Is there a place for medical students as teachers in the education of junior residents?

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\textbf{Abstract}

\textbf{BACKGROUND:} The aim of this study was to investigate a novel resident education model that turns the traditional surgical hierarchy upside down, termed a “reverse” peer-assisted learning curriculum.

\textbf{METHODS:} Thirty surgical topics were randomized between medical students and chief residents on each clinical team, with 1 topic being presented briefly during morning rounds. An exam evaluating junior residents’ knowledge of these topics was administered before and after 1 month of presentations. A questionnaire was distributed to evaluate the junior residents’ perceptions of this teaching model.

\textbf{RESULTS:} Thirty-four residents participated. There was a significant improvement in the mean examination score (54 vs 74, \(P < .05\)). No significant difference was noted in the mean score differentials of topics presented by either the medical students or the chief resident (21 vs 18, \(P = .22\)). More than 80\% of the residents responded positively about the effectiveness of this exercise and agreed that they would like to see this model used on other services.

\textbf{CONCLUSIONS:} This study confirms the hypothesis that medical students can teach surgical topics to junior residents at least as effectively as their chief residents.

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to support a teaching style already informally used in medical education: a teaching relationship between medical students and their seniors. Medical students provide a fresh source of knowledge and up-to-date references; they often refresh their teams with basic surgical knowledge or update their teams with interesting new research findings. This relationship, in which the teacher is actually more junior in academic level to the learner, has been described as a “reverse” teaching distance.5

The goal of this study was to investigate a novel near-peer teaching curriculum in which medical students take the role of resident educators on a general surgery service. We hypothesized that medical students would prove effective at teaching core surgical knowledge to junior residents.

**Methods**

A list of 30 core surgical topics was compiled before initiating this study. This list was based on topics frequently encountered on standardized exams and an informal survey of common conditions encountered on a busy general surgery service. Topics included conditions such as diverticulitis and pancreatitis and management issues such as fluid and electrolytes (please contact the authors for a full list). A bank of questions testing the knowledge of each of these core topics was adapted from the 4th edition of Lawrence’s Essentials of General Surgery.

Each study period was defined as a 4-week block. To assess the junior residents’ baseline knowledge of these core surgical topics, each junior resident was given a preintervention exam at the beginning of the 4-week period. The exam consisted of 30 questions from the textbook question bank, 1 on each of the 30 topics. The questions were rotated every month, maintaining the format of 1 question per topic. The 30 core topics were randomly assigned and distributed among the medical students (20 topics) and chief resident (10 topics) on each clinical team. Medical students were instructed to prepare 5-minute oral presentations on their assigned topics. They were told that they should be able to give these presentations “on the fly” directly before, during, or after team morning rounds. They were asked to provide outlines of their presentations to the chief resident early in the evening before their assigned dates. The chief resident did not provide feedback regarding the outlines. The students were instructed not to make PowerPoint slides or to read from their outlines. The chief residents’ presentations were to be in the same format. The chief resident would provide supplementation to the medical students’ presentations only if grossly incomplete or incorrect data were presented. Dates for each presentation were assigned, with 1 or 2 topics to be presented each day, depending on the monthly schedule. The junior surgery residents and chief resident were required to be present during all presentations. At the end of the month, the same 30-question exam given at the beginning of the month was readministered to the junior residents, and these results were our main outcome measure.

This investigation was designed as a crossover study because population size is a limiting factor in any resident education study at a single institution. The medical student presentations served as the intervention arm and the chief resident presentations as the control arm. Each month, the distribution of topics between medical students and chief resident was randomized, so that no topic was exclusively presented by either group.

This study was approved with institutional review board exempt status as an educational study. The institutional review board consent for this study was designed to remove any influence of incentive or negative repercussions from results of the preintervention and postintervention exams (ie, the junior residents studying to perform better on the exams or being concerned that poor results would be reported to faculty members). As such, the exams were deidentified after being paired for grading, and results were not shared with faculty members. The residents were not informed that the preintervention exam would be repeated at the end of the month or that the topics being presented by the medical students were included in the exam. The results of the preintervention exam were not shared with the residents and were not discussed after administration. The residents were told only that if they consented, they would be participating in an educational research study.

The mean scores of the preintervention and postintervention examinations were calculated and compared on the basis of those topics taught by the medical students versus those taught by the chief resident. Results were analyzed using Excel (Microsoft Corporation, Redmond, WA) using a paired t test for continuous data.

A 5-point, Likert-type scale questionnaire evaluating the junior residents’ perception of this teaching model was also distributed at the end of the month, and percentage responses were calculated.

**Results**

This study was conducted in a busy academic surgical residency program in Brooklyn, New York, over a 12-month period. A total of 34 junior residents participated in the study. None of the residents refused to participate. Nineteen of the residents were categorical surgical residents, 8 were preliminary surgery, 5 were from surgical subspecialties, and 2 were from family medicine. Because this study was conducted over a 12-month period, at least 1 first-year resident participated in each month of the intern year. No more than 4 junior residents were a part of the study each month. The composition of each “clinical team” varied on the basis of the medical students’ and residents’ schedules but consisted of 3 to 6 medical students, 1 to 4 junior residents, and 1 chief resident.

There was a significant improvement in the overall mean examination scores comparing the preintervention scores with the posttest scores (54 vs 74, P < .05). When analyzed according to “teacher status,” the mean score for those
topics presented by the medical students increased from the pretest examination compared with the posttest (55 vs 76, \( P < .05 \)). The mean score for those topics taught by the chief resident improved from the preintervention to the postintervention period (52 vs 71, \( P < .05 \)). No difference was noted between the mean score differential on topics taught by medical students or chief residents (21 vs 18, \( P = .22 \)).

A total of 29 residents completed the postintervention questionnaire (response rate, 85%) All of the statements on the questionnaire received \( \geq 80\% \) positive scores (Likert score > 3). In response to the statement “the student presentations were educational,” 89.6% of residents agreed or strongly agreed. In addition, 82.8% of respondents agreed that they would like to see this structure of teaching on other rotations. The results for all of the questions are outlined in Fig. 1.

Comments

We have demonstrated that 3rd-year medical students can teach core surgical topics to junior residents at least as effectively as chief residents. Junior residents reported a subjective improvement in their surgical knowledge and further agreed that they would appreciate the use of this type of curriculum on other rotations.

Ten Cate and Durning\(^5\) highlighted 3 features that differentiate the basic framework of any peer teaching model: “the educational distance between teacher and learner, the formality of the setting, and the learner group size.” Our study focused on educational distance and learner population.

The learner population of this study was junior residents. In a recent literature search, we found only 3 formal studies investigating the use of peer learning in resident education.\(^6–8\) Two of these studies focused on procedural skills or knowledge, and only 1 involved only medical knowledge. The results of these studies were consistent with ours, demonstrating that peer teaching can be effective in the resident population. These articles also provided evidence supporting the need for innovative teaching modalities in residency training.

The most unique variable in our curriculum was that of the “educational distance.” Educational distance is the difference in seniority between teacher and learner and typically falls into 1 of 2 categories: (1) peers of the same academic level act as teachers, usually with faculty oversight, or (2) more advanced students teach those students junior to their academic levels.\(^2\) A “reverse” educational distance, in which the learner is actually senior to the teacher, has been described, to our knowledge, in only 1 publication to date.\(^9\) Gustafsson et al\(^9\) were not intentionally investigating such a variable, however, which makes comparison with our data set less appropriate. The junior students in that study were trained to be instructors before teaching their seniors, and therefore the true educational distance would be difficult to establish.

We believe that our study provided both an appropriate and successful model for research of the reverse teaching relationship for the following reasons.

The topics selected represent core surgical issues with which every junior resident should be familiar and to which all medical students should be exposed during their rotations. The benefit of the teacher and learner being so close in academic level is that each group has something to gain from these presentations. Both groups have recently learned this information, or are actively studying it, and therefore each could have a better idea of the other’s thought process, a concept defined as “cognitive congruence.”\(^5\) Each group offers its own strengths. Junior residents are more actively involved in the management of these conditions. Medical students are closer to the pathophysiology of these topics and have recently studied for and passed the United States Medical Licensing

\[\text{Figure 1} \quad \text{Questionnaire results.}\]
Examination Step 1. The topics selected provided an opportunity for the presentations to be beneficial and engaging for both the presenters and the audience. They could encourage the medical students to learn more about management, and, more important to this study, the medical students could possibly refresh the junior residents on core surgical knowledge they have forgotten since medical school.

Additionally, we believe this curriculum is appropriate for the junior resident population because of the brief, defined time structure. As residents are integral members of the house staff, any educational study must take into account the effect of interventions on the limited in-house time of the residents. We were unable to find any studies investigating the effect of resident work-hour restrictions on peer-to-peer teaching among residents; however, recent evidence has suggested a negative effect of work-hour restrictions on the teaching of medical students by residents. As residents are teaching medical students less, one may question if the same phenomenon is occurring in the teaching of junior residents by their seniors. Our curriculum provides an adjunctive teaching dynamic that takes only 5 to 10 minutes each day and can help mitigate this potential shortage of teaching directed at junior surgical residents.

Finally, the effectiveness of this curriculum could also be attributed to the simple implementation of a framework of learning expectations and more accountability. In a study by Lube et al., the investigators suggested that their interventions of mandatory attendance, a structured reading list, and bimonthly ungraded quizzes were effective in increasing American Board of Surgery In-Training Examination scores not only because it changed the actual method with which the residents were taught but also because the interventions increased the supporting factors of learning, such as attendance, participation, and self-study. Our intervention is an example demonstrating the effectiveness of establishing a clear set of learning objectives and then enforcing mandatory attendance: 30 topics were selected and used consistently, and attendance at rounds was mandatory.

There were several limitations to our study. We had a relatively small population size, and we lacked a separate control group. Although our crossover design did prove statistical significance, a randomized control group may have provided different results. Next, the outcome measure used an identical repeated examination. Although it is possible that the exam itself prompted residents to read about the topics and look up the answers, we believe that our consent design controlled for this as best as possible. Without the knowledge that the same exam would be repeated, and with the 30-day period between the exam administrations, it is unlikely that the residents would have remembered questions or had incentive to look up specific answers. Finally, the residents were told that the individual results of the exams would never be communicated to faculty members. As such, there was no incentive to perform well on the exams, and the results of the exams were not reported to the residents at any time.

Conclusions

This study confirms our hypothesis that, with the appropriate selection of topics, medical students can teach surgical topics to junior residents at least as effectively as their chief residents. The role of medical students as resident educators is a novel concept and should be encouraged on general surgery services. Peer-assisted learning is an attractive and efficient tool that may be used in graduate medical education of junior residents. It is not necessary that teachers in these settings be senior to the learners. This study demonstrated that a “reverse” peer-assisted learning curriculum, in which medical students served as teachers for junior surgical residents, was both effective and well accepted on a general surgery service.

References