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A Case-based Emergency Medicine Curriculum for Senior Medical Students

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ABSTRACT

Objective: To determine the effects of a case-based, core content–oriented emergency medicine (EM) curriculum on the basic EM knowledge of senior medical students.

Methods: All senior medical students rotating through the Milwaukee County EM elective during the 1992–1993 academic year were assigned specific chapter readings from a case-oriented EM textbook. A course curriculum consisting of goals and objectives for each chapter and two to three representative cases for the discussion topic also was distributed to each student. Interspersed with the cases was a series of questions directed at pathophysiology, diagnosis, management, and disposition. The EM faculty and residents conducted case discussions three times per week. All students completing the rotation were given a pretest at the beginning and a final examination at the end of the rotation. In addition, the students rated the textbook, coursebook, and lecture series at the end of the rotation using a five-point Likert scale.

Results: Seventy-five students rotated through the elective. The students showed a significant improvement in their EM knowledge base as judged by improvement in final examination scores compared with pretest scores (pretest score 62.2 ± 7.1%; final examination score 76.2 ± 6.3%; $p < 0.0001$). The mean change in scores was 14.8%, with a range of −1.6% to 34%. The students also rated the textbook, coursebook, and lecture series as effective, as shown by high median scores on a Likert scale.

Conclusions: A case-based EM curriculum coupled with ED clinical experience improves basic EM diagnostic and management knowledge of senior medical students.

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The diagnosis and management of emergency medical conditions have generally been taught in the traditional medical school clerkships (surgery, medicine, obstetrics/gynecology, pediatrics). This approach has been criticized due to lack of student exposure to important initial resuscitation skills and out-of-hospital care.[1] The ED provides a concentrated exposure to undifferentiated emergency medical/surgical conditions. A medical student rotation in emergency medicine (EM) provides clinical and didactic exposure to these conditions and an opportunity to learn resuscitation skills.

The clinical population in an active urban ED can provide an adequate exposure to a variety of emergency medical/surgical conditions.[2] Because each student will not be exposed to the full range

TABLE 1 Specific Lecture Topics Covered during the Monthly Didactic Lecture Series

Airway Management
Cardiopulmonary Resuscitation
Multiple Trauma
Abdominal Pain
Acute Chest Pain
Wound Care
Toxicology
Acid–Base Disorders
Respiratory Complaints
Altered Mental Status
Head and Neck Trauma
Suicide and Behavioral Disorders

of emergency medical problems during his or her clinical experience, a didactic curriculum is necessary. This curriculum should cover essential areas and fill in gaps from the clinical experience. SAEM has developed and published a model curriculum for undergraduate education in EM.[3] This model curriculum contains information about "what" to teach but not "how" to teach it. A recent survey of medical schools determined that core content topics and skills in EM were offered in the majority of medical school curricula, but were required in a smaller percentage.[4] Therefore, exposure to these basic topics and skills is not ensured for all students.

Only one study has examined the effects of an EM curriculum on the basic knowledge base of medical students.[5] This previous study evaluated a lecture-based curriculum for junior medical students and showed significant improvement (as judged by change in pretest to posttest scores) among the students exposed to the curriculum compared with those not exposed. The previously studied course did not include a concurrent concentrated clinical exposure to EM. We studied the effects of a case-based, core content–oriented EM curriculum on the knowledge base of senior medical students.

METHODS

Study Design

A prospective study of pretest and final examination scores after a case-based, core content–oriented senior elective in EM was done to determine knowledge gain.

Population and Setting

All senior medical students rotating through the EM elective at the Milwaukee County Medical Complex during the 1992–1993 academic year were involved in this study. The clinical experience in this elective included 15 nine-hour ED shifts at the Milwaukee County Medical Complex and two eight-hour ED shifts at St. Mary's Hospital, a private Medical College of Wisconsin teaching affiliate. The students were responsible for patient examination, diagnosis, management, and disposition under close supervision by EM senior residents and attending staff. Teaching in the ED was based on clinical case experience. No formal guideline was given to instructors or students for the educational content or format of clinical teaching.

Interventions

The didactic curriculum involved specific assigned chapter readings from a case-based, problem-oriented EM textbook.[6] Each student received a copy of the textbook for use during the month. The readings in the textbook were oriented toward a specific case discussion series that occurred three times per week for 90 minutes per session. The specific topics covered during this case discussion series are shown in Table 1. To supplement the textbook readings, a coursebook was developed from a curriculum initiated at the Wright State University School of Medicine Department of Emergency Medicine. This coursebook consisted of introductory material regarding the rotation, goals and objectives for each chapter and two to three representative cases for each topic. Interspersed with the cases was a series of questions addressing pathophysiology, diagnosis, management, and disposition. An instructor guide paralleling the material in the student coursebook was given to each EM resident (PGY2–4) and attending physician. Answers to the questions in the student coursebook were provided in the instructor guide along with specific teaching topics to be covered during each case discussion. The case discussion series was divided between the residents and the faculty, with the majority of discussions led by the residents.

Examination Development

A database of more than 2,000 questions covering each of the objectives in the coursebook/textbook was used. This database was developed by faculty at the Wright State University School of Medicine Department of Emergency Medicine. Examination questions in this database were directly related to goals and objectives for each of the chapters in the textbook. Questions about basic fundamental goals and objectives for each of the covered lectures were selected by the three investigators and compiled into a 60-item pretest and three 105–110-item final examinations. Approximately equal numbers of questions for each chapter objective were included in all the final examinations; however, no identical questions were used in the three examinations. The students completed the pretest on the first day of the rotation and the final examination on the last day of the rotation. Each student also anonymously

evaluated the rotation using a five-point Likert scale (1 = poor, 5 = excellent).

Analytical Methods

Examination score data were analyzed using analysis of variance (ANOVA) or paired Student's t-tests where appropriate. The students also were divided by month of rotation, and examination scores were compared between groups using ANOVA. A p-value < 0.05 was considered significant.

RESULTS

Seventy-five students rotated through the 1992–1993 EM elective. The majority of the students taking the elective matched in EM (16%), internal medicine (19%), surgery (17%), family medicine (13%), or anesthesia (11%).

The students showed a significant improvement in EM knowledge as demonstrated by improvement in the final examination scores compared with the pretest scores (pretest score 62.2 ± 7.1%; final examination score 76.2 ± 6.3%; $p < 0.0001$). The mean change in scores was 14.8%, with a range of −1.6% to 34%. The pretest score, final examination score, and change in scores by month of rotation are summarized in Table 2.

The students rated the textbook, coursebook, and lecture series as useful, as denoted by median scores of 5, 4, and 4 on the five-point Likert scale, respectively. The final examination was considered to be of moderate difficulty.

DISCUSSION

Academic units of EM may have the responsibility of teaching medical and surgical diagnostic and management skills to fourth-year medical students. A complementary didactic curriculum will augment students' clinical experience and allow them the opportunity to learn the diagnostic and management issues for patients they may not have had the opportunity to evaluate clinically in the ED. We adapted a case-oriented didactic curriculum from a similar curriculum developed at the Department of Emergency Medicine, Wright State University School of Medicine, Dayton, OH. The students found the distribution of curriculum material and interactive nature of the lectures helpful in their learning process as judged by their evaluation responses. Furthermore, the basic EM knowledge base of the students improved significantly over the month of their rotation. The students rotating during the months of July and November did not show statistically significant improvement in their examination scores. This may represent a Type II error resulting from division of the student population into multiple subgroups. To detect a 15% improvement in pretest score with an α of 0.05 and a power of 80%, more than 100 students would be needed per group.

The information taught and tested in this curriculum is basic knowledge every graduating medical student should possess, regardless of career choice. One would expect that this knowledge is taught during the clinical years of medical school training. However, there was a lack of improvement in pretest scores with increasing month of rotation (Table 2). All the students took the same pretest; however, mean pretest scores did not differ over the ten months; despite exposure to clinical rotations that should have covered issues such as treatment of an asthmatic patient, the differential diagnosis of chest pain, and the other clinical topics listed in Table 1. It is reassuring that the students were able to improve their pretest score during all rotations following exposure to the information taught in this EM curriculum.

LIMITATIONS AND FUTURE QUESTIONS

The improvement in final examination scores could be a response to the clinical experience only. This certainly

TABLE 2 Pretest Scores, Final Examination Scores, and Change in Scores by Month of Rotation*

Month	No. Students	Pretest Score (%)	Final Examination Score (%)	Change (%)
July	2	64.7 ± 6.1	79.5 ± 0.7	14.9 ± 5.4
August	10	63.8 ± 4.6	79.7 ± 5.3†	15.9 ± 5.3
September	8	63.8 ± 6.4	78.0 ± 6.6†	14.2 ± 6.1
October	8	57.8 ± 6.0	72.3 ± 8.0†	14.5 ± 4.6
November	5	63.8 ± 10.3	78.3 ± 3.9	14.5 ± 12.5
December	7	68.0 ± 5.3	75.7 ± 6.6†	7.7 ± 7.5
January	5	60.0 ± 7.7	75.6 ± 7.0†	15.6 ± 11.3
February	10	57.8 ± 7.5	76.3 ± 7.2†	18.6 ± 8.3
March	10	61.0 ± 5.5	76.7 ± 4.7†	15.7 ± 8.3
April	10	64.3 ± 8.5	72.7 ± 5.9†	8.4 ± 7.0

*Expressed as mean ± SD; p = NS, for between-month comparisons for pretest and final examination scores; no students rotate during May and June.

†The final examination score was significantly higher ($p < 0.05$) than the pretest score.

could be the case since we did not test students exposed only to ED clinical teaching. Future research should delineate the respective roles of clinical bedside teaching and didactic teaching in the student's understanding of diagnostic and management skills. Whatever the case, students found the didactic material helpful in their study process.

One might argue that the final examination scores of students not taking the elective would not be significantly different from those of our students who took the elective. Although we did not specifically test that hypothesis, the consistently low pretest scores throughout the ten-month period are evidence that this should not be the case.

The following are questions for future research:

1. What is the effect of clinical bedside teaching in the ED on the basic EM knowledge base of senior medical students? If similar improvement in examination scores is seen following exposure only to clinical teaching, then didactic curricula may not be necessary.
2. Is the change in examination scores simply a reflection of the pretest–posttest phenomenon? The scores of students not rotating on the EM elective should be analyzed.
3. What is the role of the interactive case discussion series? Would students do just as well with the didactic material and no formal instruction?
4. What is the retention of material taught in this EM elective and what is its eventual applicability to postgraduate training?

CONCLUSIONS

Our data demonstrate that this case-oriented curriculum in EM coupled with the clinical material students were exposed to in the ED improves basic EM knowledge over the month of the rotation. Since this knowledge may not be taught during the other rotations in the fourth year of medical school, an EM rotation should be required for all students. The case-based format evaluated in this study appears effective for imparting EM knowledge in conjunction with the traditional clinical exposure.

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Further Thoughts from the Reviewers

The authors have shown that senior medical students participating in a one-month EM elective improve their test performance scores on EM related topics. We do not know a priori whether the didactic material and the examinations used to test "EM knowledge" are relevant to the average student. These materials have not been universally endorsed as representative of the body of EM knowledge required by practicing physicians. Nor do we know the long-term value of acquiring this knowledge base during the senior year of medical school.

However, those familiar with the textbook used as the central focus of this course[1] are likely to agree that the information evaluated by the authors is basic to the practice of EM and reasonable information to be obtained by all practitioners during medical school.

But, is the didactic portion of the authors' course (and the specific format used) required to gain the desired knowledge (i.e., improve test scores)? Future studies should investigate the complementary roles of didactic instruction and clinical experience. If didactic instruction is sufficient for knowledge acquisition, the course material might be introduced at another point in the medical school curriculum. Furthermore, it will be important to determine the role of clinical experience for proper application of this knowledge base. Testing of student knowledge and its application using standardized clinical models may be required to determine the best means of guiding student acquisition of EM knowledge.[2] That is, is case-based (case-management-focused) instruction more effective in teaching clinical decision making than is standard topic-based didactic instruction? Controlled educational trials evaluating these concepts in simulated case-management scenarios are warranted.

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