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Should Critical Care Medicine be a Formal Part of the Undergraduate Curriculum?

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Medical students were surveyed shortly after completing the third year of medical school. The survey was designed to identify those areas of critical care medicine students had been exposed to and expressed interest in learning more about. In addition, the surveys sought to discern the level of confidence students felt with respect to different critical illnesses and intensive care unit (ICU) therapeutic modalities. Finally, the students were asked their opinion regarding the possibility or need for critical care medicine as part of their medical school curriculum. The three most common topics of interest among medical students who had recently finished their third year in medical school were shock, hemodynamic monitoring, and mechanical ventilation. Less than 30% of the students surveyed felt "better-than-average" confidence on any one of a number of critical care topics and treatment modalities. Of the 80% of students (n = 70) who completed the survey, 91% (n = 64) felt that critical care medicine should be made a part of the medical school curriculum, 6% (n = 4) felt it should not, and 3% (n = 2) were undecided. The survey results and the finding that most of the relevant literature acknowledges the need for critical care medicine in medical school has led us to conclude that a national core clerkship or a didactic lecture series in critical care medicine should be carefully designed and implemented into the undergraduate curriculum.

Nearly 100 years after publication of the Flexner Report on medical education, we find ourselves in the midst of national health care reform. It behooves us to examine medical education carefully as we train the physicians who will be practicing medicine in the twenty first century. The role of critical care education in the undergraduate curriculum is an area of current controversy.

Critical care unit rotations are typically offered only on an elective basis to medical students during their senior year in medical school. Before considering whether such an elective status for critical care medicine is ideal, one must first examine how undergraduate curriculums are created.

The Liaison Committee on Medical Education (LCME) is the agency responsible for the national accreditation of medical schools. It is the official accrediting body of the educational programs leading to the doctor of medicine degree, and it is recognized for this purpose by the United States Department of Education and the Council on Postsecondary Accreditation [1]. This committee recommends a set of curriculum guidelines, implementation of which (along with other criteria) is required for accreditation. The committee conducts on-campus site visits every 3 to 5 years to credential medical colleges.

The LCME requires courses to be taught by all medical schools in the following three areas.

1. Specific basic sciences, typically taught during the preclinical years in medical school: anatomy, physiology, microbiology, behavioral science, pathology, and pharmacology.
2. Specific core clinical disciplines, typically encountered by medical students during their third-year clerkships: obstetrics and gynecology, internal medicine, general surgery, pediatrics, and psychiatry.
3. Disciplines that support the fundamental clinical subjects: diagnostic imaging, anesthesiology, clinical pathology.

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A separate set of disciplines, commonly referred to as "bridge areas," are not required to be a part of the core curriculum by the LCME for accreditation. These "bridge" disciplines are believed to be derived from a number of separate primary disciplines, and they include areas of medicine such as geriatric medicine, emergency medicine, and critical care medicine. The LCME only makes the recommendation that these disciplines be made available to medical students should they elect to take rotations in one or more of them.

In addition to the guidelines proposed by the LCME, each college of medicine has its own local curriculum committee that implements the LCME recommendations and adds to and structures the medical curriculum according to the opinions of the local curriculum committee members.

In their examination of why critical care medicine has been left out of most undergraduate curriculums, Buchman and colleagues [2] suggested that perhaps any or all three of the following opinions may be prevalent among members of local curriculum committees at various colleges of medicine: (1) critical care medicine may be unimportant to medical students; (2) critical care medicine may be important to students, but not to undergraduate curriculum committees; and (3) undergraduate curriculum committees recognize the importance of critical care medicine, but they may believe the topics are adequately covered in the core clerkships.

No previous study has reported medical student views on these issues. The purpose of this study was to survey medical students to determine their assessment of the role of critical care medicine in their medical school curriculum.

Materials and Methods

The Critical Care Survey, designated "Phase One" of the Critical Care Medicine Study by the Division of Medical Education at the University of California, Irvine-College of Medicine, was administered to the medical students of the Class of 1994 during the first three months of their fourth year in medical school (July–September 1993). It was presumed that as third year students, they would have received some exposure to intensive care units (ICUs), and the ideal time to survey them on the medical curriculum would be during the first part of their senior year, when they began consideration of which specialties to pursue. Students who had not completed the five-core third year clinical rotations (i.e., obstetrics and gynecology, internal medi-

cine, general surgery, pediatrics, and psychiatry) were excluded from the survey ($n = 4$).

The survey consisted of five sets of questions. The first set of questions involved asking students about their desired residency of intent, if known at the time. The second set of questions asked the students to comment on their source of ICU exposure and to determine whether there were any critical care topics they wished to learn more about; for this portion, students were asked to rank list up to 6 critical care topics, leaving blank any of which they had no interest in. The third set of questions asked the students if they intended to take a fourth year elective rotation in one of the ICUs and requested what the reasons were for those who would not be taking an ICU elective. The fourth set of questions asked students to subjectively rate their familiarity with a number of topics (not all necessarily specific to an ICU) with respect to their general knowledge base acquired during their first three years of medical school; for this portion, the students were asked to use a scale of "1 to 5"; a "4" or a "5" represented "better than average" confidence from a student's standpoint, a "3" represented average familiarity, and a "1" or a "2" delineated areas in which students did not feel as comfortable with a topic as they did with other areas of medicine. The final set of questions asked the students to comment on whether they felt critical care medicine should be required in their medical school curriculum. Explanations were requested for any one who wished to comment further on the subject or on their responses.

The surveys were administered blindly, in that students were not informed who had designed the survey nor who was participating in its analysis. Furthermore, students were notified that their responses would remain anonymous.

To prevent an individual student from submitting more than one survey, all surveys were numbered by student last names, and, when the survey was returned, the student's name was checked off on a master list and the number clipped from the survey to ensure confidentiality.

During the first half of September 1993, the survey results were tallied by hand. The results were stratified according to the specialty of intent indicated by the respondent (for many, this specialty was "undecided" at the time).

Results

Of the 87 surveys distributed, 70 were completed (80% return rate). When asked about their desired

residency, the responses listed in Table 1 were obtained. The highest percentage of respondents were undecided or going into residencies other than obstetrics and gynecology, internal medicine, family practice, surgery, pediatrics, or psychiatry. In addition to this "undecided/other" group, 13–16% of respondents were interested in obstetrics and gynecology, internal medicine, family practice, and surgery. A minority of students were intending to pursue residency training in either psychiatry or pediatrics.

When asked to rank list up to 6 critical care topics of desired further interest and teaching, the responses listed in Table 2 were obtained; shock, mechanical ventilation, and hemodynamic monitoring were the most common.

When asked to identify their source of ICU exposure in the third year, 74% of respondents stated that they had received most exposure in the surgical intensive unit, 3% in medical ICU, and 9% of the respondents reported equal exposure in both the medical and the surgical ICUs. Fourteen percent of respondents stated they had received no exposure to the ICU during their third year in medical school.

Sixty-four percent ($n = 15$) of respondents stated they intended to take a fourth year elective in an ICU (9); the breakdowns by residency of intent are listed in Table 3. For students who stated they would not be taking a fourth year elective rotation

Table 1. Desired Residency Programs at the End of the Third Year of Medical School

Residency Program	Percentage of Respondents
Obstetrics and Gynecology	16 ($n = 11$)
Internal Medicine	16 ($n = 11$)
Family Practice	14 ($n = 10$)
Surgery	13 ($n = 9$)
Pediatrics	4 ($n = 3$)
Psychiatry	4 ($n = 3$)
Undecided/Other*	33 ($n = 23$)

*Emergency Medicine, Radiology, Anesthesiology, etc.

Table 2. Critical Care Topics of Interest

Critical Care Topic	Percentage of Respondents
Shock	64 ($n = 45$)
Mechanical ventilation	63 ($n = 44$)
Hemodynamic monitoring	59 ($n = 41$)
Sepsis	33 ($n = 23$)
Adult respiratory distress syndrome	<30
Multiple organ failure	<30

Table 3. Students Intending to Take an Elective Rotation in the Intensive Care Unit

Desired Residency	Percentage Planning a Fourth Year ICU Rotation
Pediatrics	100 ($n = 3$)
Surgery	89 ($n = 9$)
Obstetrics and Gynecology	82 ($n = 11$)
Internal Medicine	82 ($n = 11$)
Undecided/Other	61 ($n = 23$)
Family Practice	20 ($n = 10$)
Psychiatry	0 ($n = 3$)

*Emergency Medicine, Radiology, Anesthesiology, etc.

in an ICU ($n = 25$), the reasons cited included primarily scheduling conflicts with other required fourth year rotations, or lack of available spots in the ICU during the periods available to the students.

Subjective confidence ratings on the pathophysiology of several critical illnesses or critical care treatment modalities resulted in "better than average" confidence (i.e., a "4" or a "5" on the described 5-point scale) for less than one third of respondents on each of the topics listed in Table 4.

Ninety-one percent ($n = 64$) of respondents felt that critical care medicine should be included as a formal part of the medical school curriculum. Three percent ($n = 2$) were undecided, and 6% ($n = 4$) felt that critical care medicine should not be required in the undergraduate curriculum. Of the four students who were not in favor of the implementation of critical care teaching in medical school, 2 were interested in family practice, 1 would be pursuing residency training in anesthesiology, and 1 was undecided on residency at the time of the survey's administration.

Discussion

The results of our Critical Care Survey are significant in that nearly all of the respondents (91%) felt that critical care medicine should be required in the medical school curriculum. Furthermore, although only 20% of respondents intending to pursue family practice residency training programs stated they would be taking a fourth year ICU elective rotation, all but 2 of these students ($n = 10$; 80% of respondents seeking residency in family practice) felt that critical care medicine should be a part of the curriculum. Nearly all students felt they needed more education on critical care issues.

This effort constitutes the first reported survey

Table 4. "Better than Average" Confidence with the Pathophysiology of Critical Illnesses

Critical Illness/Treatment Modality	Percentage of Respondents with "Better than Average" Confidence
Hypovolemic shock	29 (n = 20)
Overwhelming sepsis	26 (n = 18)
Fluid resuscitation	23 (n = 16)
Parenteral nutrition	20 (n = 13)
Disseminated intravascular coagulation	20 (n = 13)
Mechanical ventilation	13 (n = 9)
Multiple organ failure	11 (n = 8)
Adult respiratory distress syndrome	7 (n = 5)

we are aware of regarding opinions of medical students on critical care medicine. The data clearly demonstrate that our medical students consider critical care medicine to be important, and that they want it incorporated into the curriculum, including students entering primary care specialties.

We realize, however, that had we surveyed fourth-year medical students on whether they felt comfortable with, for example, the pediatric immunization schedule or with gram-negative antibiotic selection, many would not report "better than average" confidence. Furthermore, had we surveyed students on whether they felt their curriculum should include, for example, a "history of medicine" course, most students would probably be in the affirmative. Bearing these potential and valid criticisms of the Critical Care Survey in mind, we turned our attention to the second question we wished to answer: Why should critical care medicine be required in the undergraduate curriculum? After all, is it truly necessary to teach what is essentially tertiary care medicine to all future physicians, many of whom undoubtedly will not be practicing in tertiary care centers?

On the basis of our review and consideration of these issues, we formulated 7 reasons we think support implementation of a formal critical care clerkship or didactic lecture series in the medical school curriculum.

1. Certain topics are best taught in an ICU setting.
2. The recognition of life-threatening illness is important for all kinds of physicians in that it allows for appropriate and cost-effective referrals to ICUs.
3. A required fourth year ICU rotation with a set of learning objectives would give structure to the fourth year in medical school.
4. Rotations in the ICU may reinforce and strengthen the general medical knowledge base.
5. The ICU provides an environment in which to explore medicolegal, socioeconomic, and ethi-

cal issues (e.g., DNR status, organ donation, termination of life support).

6. Although medical students become familiar with the roles of out-patient clinic nurses, hospital ward nurses, operating room nurses, and labor and delivery nurses, an active rotation in the ICU allows students to observe and to learn from critical care nurses.
7. The ICU is an ideal place to gain exposure to medical technology at the cutting edge.

There are subject areas which in particular are best taught in the ICU. Buchman and co-workers [2] describe both general critical care topics (e.g., airway and ventilatory management, multiple organ failure), as well as topics associated with specific specialties but which are invariably managed in an ICU (e.g., status epilepticus, status asthmaticus, critical postoperative care). Ninety-four percent of critical care professionals surveyed at the 1990 Educational & Scientific Symposium of the Society of Critical Care Medicine stated that critical care medicine encompasses a distinct body of knowledge and set of clinical skills [2]. Only 16% of critical care professionals agreed with the statement that critical care medicine is merely an extension of several primary disciplines. These opinions differ from that which has been adopted by the LCME, as well as possibly local undergraduate curriculum committees (see explanation 3 cited by Buchman and colleagues) in that critical care medicine is a "bridge area" composed of several primary disciplines. In fact, the critical care professionals surveyed at this symposium felt that a rotation in the ICU should be required in the fourth year of medical school and that its successful completion should be a prerequisite for graduation. At least three prior reports document the importance of such education [3–5].

Nearly every specialty places patients in the ICU; thus, students entering most specialties will benefit from this experience. Groeger and associates

[6] reported that the leading primary admitting intensive care diagnoses were postoperative management, ischemic heart disorder, respiratory insufficiency/failure, and prematurity. Such disorders may occur across specialty barriers. Chalfin and Carlon [7] reported on criteria for utilization and allocation of ICU resources, emphasizing that appropriately timed referrals (i.e., based on primary disease and the nature and severity of organ system failures) are in the best interests of not only the patients, but also of the rational use of critical care resources, which are invariably expensive. This is an important reason cited by students in our study for the importance of critical care education, including students planning primary care specialty.

If we consider the third reason that supports the need for critical care medicine in the undergraduate curriculum, perhaps a well-structured critical care rotation with a defined set of learning objectives may be an idea worth pursuing as a means to develop a degree of uniformity to the learning experiences of fourth-year medical students. The 1993 recommendations of the Association of Professors of Gynecology and Obstetrics and the Council on Resident Education in Obstetrics and Gynecology for the fourth-year curriculum of students interested in going into obstetrics and gynecology stated that a core curriculum should include time spent on a medical or surgical ICU [8]. In addition, the recommendations stated that serious consideration should be given to a subinternship in an ICU. Residents training in obstetrics and gynecology were surveyed at this meeting and 12 of 20 felt that the fourth year should focus on general medicine, 11 of 20 stated a medical ICU rotation should be taken, and 10 of 20 stated a surgical ICU rotation should be taken in the fourth year; these areas (general medicine, MICU, and SICU) were the 3 most highly recommended fourth-year clerkships.

The fourth reason for adopting a core curriculum in critical care medicine at the undergraduate level is perhaps most important. A 1988 survey of departmental chairman in obstetrics and gynecology by Sorosky and Ekbladh [9] resulted in the opinion that nearly one half of the senior year in medical school should be devoted to general medicine. ICU rotations may reinforce the general medical knowledge base of graduating medical students. *Specifically, a subinternship in the ICU not only introduces medical students to critical care concepts and treatment modalities, but also provides an ideal environment wherein students can strengthen their general knowledge base of medicine (e.g., infection, electrolyte disorders, wound care, nutrition). In the ICU, one is continually challenged with acute changes in physiology, and we*

must learn to think in terms of an organ systems approach to patient care. It is very common for medical students to lose what autonomy they have been given when one of their patients is transferred to the ICU. No longer a part of the patient's immediate medical team, the student often ceases to participate and becomes a perplexed observer standing outside the ICU. Personal participation driven by a sense of personal responsibility is the key to medical student learning [2].

Cerra has stated that in this period of healthcare reform, critical care practitioners must become involved with the reform process on all levels, including the level of education and training [10]; perhaps this involvement should encompass undergraduate education in critical care medicine. To institute a national core curriculum in critical care medicine, Buchman and colleagues [2] outline the three approaches that need to be taken. First, the LCME must be educated on the need for critical care teaching in medical school. Second, the United States Medical Licensing Examiners must begin to include questions on critical care medicine in their examinations. And finally, medical school curriculum committees need to be convinced of the need for critical care medicine in their undergraduate curriculums.

With respect to the University of California, Irvine-College of Medicine, "Phase Two" of our Critical Care Study will include surveying the ICU experience of those students from the Class of 1994 who took elective rotations in the ICU during their fourth year. Furthermore, we plan to construct a pre-test and a post-test, which will be administered to students at the beginning and at the completion of their elective fourth year ICU rotations. These tests will be designed to test general medical knowledge, and they will be given to the students of the Class of 1995 during the 1994-1995 academic year. In this way, we will be able to examine in part our theory that rotations in the critical care unit may strengthen the general medical knowledge base of the students who take them. If this is indeed what is found, we can think of no stronger argument that would support implementation of a strengthened curriculum in critical care medicine.

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