Factors Influencing Length of Stay in the Intensive Care Unit

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Abstract and Introduction

Abstract

Background: Long stays in the intensive care unit are associated with high costs and burdens on patients and patients' families and in turn affect society at large. Although factors that affect length of stay and outcomes of care in the intensive care unit have been studied extensively, the conclusions reached have not been reviewed to determine whether they reveal an organizational pattern that might be of practical use in reducing length of stay in the unit.
Objective: To identify and categorize the factors associated with prolonged stays in the intensive care unit and to describe briefly the nonmedical interventions to date designed to reduce length of stay.
Methods: Articles published between January 1990 and March 2005 in English-language journals indexed by MEDLINE were searched for studies on outcomes and costs of care in the intensive care unit and on care at the end of life.
Results: The emerging consensus is that length of stay in the intensive care unit is exacerbated by several increasingly discernible medical, social, psychological, and institutional factors. At the same time, several nonmedical, experimental interventions have been designed to reduce length of stay.
Conclusions: Interventions involving palliative care, ethics consultations, and other methods to increase communication between healthcare personnel, patients, and patients' families may be helpful in decreasing length of stay in the intensive care unit. Further studies are needed to provide a strategy for targeting specific risk factors indicated by the literature review.

Introduction

Long stays in the intensive care unit (ICU) are associated with high costs and burdens on patients and patients' families and in turn affect society at large. The cost of caring for patients in ICUs in the United States has been estimated to account for 1% to 2% of the gross national product[1,2] and 15% to 20% of US hospital costs,[3] which represents 38% of total US healthcare costs.[4,5] Although the total number of hospitals, hospital beds, and inpatient days decreased during the years 1985 to 2000, the number of critical care beds and days in critical care increased dramatically during the same period.[2] In a study[6] of 323 patients with ICU stays of 30 days or more, these patients were found to occupy 15.7% of total ICU bed days, although they represented only 1.6% of patients admitted to the ICU. In a prospective observational study, Stricker et al[7] found that whereas only 11% of patients admitted to the ICU stayed for more than 7 days, these patients used more than 50% of ICU resources. Furthermore, in several studies[8,9] the mortality of patients with ICU admissions lasting 14 days or longer was estimated to be nearly 50%. Fakhry et al[10] found that 70% of patients with stays longer than 2 weeks reported less than 50% functional recovery. Of the patients who were employed before ICU admission, less than 50% had returned to work. Finally, Esserman et al[11] found that 32% of ICU resources were spent caring for patients who survived less than 100 days after discharge from the hospital.

Generally, a primary goal in intensive care is to decrease length of stay when medically appropriate in order to both improve the quality of medical care and reduce cost and excess use of resources. Although factors that affect length of stay and outcomes of care in the ICU have been studied extensively, the conclusions reached have not been reviewed to determine whether they reveal an organizational pattern that might be of practical use in reducing length of stay in the ICU. We reviewed the literature to determine if such a pattern exists.

Materials and Methods

Search Strategy and Selection Criteria

Articles published between January 1990 and March 2005 in English-language journals indexed by MEDLINE were searched for studies on outcomes and costs of care in the ICU and on care at the end of life. Key words for the search were "long ICU stay," "extended ICU stay," "intensive care," "critical care," "end-of-life care," and "cost of stay." The reference lists of articles on outcomes and costs of ICU care and care at the end of life also were examined. Types of ICUs discussed in these articles included medical, surgical, and cardiac units. Patients were too heterogeneous for classification according to factors other than stay in an ICU. Only articles relevant to the issue of patients' length of stay in the ICU were included.

Data Extraction and Synthesis

The information contained in each article was evaluated separately but within the context of the other articles. Because the studies were too heterogeneous to be combined in a formal meta-analysis, a narrative literature review was undertaken. The many factors affecting length of stay in the ICU were categorized as institutional, medical, social, and psychological.

Results

The emerging consensus is that length of stay in the ICU is exacerbated by several increasingly discernible institutional, medical, social, and psychological factors. At the same time, a number of nonmedical, experimental interventions designed to reduce length of ICU stay warrant further study (see Appendix).

Institutional Factors

ICUs in the United States vary greatly in geographic location, resources, organizational structure, and leadership. Each of these factors may have an effect on patients' care and length of stay.

Fisher et al[12] examined the variation in Medicare spending between different geographic areas. They found that certain areas of the United States had greater use of ICU beds and longer lengths of stay than did other areas, and they claimed that both factors were sensitive to the local supply of physicians and hospital resources: more physicians and resources led to greater use and longer stays.

Boulanger et al[13] compared the treatment of trauma patients in the United States and Canada and found that for patients with equivalent mortality rates and similar discharge dispositions, those in the United States were twice as likely as those in Canada to be admitted to ICUs and had longer ICU stays. ICU patterns of use in the United States are 2.5 times greater than those in Canada.[14] Similarly, Sirio et al[15] found that the use of ICUs for patients at low risk of death is significantly higher in the United States (12.9%) than in Japan (10.2%).

In a retrospective cohort study, Rosenthal et al[16] found that length of stay of patients in major teaching hospitals was 9% lower than that of patients in non-teaching hospitals or minor teaching hospitals. Other factors, such as the time of year of admission, may not affect patients' outcome or length of stay to the same degree. Although admission to the ICU in July is often thought to be associated with poorer outcome because of the relative inexperience of new residents and fellows, a retrospective cohort study at the Mayo Clinic by Finkielman et al[17] indicated that ICU admission in July was not associated with increased ICU length of stay or increased hospital mortality. However, hospitals with training programs have been associated with increased use of resources.[18]

The presence of a full-time ICU physician who does daily rounds also has been associated with a reduced likelihood of prolonged length of stay and reduced complications after high-risk surgery.[18,19] Most explanations of this phenomenon cite consistency of care and increased experience in dealing with both clinical issues and issues of patients' families as the main reasons for shortened stays.[18]

Medical Factors

The influence of specific medical interventions or specific clinical laboratory values on length of stay has been examined in numerous studies; conclusions about the variables affecting length of stay in the ICU differed in each study.

The type and severity of patients' illnesses can directly affect the length of ICU stays. Knaus et al[20] found that 78% of the variation in length of ICU stays and 90% of the variation in in-hospital mortality rates were attributable to patients' characteristics at the time of admission. In a prospective study by Wong et al,[9] for patients in a medical-surgical ICU requiring stays longer than 14 days, the most common reasons for admission were neuromuscular weakness, pneumonia, multiple trauma, and septic shock, in that order. Respiratory arrest, postoperative mechanical ventilation, congestive heart failure, cardiac arrest, airway protection or obstruction, and exacerbation of chronic obstructive pulmonary disease were the next most common indications for ICU

admission in these patients.

Several factors influence length of stay among postsurgical patients. In one study,[6] postoperative patients on the whole were less likely to have prolonged ICU stays than were patients admitted to the ICU for other reasons and were less likely to die during the ICU stay. Weissman[21] points out that patients admitted to the ICU after elective surgery rarely stay for extended periods, whereas patients admitted after emergency surgery often have prolonged stays.

Although the usefulness of scores on the Acute Physiology and Chronic Health Evaluation (APACHE) II in predicting hospital and ICU outcome has been supported by several studies,[22,23] in patients with extended ICU stays the risk of death was underestimated in the low range of predicted mortality and overestimated in the high range when the scores were used to predict outcomes.[24] APACHE II scores have been higher in patients with longer stays in the ICU, but in this group they were similar in both survivors and nonsurvivors.[6] In a retrospective cohort study, Sirio et al[25] also found that use of APACHE III scores resulted in systematic overestimates of the risk of death among ICU patients. Consequently, ascertaining hospital and ICU lengths of stay or prognosis on the basis of clinical factors and mathematical models is not necessarily clear-cut, and determining futility of care is often difficult.[26,27]

In a study by Goldhill et al,[28] patients who were in the hospital for more than 15 days before ICU admission had significantly higher mortality than did patients who were in the hospital for 0 to 3 days before admission. Higgins et al[18] also found a correlation between prolonged hospital stay before ICU admission and decreased survival and increased resource utilization. Increasing age is an independent risk factor for mortality in cancer patients admitted to the ICU.[31] Although mortality and length of stay in the ICU increase with age, outcome is mainly related to the severity of illness; age, by itself, may not be a reliable predictor of outcome after admission to the ICU.[32] Race and sex also are not correlated with increased length of stay.[18]

Do-not-resuscitate (DNR) orders by physicians and advance directives by patients are associated with reduced length of stay in the ICU and with reduced suffering of patients and patients' family members. Higgins et al[18] identified 2 important clinical factors that can help predict prolonged length of stay when used with a severity scoring model. Mechanical ventilation at 24 hours and the presence of a confirmed infection at 24 hours are both associated with prolonged stays in the ICU. Shorter length of stay was associated with DNR orders at time of ICU admission and coma at 24 hours.[18] In a prospective cohort study of 6802 patients, Hakim et al[29] found that only 52% of patients who preferred not to be resuscitated actually had DNR orders written. Moreover, the finding that orders were written more quickly for patients older than 75 years, regardless of prognosis, indicates that physicians may be using age as a predictor of survival even in instances in which no clear link exists between survival and age.[29]

Although patients are encouraged to prepare advance directives before admission to a hospital, participants at the Fifth International Consensus Conference in Critical Care in April 2003 found that only 10% of ICU patients actually have prepared such directives.[30] The paucity of advance directives and the inconsistencies of DNR orders among physicians attest to gaps in the education of both physicians and patients.

Abuse of alcohol and other substances also has been associated with increased length of stay and use of resources. Spies et al[33] found an increased frequency of death for chronic alcoholics after tumor resection. These patients also had an increase in the incidence of pneumonia and sepsis, and their ICU stays were prolonged by approximately 8 days. Similarly, Baldwin et al[34] found that admissions related to substance abuse were significantly longer and more costly than admissions not related to substance abuse.

Social Factors

In the ICU, lack of quality communication between patients' families and physicians or other healthcare personnel often leads to confusion among the family members, which is associated with unrealistic expectations and unnecessarily prolonged ICU stays. Investigators in the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments found multiple shortcomings in patient-physician communication. For example, 53% of physicians enrolled in the study did not know when their patients preferred to avoid cardiopulmonary resuscitation, and 49% of patients who wished to have resuscitation withheld did not receive a DNR order during that hospitalization.[35] For patients who had a DNR order when they died, 46% of the orders were written within 2 days of death.[35]

In a prospective study of ICU patients in Paris, France,[36] more than 50% of patients' family members did not comprehend the diagnosis, prognosis, or treatment of the patients. In a retrospective study[37] of 248 ICU patients with a predicted in-hospital mortality rate of 95% or higher, 15% of medical records documented unrealistic expectations of the patients' families; these expectations were associated with increased resource use without significant survival benefit.

Conflict between patients' families and hospital staff is a frequent problem in ICUs and can delay both treatment

and decision making, resulting in prolonged ICU and hospital stays. In interviews with 406 physicians and nurses caring for 102 patients in 6 ICUs at Duke University Medical Center, healthcare providers described conflict in 78% of cases.[38] Conflicts occurred between staff and patients' families in 48% of cases, among staff members in 48%, and among patients' family members in 48%. Most of the conflicts arose over the decision to withhold or withdraw life-sustaining treatment.

In a series of interviews with intensive care nurses, Melia[39] found that physicians and nurses in ICUs are often at odds over decisions to withhold or withdraw treatment and that these disagreements can compromise patients' care. In a survey of 230 Texas nurses by Thomas et al,[40] only 33% of nurses rated collaboration and communication with physicians as high or very high. These conflicts may be related to the finding in the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatments that many physicians lacked an understanding of their patients' wishes for end-of-life treatment.

Psychological Factors

Although no study has addressed the correlation between psychological characteristics and length of stay, the relationship between psychological health and medical decision making is well established. As a consequence of the stresses imposed on family members of ICU patients, the families often experience a high incidence of psychological turmoil, which can contribute to inadequate decision making and extended ICU stays.

A literature review by Azoulay and Sprung[41] indicates that up to 70% of family members of ICU patients experience symptoms of anxiety and depression. In a prospective multicenter study[42] of 637 patients and 920 family members of patients, the estimated prevalences of symptoms of anxiety and depression in family members were 69.1% and 35.4%, respectively. More than 72% of family members and 84% of patients' spouses had psychological symptoms: anxiety, depression, or both. In other studies, the degree of stress was greater for the sons and daughters of patients,[43] especially sons and daughters who lacked social support themselves.[44] Finally, in a study by Young et al,[45] relatives of ICU patients reported significantly more symptoms of anxiety and depression than did relatives of patients who were admitted for elective surgery.

The degree of anxiety and depression experienced by a patient's family members may, in turn, affect the willingness of the members to participate in making decisions about the patient's care. In a prospective multicenter study[46] involving 78 ICUs in France, only 47% of family members of ICU patients expressed a desire to share in the decision-making process; among these family members, anxiety was noted in 73%, depression in 35%, and poor comprehension in 35%. This phenomenon is not unique to France; in a multicenter study[47] of 6 Canadian ICUs, more than one third of patients' family members did not wish to share in the decision-making process.

Nonmedical Interventions to Reduce Length of Stay

Numerous researchers have proposed ways in which increased communication between healthcare personnel and families may reduce the severity of some of the social and psychological factors that influence ICU length of stay. Ahrens et al[48] found that a specialized communications team that included a physician and a clinical nurse specialist resulted in significantly shorter ICU stays (6.1 vs 9.5 days) and in reduced costs. In another study,[49] intensive communication significantly reduced median ICU length of stay from 4 days to 3 days. A follow-up study[50] 4 years later not only yielded similar results but also indicated a significant decrease in ICU mortality from 31.3% before the intervention to 18% afterward.

Providing increased feedback to the clinical team caring for ICU patients has also had favorable results in reducing ICU length of stay. Eagle et al[52] reported that increased feedback and communication between house staff physicians and cardiologists on a daily basis and between groups of house staff physicians on a weekly basis were associated with decreases in mean ICU length of stay from 2.45 days to 2.07 days and in mean hospital length of stay from 8.34 days to 7.14 days. In a nonrandomized controlled trial of 1752 critically ill patients, Burns et al[53] assessed an intervention in which a social worker conducted interviews "focusing on the adequacy of information giving and understanding, communication, psychosocial support, and whether there are any perceived conflicts in decision making." Feedback on these interviews was then delivered to the clinical team, a step that led to a significant impact on decisions to forgo cardiopulmonary resuscitation, to provide comfort care only, and to treat patients aggressively.

These studies suggest that a change in attitude and practice by the medical team, even despite confusion and anxiety on the part of patients' families, may facilitate decision making. For instance, Kirchhoff et al[51] mention how more than 60% of patients' families immediately agreed to limit life-support treatment when physicians discussed such treatment with the families.

Palliative care is also an important intervention in reducing length of stay in the ICU. Campbell and Guzman[57] found that a proactive palliative care approach for patients in a medical ICU decreased the time between determination of a poor prognosis and establishment of the goals of comfort care. Use of this intervention

consequently decreased the time that dying patients remained in the ICU, thus reducing the use of nonbeneficial resources and the cost of care. Campbell and Guzman[58] also found that proactive interventions from a palliative care consultant decreased hospital and ICU length of stay for patients with terminal dementia who had been admitted to the ICU by reducing the time between determination of a poor prognosis and establishment of DNR goals.

Finally, proposals have been made to introduce some form of ethics consultation into the ICU setting. Dowdy et al[54] found that proactive ethics consultations were associated with more frequent and documented conversations, more frequent decisions to forgo life-sustaining treatment, and reduced length of stay in the ICU. Similarly, Schneiderman et al[55] reported that ethics consultations were associated with reductions in ICU hospital days and life-sustaining treatments, although overall mortality in patients in the experimental group did not differ from that of the control group. In a subsequent study[56] with the same intervention, ICU length of stay for patients in the experimental group was reduced by a mean of 1.44 days and hospital length of stay by a mean of 2.95 days.

Discussion

Our review suggests that factors affecting length of stay in the ICU can usefully be categorized as institutional, medical, social, and psychological. Further research on innovations to reduce length of stay should address the impact of each of these categories. The training of medical students and residents in the ICU might benefit from the introduction of this or a similar categorization.

Making changes in any of the medical factors associated with type and severity of illness that affect length of stay requires expert medical skills. Often the medical factors are the basic reality that cannot be altered greatly. However, for patients deemed appropriate for DNR status, those who have a DNR order have shorter lengths of stay than do patients without such orders, a finding that further indicates the importance of effective communication between physicians and patients. The persistent low number of patients who have advance directives and inconsistencies in DNR orders suggest serious problems that may be systemic in medicine.

Social, psychological, and institutional factors also have a large impact on ICU length of stay. Clearly, lack of effective communication and the occurrence of conflicts—not only between a patient's physician, other healthcare professionals, and the patient but also between the physician and the patient's family—can lead to extended ICU stays. Moreover, stress and anxiety and depression among a patient's family members may make them less willing or able to participate effectively in important decisions on the patient's behalf, a situation that can lead to unnecessary, extended ICU stays. Although our findings indicate that having more physicians and resources in the ICU led to longer stays in the unit, having a full-time ICU physician who did daily rounds was associated with reduced likelihood of prolonged stays after complicated surgery.[18,19]

Finally, many of the potential risk factors we mentioned have been addressed by experimental interventions to reduce length of stay in the ICU, including various specialized communication strategies. The presence of a skilled social worker can help facilitate medical decision making that affects length of stay. Ethics and palliative care interventions can help determine poor prognoses more quickly and allow patients to be given comfort care.

Our review and analysis have limitations. For example, some factors that affect ICU length of stay may be unique to certain kinds of institutions, or to specific institutions, and might not be effectively detected by the methods used in the studies we reviewed. Furthermore, some factors that might have a significant effect on length of stay are not often studied. For example, other factors that might play a role include physicians' fears of malpractice litigation, concerns about the attitude of institutions toward reimbursement or other incentives or disincentives, and impasses in medical decision making caused by the distress of patients' families or the families' fear of loss. Only further research will uncover these and other possible categories.

In addition, the concept of length of stay might be used in an unreliable way or framed by investigators as a de facto negative factor. The whole concept of length of stay may be value laden, with a negative bias toward the idea of additional days in the ICU. However, many patients who have long ICU stays can have important and practical medical goals accomplished for them. The key task, the one to which this review is dedicated, is to establish a knowledge base for providing interventions to reduce length of stay in the ICU while preserving or improving the quality of medical care.

Conclusions

An organizational pattern consisting of institutional, medical, social, and psychological factors influences patients' length of stay in the ICU. The use of these categories in describing and teaching issues related to length of stay may provide a clearer way to identify patterns that interfere with quality care. Interventions to reduce length of stay have been identified, including improving the type and quality of communication and use of palliative care, and social work and ethics consultations.

Although many of the studies we reviewed had initial positive results, descriptive studies are needed to assess other factors that contribute to care in the ICU. Also, methods for evaluating the impact of these factors on

length of stay are needed. Further intervention studies could provide a strategy for targeting the specific risk factors delineated in this review. In particular, further studies of the factors that influence length of stay in relation to patients' outcomes, cost, and other concerns must include a consideration of variability among institutions.

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unit for patients with terminal dementia. Crit Care Med. 2004;32:1839-1843.

Appendix

Category of study	Factors and interventions affecting length of stay in the intensive care unit	References
Institutional factors	Geographic location of hospital, type of hospital, use of hospital resources	Fisher et al[12] Boulanger et al[13] Jacobs and Noseworthy[14] Sirio et al[15] Rosenthal et al[16] Finkielman et al[17] Higgins et al[18]
	Presence of physicians	Higgins et al[18] Dimick et al[19]
Medical factors	Type and severity of illness	Hughes et al[6] Wong et al[9] Knaus et al[20] Weissman[21] Wong et al[22] Barie et al[23] Suistomaa et al[24] Sirio et al[25] Wijdicks and Rabinstein[26] Faber-Langendeoen and Lanken[27]
	Establishment of do-not-resuscitate orders	Higgins et al[18] Goldhill et al[28] Hakim et al[29] Thompson et al[30]
	Type of treatment/infections in first 24 hours after admission	Higgins et al[18]
	Length of stay in hospital before admission to intensive care unit	Higgins et al[18] Goldhill et al[28]
	Patient's age	Hakim et al[29] Soares et al[31] Montuclard et al[32]
	Alcohol and substance abuse	Spies et al[33] Baldwin et al[34]
Social factors	Communication between physicians and patients about do-not-resuscitates orders	SUPPORT Principal Investigators[35] Azoulay et al[36]
	Conflicts between patients' families and caregivers, conflicts between members of healthcare team	Berge et al[37] Breen et al[38] Melia[39] Thomas et al[40]
Psychological factors	Stress and depression among patients' family members	Azoulay and Sprung[41] Pochard et al[42] Foster and Chaboyer[43] Vrabec[44] Young et al[45] Azoulay et al[46] Heyland et al[47]
Nonmedical interventions	Intense communication, specialized communication between patients' families and healthcare team	Ahrens et al[48] Lilly et al[49] Lilly et al[50] Kirchhoff et al[51]
	Increased feedback to the clinical caregivers of intensive care unit patients	Eagle et al[52] Burns et al[53]
	Availability of ethics interventions	Dowdy et al[54] Schneiderman et al[55] Schneiderman et al[56]
	Availability and effectiveness of palliative care	Campbell and Guzman[57] Campbell and Guzman[58]

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