvements as a result of proper nurse-to-patient ratios (Pronovost 1999), the active presence of pharmacologists on clinical rounds (Leape 1999) along with other qualified personnel who work in a coordinated and organized fashion as members of the multidisciplinary team. In addition, many tasks formerly thought to be the exclusive domain of the intensivist can be safely and expertly performed by many members of the multidisciplinary team.

**Intensivists are physicians who are board certified in a medical specialty, such as surgery, internal medicine, pediatrics, or anesthesiology, and who receive special education, training and subspecialty board certification specifically in critical care. Intensivists work closely with other critical care experts to provide their patients with ongoing and consistent care.*

Examples include weaning from ventilatory support (Thorens 1995) and the administration of respiratory treatments (Kollef 2000). Furthermore, many patients receive critical care services because they need monitoring but not necessarily direct intensivist supervision and care. Critical care policy must recognize the vital role that critical care nurses and other experienced clinicians play in the care of critically ill and injured patients.

Levels Of Critical Care Services Should Be Defined By Severity Of Illness And Resource Consumption

Health care policy makers should consider organization of critical care services and ICUs provided by highly specialized, acute-care services, such as for burns, trauma, and neonatal care. Such care is often regionalized and provided by centers of excellence that meet and adhere to pre-set guidelines to determine the levels of service. There are multiple advantages to such organization: coordination of services including planning, credentialing, transport, triage, reimbursement, and equitable distribution of scarce capital and personnel resources.

Critical Care Has Tools To Define Prognosis And Resource Consumption Which Should Be Applied To Improve Critical Care Delivery

Critical care has pioneered the science of outcome prediction by the development of time-tested severity scores such as APACHE, MPM, SAPS, and SOFA. The use of these tools in the determination of individual patient triage and resource allocation remains controversial. However, these tools are useful assessing outcomes and quality between ICUs and benchmarking meaningful comparison of unit performance. Furthermore, increasing evidence suggests that critical care services may be best organized according to acuity as opposed to subjective diagnosis and admitting clinical service. Thus, policy recommendations should actively embrace the effective and proper uses of quantitative indices to facilitate effective planning and inter- and intra-unit comparisons.

The United States Should Look To Other Countries For Examples Of Effective Critical Care Delivery Models

Intensive care services in Europe and Australia largely embrace a closed-unit structure. This intensivist-directed model of care is, in many ways, more organizationally advanced than the American system of critical care services. In these countries, the role of the intensivist is more clearly defined and the overall organization of critical care services is more uniform from hospital to hospital. Health care planners should consider other systems of critical care organization and intensivist practice for potential application in the United States.

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ORGANIZATION OF CRITICAL CARE WITHIN INSTITUTIONS

The delivery of critical care in the United States has been a grass-roots movement with no national planning. Historically, most hospitals used monitoring technology to develop coronary care units and later these units evolved into modern multi-purpose ICUs. Recently, the Committee on Manpower for the Pulmonary and Critical Care Societies (COMPACCS) study provided a snapshot of the delivery of critical care in the United States (Angus 2000). Most critical care is provided in medium-sized hospitals (100-300 beds) and the most common ICU is a combined medical/surgical unit, encompassing a variety of patients and care needs. These observations confirmed previous survey data (Groeger 1992).

Large hospitals (more than 300 beds) usually organize critical care services both horizontally and vertically. Vertical organization relates to the use of different intensities of care, from monitored beds to intermediate (or step-down) units, to intensive care units. Horizontal organization separates critically ill patients by age or by clinical condition. Examples include neonatal intensive care and coronary care units. Accordingly, large hospitals often have both medical intensive care and surgical intensive care units, and the largest institutions (more than 500 beds) may house cardiothoracic, neurosurgical/neurological, burn, oncological, or trauma units. This listing does not include other sites where intensive care may be delivered, such as emergency departments, recovery rooms, and long-term acute care (ventilator) units.

In theory, hospitals create intensive care units to provide high quality care and to create cost effectiveness. Nevertheless, the organization of these units within the hospital has not been well studied (Brilli 2001). More commonly, ICUs are designed to fit the educational or logistic requirements of a specific department or service line (Groeger 1992). The integration and coordination of intensive care, particularly in large, complex institutions, needs more research to justify and improve overall care delivery.

Surprisingly little is known about the effectiveness of critical care delivery models in the United States. Most information is descriptive. Surveys have shown that the elderly occupy 58% of adult ICU beds, and that the leading diagnoses are post-operative care, ischemic heart disease, and respiratory insufficiency (Groeger 1993). However, scant information exists about the severity of illness or the resource needs of patients who currently occupy America's ICU beds. A recent comprehensive review demonstrated that there is no scientific study to define a "best practice" model of critical care. Critical care units usually have local admission and discharge policies and treat most protocols; however, there are no national standards. Clinical trials on specific patient populations such as those with acute respiratory distress syndrome or sepsis have provided useful descriptive information about some patients. However, these data are from narrowly defined patient groups and are of limited value in defining the optimal use of resources both between institutions and within them.

Recommendations

It is generally accepted that the current delivery of critical care in American hospitals is very good—but it could be better. With the predicted shortage of intensivist physicians and nurses, even the current status quo is threatened. Research into the optimal modes of local critical care organization and delivery could lead the way to improvements. In formulating this research, it would appear that standardization has great potential to create efficiencies and improve quality as follows:

1. Research should define the most important elements of initial care that match resources to severity of illness, as well as improve quality of care. Specific issues are the roles of:
   - ICU administrative organization
   - Clinical expertise and its timely availability
   - Standardized treatment

2. Standardization should be used to assess the comparability of hospital intensive care units. Specific opportunities include:
   - Development of specific protocols for common conditions
   - Rationalization of intensive care unit types and sizes within an institution
   - Specification of admission and discharge criteria.
   - Use of severity of illness scoring systems to develop common outcome databases

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BETWEEN INSTITUTIONS: REGIONALIZATION OF CRITICAL CARE

It has long been assumed that, when properly organized by regional triage, critical care services can be provided more efficiently, with better outcomes, and at relatively lower cost. Several task forces have addressed this issue over the past 20 years (NIH Consensus Conference 1983). Expert opinion of critical care specialists strongly supports this concept, but this is not based on convincing data. The relative advantages and disadvantages of regionalization are presented in Table 1. The data thus far indicate that there is some benefit for pediatrics (AAP/ACCCM/SCCM 2000) and trauma, with possible benefit in neurology and neurosurgery. For other disciplines, data supporting regionalization is scant. Even within the disciplines of pediatric and trauma critical care, the specific conditions that benefit from regionalization remain largely undefined.

TABLE 1

ADVANTAGES & DISADVANTAGES OF REGIONALIZATION OF CRITICAL CARE

SITE	ADVANTAGES	DISADVANTAGES
Referring Hospital & MD	• Less technology & expertise needed • Don't need comprehensive services • Lower overhead • Less legal liability	• Loss of local expertise • Lesser prestige • Decreased continuity of care
Regional Referral Center	• Specialty units with adequate volume • Greater available expertise • Better technology • Better research & advances • Increased education • Better staffed • More efficient, including ancillary services • Standardization possible • Potential for better CQI	• Possible increased fiscal risk • Need to meet peak demand ▪ Higher cost of care ▪ Levels of reimbursement • More complex system needed
System	• Potential for better outcomes • Potential for lower net cost • Avoids reduplication • Potential for better workforce deployment • Cooperation between sites and groups required	• Requires payer, community, hospital & MD support • Greater political issues • Requires high quality, available transport system • Incurs risks of transport • Requires more intrasite communication
Patient & Family	• Greater medical, nursing & ancillary expertise • Potential for better outcome	• Patient further from home & support • Family costs of travel • Less continuity of care

For pediatric intensive care, regionalization has been partially achieved for more than 10 years (Pollack 1991, Yeh 1992). Considerable data supports the benefits of regionalization of pediatric critical care and this subject was recently reviewed (AAP/ACCCM/SCCM 2000). In premature neonates born weighing less than 2 kilograms in North Carolina, care at a level 3 neonatal ICU significantly lowered the mortality rate (Bode 2001). In the Birmingham region of the United Kingdom, a study compared 12 months before and after centralization of pediatric critical care (age < 15) (Pearson 2001). There was almost a doubling in the rate of utilization of pediatric critical care accompanied by a significant fall in the mortality and a 25% decrease in length of ICU stay. This was not due to use of intensive care for less ill patients, since the percentage of mechanically ventilated patients did not change. The authors suggested that an unmet community need for pediatric critical care was exposed and corrected by regionalization. The Pediatric Critical Care Study Group recently found that across 16 pediatric ICUs (PICUs) the risk adjusted mortality and length of ICU stay were inversely proportional to patient volume (Tilford 2000).

For trauma services, the high cost of a regionalized system has been recognized and has led to closure of some regional centers. The American College of Surgeons has helped promote the regional center of excellence program in trauma. One recent study comparing one center in 1994 and 1998 (pre and post ACS Level I trauma verification) found a significant (7.4%) decrease in mortality in 1998, particularly for the most severely ill patients (DiRusso 2001). This was accompanied by shorter ICU length of stay (LOS) and lower cost. A confounding factor in analyzing these studies is the difficulty in correcting for severity of illness among different groups or time periods. A recent study of ICU trauma patients showed that only APACHE III, but neither APACHE II nor TRISS scoring, were good outcome predictors in this population (Vassar 1999).

In 1983, a NIH consensus conference recommended regionalization for adults with non-traumatic medical and surgical critical illness, but this recommendation was never implemented. Some analyses of specific diseases also supports the concept that regionalization can decrease the net cost of care (Maerki 1986). In 1989 Crippen and colleagues documented the experience of their “scoop and run” program for rapid transfer of 81 Medicare patients over a 33-month period. Overall, 54% of patients were discharged home alive, but a very large disincentive was the average daily net loss of $1,827 per patient day (cost vs. Medicare reimbursement) (Crippen 1989). While this data may be skewed by the circumstances of one hospital, the old data emphasize the importance of fiscal assessment in assessment and planning (Rie 1989).

A task force of 38 expert physicians and nurses constituted by the American College of Critical Care Medicine reviewed the literature on regionalization and published a summary report in 1994. In considering the evidence supporting better outcomes from regionalization, they concluded that “definitive scientific evidence is not available and some papers show bias; there are no papers suggesting a worse outcome.” They also commented that no hard evidence demonstrated reduced costs through regionalization nor any guaranteed avoidance of duplication and competition.

Despite the lack of supporting data, 92% of the task force members believed that regionalization was in the patient's best interest and had the potential to lower health care costs. Major impediments to a regional system were perceived to be local pressures and the legal atmosphere. The group recommended development of disease-specific severity of illness-based triage systems, focusing on patients with ARDS, cardiac problems, liver failure, renal failure, severe sepsis, multiple organ failure, and transplants. Importantly, the task force felt that economic incentives would be needed to participate in a regional system. Since the time of this task force, there has been little activity in this arena within the medical literature.

Regionalizing critical care has many operational challenges, beyond economics (Jastremski 1993). Networking among centers must occur and a lead agency responsible for the organization is required. A plan to achieve the new system must be established and then must be publicized in a way that permits input and modification to achieve support and political "buy-in." The facilities and existing resources within a region need to be categorized, with their acceptance of this process. In parallel, the patient groups who will be transferred and appropriate criteria for transfer need to be established and agreed upon. Disease-specific treatment, triage, and transfer protocols will be determined. These protocols need to be designed for rapid use, since for many critical illnesses delaying transfer loses much of the potential benefit.

Defining patients unlikely to be benefited by transport is also important. These patients may have either a very low mortality without transport or such a low likelihood of survival that transport would be futile. Implementation requires a combination of education, communication, and patient transport. In addition, the regional centers need to develop a system for easy access and ongoing communication with referring physicians. Recent data support the safety of transfer of unstable critically ill patients by mobile ICU (Gebremichael 2000). Both ongoing networking of the sites and continuous quality improvement processes also need to be established. Systems to insure appropriate cooperation from health care payers and to identify noncompliance also are needed. Over time, some of the triage implementation may occur at a pre-hospital emergency medical system level, avoiding an additional transfer step.

Recommendations

1. Government research organizations and/or private foundations should support pilot trials of regionalized critical care, starting first in states or areas with large rural regions. These studies should assess patient outcomes and the costs of care, among other endpoints.

2. Professional societies and government organizations should promote efforts to define the levels of adult critical care and promote the use of a stratification system. Regionalization has the greatest potential to work well when combined with a system for stratifying the levels of critical care provided – as occurs for trauma units and neonatal ICUs. The 1991 guideline system proposed by SCCM (1991) should be updated with broad input, applied and publicized.

3. Closed health systems with regionalized critical care should be studied to assess efficacy of this model. Such systems should include those in other countries as well as those within the United States.

4. The cost efficacy and impacts on each component of a regionalized system need to be determined carefully. The system needs to protect the tertiary centers from incurring major losses in care of these patients.

5. Retrospective and prospective research is needed to determine which clinical conditions and patients are most likely to benefit from transfer in a regionalized system.

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ROLE OF INTENSIVIST PHYSICIAN STAFFING

Despite considerable investment of resources, there remains wide variation in ICU organization (Pronovost 1999, Groeger 1992), and several studies have suggested differences in ICU organization may impact patient outcome. One key domain is the physician staffing of ICUs. In particular, does staffing with physicians trained in critical care (intensivists) improve clinical outcomes? (Vincent 2000).

A Conceptual Model To Explain Why Intensivists May Improve Patient Outcomes

The rationale for improved outcome with intensivist staffing is that physicians who have the skills to treat critically ill patients, and who are immediately available to detect and treat problems, may prevent or attenuate morbidity and mortality (Pronovost 1999). The skills are first attained through dedicated training programs and consist of procedural competence, diagnostic expertise, and a wide set of patient management and counseling capabilities required for dealing with critically ill and dying patients. These skills are well documented elsewhere as the requirements of all critical care fellowship training programs (American College of Critical Care Medicine 1997). Thereafter, through the consistent application of these skills, one would expect further improvement, analogous to the "surgeon-volume argument," where data suggest that, with more practice and experience, the operator continues to improve (Dudley 2000). The immediate availability is a direct consequence of being dedicated to covering the ICU. In contrast, for example, a surgeon or anesthesiologist with the skills required to treat a critically ill patient may be unavailable in a timely fashion because of a commitment to a current patient in the operating room.

The above concept focuses on improvements at the patient-level. Intensivist staffing may also yield benefits through a leadership role at the ICU organizational level. For example, if the ICU has physician leadership by intensivists whose only clinical responsibilities are to take care of patients in the ICU, there is the opportunity to create a strong ICU team. This sense of teamwork can boost morale and encourage close examination of all ICU care operations, potentially realizing further improvements in the quality and efficiency of care. The improved sense of continuity and close attendance to patients may also bolster improved patient and family satisfaction. Intensivist-led or intensivist-staffed ICUs may also realize decreased resource use because these physicians may be better at reducing inappropriate ICU admissions, preventing complications that prolong length of stay (LOS), and recognizing opportunities for prompt discharge (Pronovost 1999).

A Conceptual Model To Explain Why Intensivists May Not Improve Patient Outcomes

There are three theoretic reasons why intensivists may not improve outcomes. The first is a lack of continuity in care. Individual patients only spend a portion of their time in the ICU. The primary attending who manages the patient both before and after the ICU stay may have a superior knowledge of unique characteristics of that patient – and this

knowledge may be crucial to a variety of key clinical decisions both within and outside the ICU. By ceding care to the intensivist, decision-making may suffer.

Second, the intensivist may not be superior to the primary provider in ICU skills. Many of the skills required to care for ICU patients overlap with skills in other areas of medicine. Dedicated training programs help ensure intensivists are appropriately trained. But, they do not ensure that the intensivist will be *better* than any other particular physician.

Third, there may not be a consistent intensivist practice. Even if there are elements of intensivist care that, on average, are superior to that provided by other physician groups, it is unclear what that practice is, or whether intensivists always ensure that practice is appropriately executed. This potential variation can include within-intensivist variation and between-intensivist variation. The net effect is that any gains from intensivist care could well be off set by losses. As an example, recent data suggest that patients with ARDS will benefit from low tidal volume mechanical ventilation (ARDS Network 2000). Yet, do all intensivists ensure such a strategy is consistently applied? Failure to do so could quickly nullify the benefits of intensivist-care at the bedside of such patients.

Physician Staffing Models In The ICU

There are four attending physician staffing models practiced in critical care units in the United States: 1) *closed-staff ICU*, the intensivist is the patient's primary attending for all patients in the ICU; 2) *mandatory critical care consult*, the intensivist is not the patient's primary attending but every patient admitted to the ICU receives a critical care consult; 3) *elective critical care consult*, the intensivist is involved in the care of the patient only when the attending physician requests a consult; and 4) *no critical care physician.* Under models 2 and 3, the intensivist consults for another physician to coordinate or assist in critical care but does not have primary responsibility. Under model 4, there may either be a multiple consultant model, where multiple specialists are involved (in such instances, a pulmonologist or intensivist may be consulted for ventilator management but no one is designated as the consultant intensivist), or a single physician model, where the primary physician provides all ICU care.

Current And Future Distribution Of ICU Physician Staffing Models In The US

The COMPACCS study recently estimated current and future requirements for adult critical care and pulmonary medicine physicians in the United States (Angus 2000). The study used existing population, patient, and hospital datasets combined with prospective, nationally representative surveys of ICUs and critical care and pulmonary specialists. The results showed that intensivists currently provide care to 36.7% of all ICU patients. Intensivists are more likely to provide care in medical ICUs, in larger hospitals, in teaching hospitals, and in hospitals with a high proportion of patients covered by health maintenance organization contracts. Furthermore, most intensivists are providing care to only a proportion of the patients in the ICU and only 5-6% of all

ICUs are closed or have mandatory intensivist consults (models 1 and 2). ICUs most likely to be closed or to have mandatory consults are those dedicated to the care of trauma patients and those in teaching hospitals and larger hospitals.

The current ratio of supply of intensivists to demand (assuming the current use of intensivists equals demand) is forecast to remain in rough equilibrium until the year 2007. Subsequently, COMPACCS predicted demand will grow rapidly without a change in supply. This will yield a shortfall of intensivist hours equal to 22% of demand by 2020 and 35% by 2030. The principal reason is the aging of the US population. Unfortunately, sensitivity analyses suggested that the array of current health care reform initiatives will either have no effect or will worsen this shortfall. Needless to say, if the number of closed-staff model ICUs should be higher, or if the number of patients that ought to receive care should be higher, then the shortfall of intensivists is even worse.

Evidence That Intensivist Physician Staffing Improves Outcome

A recent systematic review evaluated the association between ICU physician staffing and outcomes (Pronovost 2002). This analysis identified 26 relevant studies of alternative staffing strategies. All studies were observational. Twenty studies focused on a single ICU. ICU physician staffing was classified into *low intensity* (no intensivist or elective intensivist consult) or *high intensity* (mandatory intensivist consult or closed ICU [all care directed by intensivist]).

High intensity staffing was associated with lower hospital mortality in 16 of 17 studies (94%) and with a random effects pooled estimate of the relative risk for hospital mortality of 0.71 (95% CI 0.62-0.82) (Figure 1, Panel A). High intensity staffing was associated with a lower ICU mortality in 14 of 15 studies (93%) and with a random effects pooled estimate of the relative risk for ICU mortality of 0.61 (95% CI 0.50-0.75) (Figure 1, Panel B). High intensity staffing reduced hospital LOS in 10 of 13 studies and reduced ICU LOS in 14 of 18 studies without case-mix adjustment (Figure 2). High intensity staffing reduced hospital LOS in 2 of 4 studies and ICU LOS in 2 of 2 studies that adjusted for case-mix. No study found increased LOS with high intensity staffing after case-mix adjustment. Thus, the review concluded that high intensity versus low intensity ICU physician staffing was associated with reduced hospital and ICU mortality and hospital and ICU LOS.

Figure 1

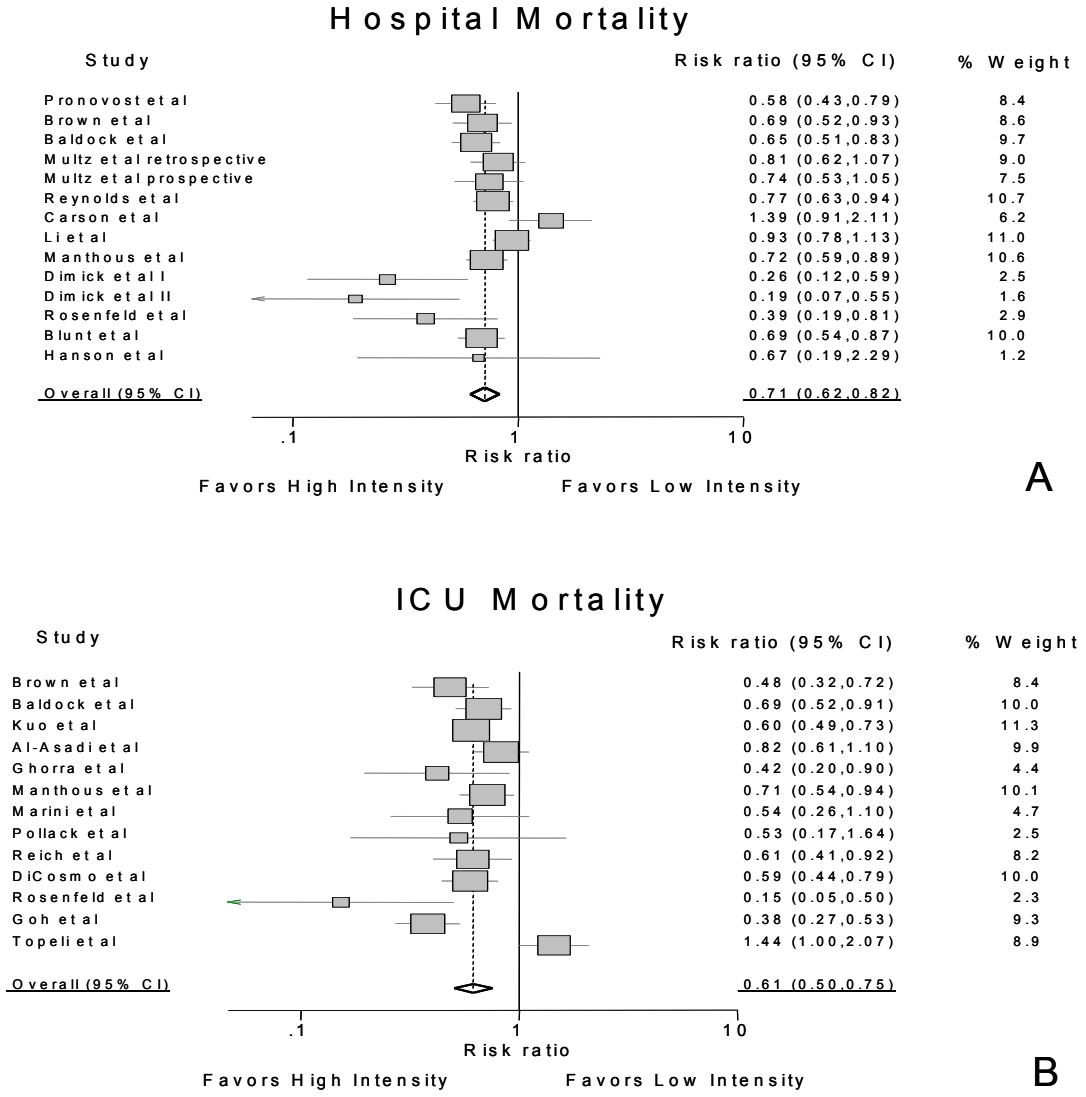

Figure 1. – Unadjusted Hospital (Panel A) and ICU (Panel B) Mortality With Low and High Intensity ICU Physician Staffing. Data from studies demonstrate the relative risk with 95% confidence intervals of hospital (panel A) and ICU (panel B) with high intensity versus low intensity ICU physician staffing. Relative risks less than 1 suggest reduced mortality with high intensity staffing while relative risks greater than one suggest increased mortality with high intensity staffing (adapted with permission from Pronovost et al. 2002).

Figure 2

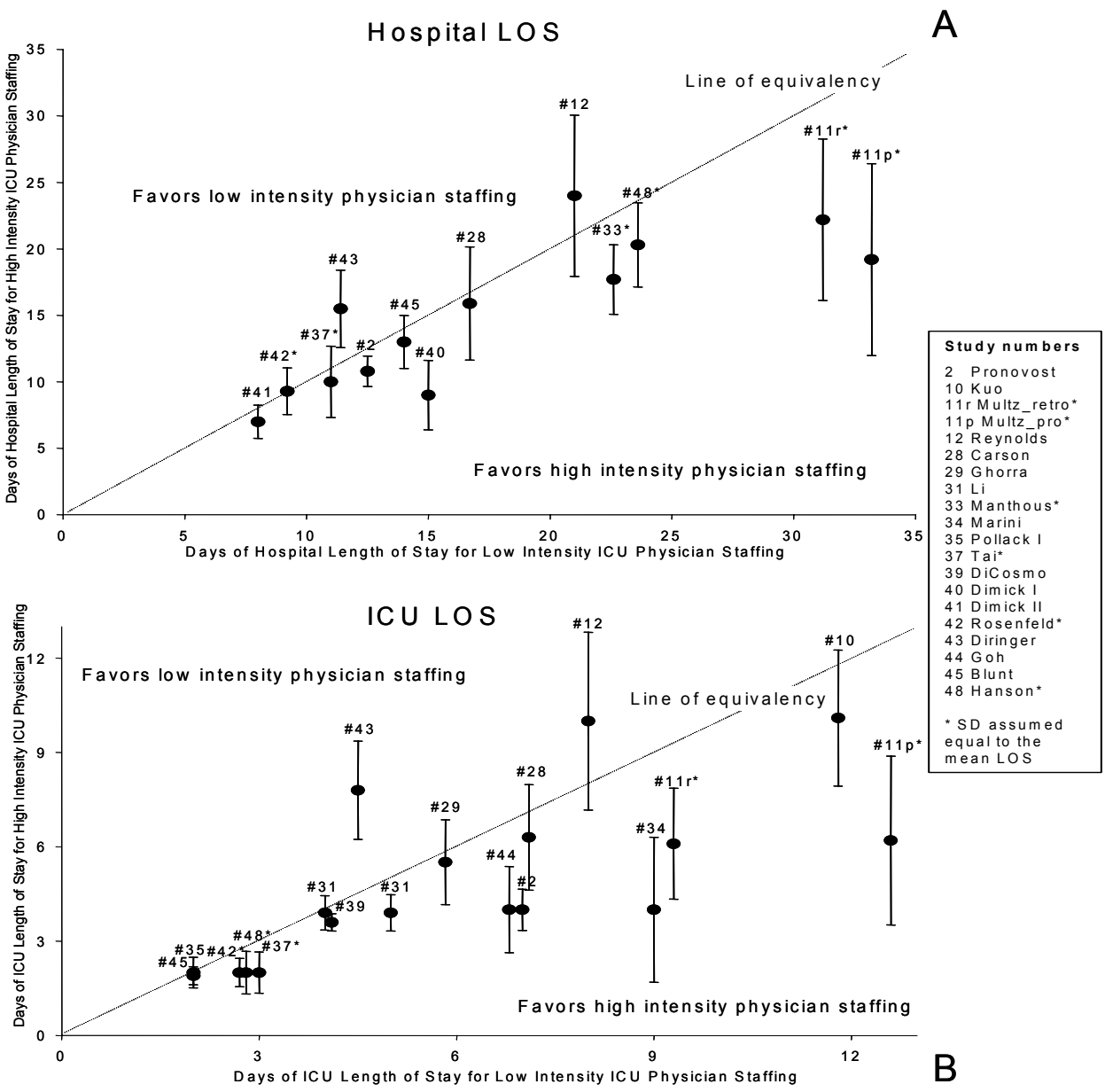

Figure 2. – Unadjusted Hospital (Panel A) and ICU (Panel B) Length of Stay (LOS) with Low and High Intensity ICU Physician Staffing. Data from studies are plotted with the high intensity mean LOS as a y-coordinate and the low intensity mean LOS as an x-coordinate along with the 95% confidence interval. The diagonal line represents the line of equivalency. Data below the line of equivalency suggest shorter LOS in the high intensity group. Data points above the line of equivalency suggest shorter LOS in the low intensity group (adapted with permission from Pronovost et al. 2002).

Future Directions

Given that most ICU patients in the United States are cared for with low intensity staffing, a major shift by hospitals toward high intensity staffing in the ICU would provide a significant opportunity to improve the quality of care and clinical outcomes of ICU patients, while reducing LOS.

Other countries have already organized critical care in this fashion with the "closed ICU" approach commonly utilized in Europe and Australia. A survey by the Audit Commission for Local Authorities and the National Health Service in England and Wales found that closed systems are usual and intensivists initiate care in 80% of all ICUs (Audit Commission 1999). The average six-bedded general ICU in the United Kingdom has 3 consultants with fixed commitments to the unit, and 3 more taking part in the on-call rotation. All ICUs in the State of Victoria, the second most populous state in Australia, have been following the "closed" model for more than a decade (Cole 2000). In 1997, a Task Force of the European Society of Intensive Care Medicine issued recommendations on minimal requirements for Intensive Care Departments (ICD). Although the publication was not evidence-based, the task force emphasized that the director of an ICD should be an intensivist, and that it is essential that a qualified intensivist provide 24-hour coverage in level II and III (moderate and high intensity care) ICDs (Ferdinande 1997). The task force also recommended that 24-hour coverage by an intensivist was desirable for level I ICDs (Ferdinande 1997).

Recommendations

With the large population of the United States and its projected shortage of intensivists, a wide scale application of the high intensity staffing model does not seem realistic. Therefore, the following areas of research should be pursued to improve the effectiveness of current resources:

1. Research should identify those characteristics of high intensity ICU staffing that improve outcome. Pronovost, et. Al., found previously that daily rounds by an ICU physician was associated with improved outcomes in patients who underwent abdominal aortic surgery. Yet, how daily rounds translates into improved outcomes remains unclear (Pronovost 1999). For example, were the improved outcomes due to specific critical care training and expertise or to increased availability, perhaps with reduced response time, of a team of physicians whose sole responsibility was to provide care in the ICU? Might some of the improvements be possible through alternative staffing models, such as telemedicine? (Rosenfeld 2000)

2. The exact role of the intensivist physician needs more precise definition. The intensivist physician is a member of a critical care delivery team whose members play highly important roles. Critical care nurses are essential and it is clear that nurse-to-patient ratios affect patient outcomes (Pronovost 2001). Pharmacists and respiratory therapists, as described later, are also important for patient outcome. Furthermore, other physicians, such as hospitalists and emergency medicine specialists, often provide care to critically ill patients. More research is needed to

define the ICU multidisciplinary staffing that matches patient needs and optimizes patient outcomes.

3. The critical care profession should identify the factors that encourage present and future physicians to pursue critical care as a career. These factors include professional reimbursement, the sustainability of a field with a high potential for professional "burnout," and the non-financial issues such as duration of training and lifestyle. Without addressing these issues, the field of critical care could lose its attractiveness, thereby creating an even more dramatic shortfall of critical care physicians in the future.

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ROLE OF CRITICAL CARE NURSING

The United States is facing a critical shortage of registered nurses -- particularly the specialized, highly trained nurses who staff intensive care units, operating rooms, and emergency departments. The average vacancy rate for registered nurses is expected to reach 15% by 2003. One in seven hospitals nationwide have reported RN vacancy rates higher than 20 percent, and nurse vacancy rates have increased for 60 percent of all hospitals since 1999.

Why Is There A Nursing Shortage?

1. Supply and demand. This current nursing shortage is the result of many factors: the aging nursing population, increased age of nurse educators, the declining number of students enrolled in nursing schools, and unsatisfactory working conditions. The sobering fact is that the growth in the nursing work force has not kept pace with the country's population growth. The Department of Health and Human Services predicts that the current shortage of experienced nurses is expected to grow worse over the next 10 to 20 years. At that time, today's nurses will enter retirement just as the aging population demands more nursing services.

   The 2000 *The National Sample Survey of Registered Nurses* showed a 5.4 percent increase in nurses from 1996 -- the lowest growth reported since data collecting began in 1977. From 1996 to 2000, the average age of registered nurses rose from 44.3 to 45.2. Based upon known trends in the supply of RNs, a projected 6% growth in supply will not address a projected 40% increase in demand by the year 2020.

   These trends may be more dramatic in critical care since fewer nurses are pursuing advanced degrees and training. According to a survey by the American Organization of Nurse Executives (AONE), critical care vacancy rates across the country have been reported at 20 percent and the average time it takes to fill them is seven percent longer than in other patient care areas. This trend is increasing nationwide.

2. Education and training. Contributing to the decline in nursing school enrollment is the availability of more career choices for women. In addition, the image of professional nursing as a field that offered many opportunities and job security has changed to one that is *perceived* as uncertain and even dangerous. There is an even more acute shortage of experienced nurses in specialty areas where more advanced training and skills are required, especially in critical care. This shortage can be explained in part by the rapidly aging RN work force and by a smaller pool of new graduates from baccalaureate programs, which have traditionally attracted younger students. Historically, intensive care units have attracted younger nurses and the rapid decline in the number of RNs under age 30 in the work force plays a large role in shortages in critical care areas.

3. Organizational systems and work environment. Changes in the financing and organization of health care delivery have created new forces that affect nursing services. These include increased acuity of hospital patients, reductions in hospital reimbursement rates, cost-containment, downsizing, and increased competition.

   Conditions in the work place have impacted nurses' ability to provide quality care in a safe environment. High nursing turnover rates have been the symptom of such problems as increased workload, low staffing ratios, mandatory overtime, diminished career opportunities, and low pay. In critical care, the situation is exacerbated by increased acuity, and pressured work environments. All of these factors have made nursing and critical care nursing, less attractive careers.

4. Communication and collaboration. Convincing evidence now exists that nurse staffing influences patient outcome. In hospitals with lower RN staffing complications occur 3-9% more often than in hospitals with a higher proportion of RN care. This suggests that as a result of their vigilance, training and knowledge, nurses are able to alert physicians to early changes in the patient's condition and thereby prevent potential complications. Clearly, communication and collaboration are the core of this teamwork. Therefore, it is not surprising that the relationship between nurses and physicians and their ability to communicate and collaborate are major factors in nursing satisfaction and retention.

Implications Of A Critical Shortage

1. Complexity of the environment. Critical care registered nurses are essential in ensuring access to and quality of care for the most seriously ill patients. The developing nursing shortage poses a significant threat to society's most vulnerable populations and has adverse implications for the quality of health care. Patient acuity has been rising rapidly, due to the declining average length of stay and to new technology that allows rapid assessment, treatment, and discharge. Hospitals are becoming large intensive care units and sicker patients are creating an increasing demand for experienced, highly skilled nurses. As the population ages this demand will far outreach the supply of trained professional nurses. Without measures to reverse the trend, the nation is in danger of experiencing serious breakdowns in the health care system such as limited access and declines in quality of care.

2. Regulated nurse/patient ratios. When the ratio of nurses to patients is too low, patients can be placed at risk. Examples include delays in care, medication errors, and lack of preventive nursing care. However, nurse staffing is more complex than simple ratios. Adequate staffing is patient focused and requires such diverse and difficult-to-quantify elements as matching the right caregiver to each patient, identifying systems that assist in the delivery of care, incorporating legal and regulatory considerations, and measuring outcomes.

   The situation is even more complicated in critical care where patient acuity is highly variable. Therefore, it is difficult to express ICU staffing numbers or patterns as a

single acceptable national staffing ratio or mix. Standards for critical care nursing practice should provide the foundation for the minimum level of competent and professional care delivered to these critically ill patients.

Recommendations

The national nursing shortage is a complex problem with no single solution. The nursing profession has organized the *Nursing's Agenda for the Future Steering Committee* to examine this issue. Nursing leaders recognize that time is limited, resources are scarce and issues are critical. This group has identified multiple strategies to address the national nursing shortage and staffing crisis. Using this framework, the critical care nursing community has developed a series of recommendations as outlined below.

1. Create professional practice environments that attract and retain nurses as follows:
   - Facilitate organizational adherence to standard quality measures and evidence-based practice. Establish certification as a professional benchmark.
   - Provide nurses with sufficient autonomy over their practice and responsibility for decision-making, policy setting, and financial management of their unit.
   - Establish a zero tolerance policy for disruptive behavior, holding nurses and physicians more accountable for their actions.
   - Involve the nursing staff in defining and developing professional nursing practice in the organization through negotiated professional development opportunities.
   - Ensure appropriate compensation and career development opportunities, especially in relation to other competing fields.
   - Facilitate creation of effective long-term work force planning models through consistent collection of work force staffing and quality data.

2. Standardize practice within the ICU
   - Require health care facilities to establish patient acuity systems utilizing valid and reliable tools to determine staffing based on the patient's acuity and the skills needed to deliver the care to meet each individual patient's needs.
   - Create infrastructures and practices that foster nurses' and physicians' participation in decision making at all levels of the organization to promote a culture of collaboration, participatory management, and teamwork.
   - Study the feasibly of creating new utilization models of nursing expertise, e.g., Nurse Manager Practice Groups (new model in which nursing service is outsourced to ensure competency, expertise, and experience to achieve the desired outcome) rather than depend on traditional models. Key strategic multidisciplinary partnerships used to design, implement, and evaluate new integrated practice models must be developed to advance the use of research findings and evidence-based practice.

3. Promote effective information systems in critical care. Technology can be used to streamline processes, ensure information sharing regarding best practices, and help hospitals and staff seek real time standards. Specific opportunities are to:

- Utilize information systems that decrease the amount of time that a critical care nurse spends on documentation and information seeking to maximize the expertise of the nurse. State of the art technology can facilitate the use of universal protocols and guidelines.
- Develop and implement continuing education and training plans to ensure competency in the use of technology.

4. Develop innovative models for ICU staffing that link patient need, cost, competency of providers, and patient outcomes. Specific areas would be to:
   - Focus on adequacy of resources (staffing, supplies, equipment, and ancillary support) rather than fixed ratio or staffing models that predetermine numbers of clinicians without looking at the needs of the patient and organization.
   - Allow for flexibility in scheduling to facilitate care roles to accommodate the aging work force who are less able to perform demanding physical activities and are more susceptible to work-related injuries.
   - Improve support for clinical decision-making and continued education/validation of knowledge. Recognize the nurses' professional status and expertise and utilize standards that focus on clinical and patient outcomes. Reestablish preceptor and orientation programs in institutions to maintain an adequate supply of specialty nurses.

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OTHER HEALTH CARE PROVIDERS IN CRITICAL CARE

The practice of critical care medicine is complex and requires a multidisciplinary team that includes respiratory therapists, clinical pharmacists, dietitian/nutritionists, speech-occupational-physical therapists, and others. Similar to the situation impacting critical care physicians and nurses, these groups are facing increasing shortages and competing opportunities that could further threaten cost-effective quality of care.

Respiratory Therapy (RT) historically has played an integral role in the management of mechanical ventilation, oxygen therapy, inhaled bronchodilator therapy, and tracheal-bronchial hygiene. It has been increasingly recognized that protocol management can be instrumental in improving the quality and cost of care in the critical care environment (Smyrnois 2002).

Mechanical ventilation is commonly used in the management of critically ill patients. Respiratory-therapist-driven protocols for ventilator management (e.g., weaning) have shown reduced duration of mechanical ventilation; reduced length of stay, as well as a proposed reduction in associated morbidities like ventilator associated pneumonia (Horst 1998, Marelich 2001, Kollef 1997). RTs have demonstrated a lower rate of discordant respiratory care orders; reduced number of treatments, as well as a reduction in charges when compared to physician directed orders, without negatively impacting morbidity or mortality (Kollef 2000).

RTs are continually expanding their competencies and roles in critical care to include airway skills, arterial lines, hemodynamic monitoring, diagnostic testing and evaluation. Increasing numbers of RTs have attained Advanced Cardiac Life Support (ACLS) and Pediatric Advanced Life Support (PALS) certification (AARC 2000). Although critical care nurses can effectively implement weaning protocols, this role is limited by the increased nursing care demands and reduced nurse availability. In addition, increasing sophistication of ventilatory management and monitoring (e.g., mechanics) have made RTs essential members of the critical care team.

There is an imminent shortage of RT personnel due to the same factors affecting other health care professions, namely an aging workforce and reduced enrollment in training programs (AARC, personal communication). Although not large, this shortage will amplify the shortages impacting other health care professionals (e.g., MD, RN). The projected increases in cardiopulmonary diseases associated with an aging population will necessitate an enhanced initiative to recruit and retain qualified individuals to this field. Continued interaction with physicians and nurses for the formulation, implementation, and evaluation of protocols, in addition to an appropriate role expansion as qualified surrogates, could have a positive impact on outcome and cost in critical care.

Organizations like Leapfrog, the Institution for Healthcare Improvement, and the Institute of Medicine have suggested that medication errors accounted for an alarming

number of deaths (IOM 1999). Critically ill patients commonly require more costly and complex medication therapy. These issues increase the demand for clinical hospital pharmacist expertise at a time when there is a rapidly growing shortage due to reduced applicants to pharmacy schools and a competitive market place (Pharmacy Manpower Project 2000).

A recent multivariate regression analysis (severity adjusted) evaluated the association between hospital pharmacy services and outcome (Bond 1999). The study demonstrated a significant reduction in mortality with four (of 14) clinical pharmacy services; clinical research; drug information; drug admission history; and participation on the CPR team. The study results support the American College of Clinical Pharmacy's vision, which states "we will be the recognized leader in initiating, fostering, and disseminating pharmacotherapy innovations that will optimize patient care outcome."

Studies have found improved quality and reduced cost in hospitals where pharmacists are employed to provide drug information, monitor adverse drug reactions (ADR), manage drug protocols and proactively participate in multidisciplinary ICU rounds. Pharmacist recommendations have resulted in a reduction in ADRs secondary to prescribing errors (Leape 1999, Smythe 1998). The majority of these recommendations are typically accepted by physicians.

In addition to reducing ADRs and mortality, the participation of a clinical pharmacist results in drug related cost savings and avoidance (Chuang 1994). ICU drug utilization has resulted in drug acquisition costs reportedly as high as 25% of a hospital's pharmacy budget (Matuszewski 1995). Common pharmacist interactions include: discontinuation of drug therapy; change in drug, dosage, frequency, route of administration; and discontinuation of laboratory testing (Baldinger 1997). The majority of the pharmacists' interventions resulted in an additional cost-savings despite the growing awareness and efforts by physicians to address treatment costs in a cost effective manner (Montazeri 1994, Chuang 1994). Other studies have suggested a reduction in hospital length of stay and drug cost without an associated change in mortality (Bjornson 1993). Pharmacists will be key to the implementation of hospital information systems and computer physician order entry to produce additional reduction in ADRs and cost.

Clearly, the literature supports the need to incorporate RTs, pharmacists and others as key participants in the multidisciplinary critical care team. Added incentives to training, opportunities for career growth and appropriate compensation for their value-added activities could help reduce our future manpower issues without compromising quality in a cost-effective manner.

Recommendations

1. The professions of a respiratory therapist and hospital pharmacist should be examined with the same scrutiny as those of the critical care physician and nurse. Important factors include:
   - Length and degree of training
   - Opportunities for cross-training
   - Compensation and reimbursement
   - Sustainability of a career in critical care, in contrast to other competing opportunities
   - Future work force supply

2. The optimal roles of the respiratory therapist and the pharmacist in critical care must be defined. Too often these professionals have been viewed as hospital-wide resources, thereby diluting their role in the ICU. More research needs to be performed to understand the impact of these professionals on critical care delivery.

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TECHNOLOGY

Few health care environments require as much technology as the ICU. Critical care practice incorporates diagnostic devices, physiologic monitoring and clinical information systems. For an already stressed health care work force, technological advances provide a double-edged sword. Health care workers must manage more and more clinical data, which requires additional time and personnel to generate, document, store, integrate, and act upon this information. On the other hand, technological advances, particularly in information technology, offer new opportunities for increased clinical efficiency as well as improved patient outcomes. Novel approaches that rely heavily on technology, such as telemedicine, might improve utilization of scarce resources such as intensivist time.

During the care of each patient, ICU health care workers must organize data from the medical history, physiological monitoring, medications and other sources such as mechanical ventilation, laboratory testing, and imaging. Successful clinical decision-making depends on integration of data on multiple levels. Yet, in most hospitals, these data are stored and displayed in multiple physical locations, some outside of the ICU. Even data that are electronically generated or communicated are often manually transferred to conventional tools such as the bedside nursing flowsheet and the patient medical record.

Fully digital patient information systems are now being developed, and implemented. These systems provide a central source for entry and storage of patient history, laboratory, and imaging results. Off-site access to these networks, often through the Internet, enhances the ability of multiple practitioners to query or modify each file. Most such information systems, however, are best suited to longitudinal care of patients who have periodic encounters, rather than the continuous management of an ICU patient.

Newer ICU information systems integrate real-time physiologic, laboratory, and imaging results along with current medications and interventions in a “dashboard” type display at a workstation (www.visicu.com 2002). These advanced systems have the potential to revolutionize critical care delivery. The display of trends, particularly with thresholds or alarms for pre-determined trends or abnormal results, emphasizes early, proactive rather than delayed, reactive patient management. Algorithms are being developed that automatically display salient information or evidence-based explicit management actions for common clinical scenarios (Morris 2002). The use of information systems that link real-time clinical events with state-of-the-art decision support can enhance the quality of patient care and improve caregiver efficiency. This could allow health care professionals to treat a larger number of critically ill patients.

More widespread bedside use of handheld computers or personal digital assistants (PDA) in the ICU offers opportunities for enhanced efficiency through immediate access to reference information and management algorithms (Lapinski 2001), as well as timely

and accurate implementation of treatment protocols such as for ventilator weaning (Iregui 2002).

Information systems can promote standardization and quality. Decision support tools can integrate benchmark data, large reference datasets, and evidence-based management algorithms with data from individual patients. Systems designed to calculate a severity of illness score for comparison to large reference populations are well established and can assist in admission and discharge decisions. Decision support tools that link patient characteristics such as documented drug allergies and results of microbiological culture and antimicrobial drug sensitivity testing, with a comprehensive pharmacy formulary database can reduce adverse events, avoid drug interactions, and improve accurate drug selection (Evans 1998). These and other applications of advanced technology can contribute to increased efficiency for caregivers as well as improved patient outcomes. Automated integration of individual patient data into population-based databases can improve the efficiency of quality improvement analysis.

Telemedicine is defined as the use of electronic information and communications technologies to provide and support health care when distance separates the participants (Field 2002). Critical care applications of telemedicine are relatively new, and documented evidence of efficacy is limited thus far. One novel project has used continuous intensivist oversight of a surgical ICU using video conferencing and computer-based data transmission at a remote site. In this study, Rosenfeld and colleagues (2000) demonstrated significant reductions in ICU and hospital mortality, ICU complications, and ICU and hospital length of stay and costs compared to control periods. A commercial application developed by these investigators uses a relational database with a dashboard-style user interface, software alerts designed to avoid adverse events, and on-line decision support in combination with remote staffing by intensivists and ICU nurses linked by voice, video, and data to multiple ICUs (www.visicu.com 2002). Studies that attest to reductions in mortality, length of stay, and cost are reported (Becker 2002), but not yet been published in peer-reviewed journals. The expanded use of ICU telemedicine would likely promote more efficient use of scarce intensivist time through the remote site management of more ICU patients per intensivist. This approach still requires on-site physician and nursing presence within the ICU.

Implementation of technological advances might contribute to alleviating critical care manpower shortages through greater efficiencies in organizing and responding to clinical data, enhanced decision support, and greater utilization of ICU telemedicine. Barriers to acquisition and maintenance of new technology are substantial and include high up-front investment costs, rapid obsolescence, and the challenges of personnel training in and acceptance of new technology and new approaches to patient care.

Recommendations

1. The critical care profession should collaborate with the IT industry and the federal government to accelerate development of information technology in critical care. IT has been recognized by the federal government as one of the major levers in improving health care. Nowhere is this more true than in the delivery of critical care services.

2. ICUs should have standard methods of analyzing and providing information for clinical care, resource management, and workflow. This standardization would have the following advantages:
   - Any critical care professional would be able to practice in any ICU interchangeably.
   - A common information platform would drive standard approaches and responses to clinical processes.
   - Standard quality measurements and outcomes would be assured.
   - The professions would apply standard processes of care to improve efficiency, quality, and professional satisfaction.
   - Informatics would be leveraged to reduce work force demands and stresses by eliminating waste, redundancy, and organizing clinical efforts by the use of "smart systems."

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SUMMARY

As described in the COMPACCS study, the future demand for critical care services in the United States will exceed the capabilities of the current delivery system. The most alarming problem is the anticipated shortage of health care professionals practicing critical care. To meet this challenge, the professional societies for critical care physicians and nurses organized a task force called FOCCUS (Framing Options for Critical Care in the United States). This task force was charged with assessing the current state of critical care and proposing ways of addressing the work force crisis. After careful consideration, FOCCUS proposes the following recommendations to its parent societies:

Recommendation #1: The FOCCUS societies should commission a task force to develop an approach to standardize the practice of critical care. Such standardization would ensure uniformity, promote quality, and rationalize resources.

The field of critical care has matured over the past two decades with advances in technology, therapeutics and training. Across a wide array of patient populations critically ill patients share many common clinical problems—respiratory failure, shock, sepsis, cardiac failure, etc. The diagnosis and therapy of these disorders has become more standardized across the specialties caring for critically ill patients. Furthermore, the organizational and economic challenges of providing this care has received increased attention within hospitals and health systems. This would appear an ideal time for the critical care professions to advocate standardization of the care of the critically ill.

Suggested opportunities include:

a) Assess critical care delivery models in other countries to identify “best practices” in the intra-hospital organization, regionalization, resource allocation, etc.

b) Define types of ICUs by specialty, specifying/rationalizing clinical goals—specific examples are general medical/surgical; surgical; medical; cardiac and specialty (like neuro or trauma).

c) Define appropriate staffing levels for each, including physicians, nurses and other health professionals. This would require standardization of the levels of critical care.

d) Define admission/discharge criteria to justify expenditure of ICU resources (this is independent of nursing requirements in the rest of the hospital, which is a separate issue). This would include criteria for the care of the chronically critically ill.

e) Define/standardize protocols that are common to all critical care, e.g., weaning, infections.

f) Define standard quality and outcome measures and acceptable standards. This would include a major effort by the profession to educate the public about the cost-effectiveness of critical care especially at the end-of life.

g) Define how such standards would be implemented and promoted by the critical care professions.

Recommendation #2: The FOCCUS societies should commission a task force to examine the opportunities and future direction of informatics in critical care. This assignment should include advocacy for promoting common datasets in critical care.

Critical care applies expensive resources in a fast-paced environment. Such care requires a wide array of data collected on every critically ill patient. Furthermore, these patients require accurate and timely therapies. Preliminary reports suggest that organizing this information and workflow reduces errors and resource consumption and improves outcomes.

A task force should examine these developments and collaborate with the information technology (IT) industry and the federal government, who have been devoting resources to this area. Information technology provides a great opportunity to implement process change in critical care. The goal is that all ICUs would have standard methods of analyzing and providing information for clinical care, resource management, and workflow. This standardization would have the following advantages:

a) Any critical care professional would be able to practice in any ICU interchangeably.
b) A common information platform would drive standard approaches and responses to clinical processes.
c) Standards quality measurements and outcomes would be assured.
d) The professions would apply standard processes of care to improve efficiency, quality, and professional satisfaction.
e) Informatics would be leveraged to reduce work force demands and stresses by eliminating waste, redundancy, and organizing clinical efforts by the use of "smart systems."

Recommendation #3: The FOCCUS societies must take a leadership role in defining and promoting incentives to ensure the future workforce in the critical care professions.

The shortage of health professionals in critical care will reach crisis levels by the end of this decade. Nursing and pharmacy are already at this stage and will soon be followed by shortages in respiratory therapists and intensivist physicians. The ICU is

a particularly stressful environment because of the high acuity of illness. This environment may be amenable to reorganization of the work and workflow to reduce this stress. In addition, other incentives, both economic and non-economic, must be identified to ensure that critical care continues to attract the "best and brightest." The FOCCUS societies must take a leadership role as follows:

a) Ensure that reimbursement for critical care services remains a priority for the federal government and other payers.
b) Conduct in-depth surveys and focus groups to define the depth and breadth of professional "burn-out" and its implications for the future workforce.
c) From such studies, define the financial and other issues (e.g., lifestyle) that influence health care professionals in choosing and sustaining critical care as a career.
d. Collaborate with the federal government, professional societies, and the medical education community to promote the training of critical care professionals

Recommendation #4: The FOCCUS societies should encourage/sponsor research that defines the optimum role for intensive care professionals in the delivery of critical care.

While there is growing evidence supporting the role of trained intensivists in critical care, little is known about the exact nature of this role. Current models range from the full-time on-site intensivists to those practicing via telemedicine. Critical care nursing, pharmacy, and respiratory therapy would benefit from similar scrutiny.

This research should define how critically ill patients are best served by all health care professionals including those not formally trained in critical care. The outcome of such research would be an evidenced-based approach to critical care delivery that would appropriately match patient needs with resources. These resources include location, technology and most importantly, professional expertise.