



## Review

## Resident-as-teacher programs in general surgery residency – A review of published curricula



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## ABSTRACT

**Introduction:** The Liaison Committee on Medical Education (LCME) requires that residents are trained to fulfill their educational duties toward medical students. This study reviews the literature on resident-as-teacher programs (RATPs) aimed at surgical residents.

**Methods:** Literature search with MeSH terms internship, residency, general surgery, teaching, education, and curriculum was performed using PubMed, Embase, Web of Science, and ERIC. Curriculum components and how curricula's success was measured were extracted for each study. Quality was scored using the Medical Education Research Study Quality Instrument (MERSQI).

**Results:** For the seven relevant publications the average MERSQI score was 9.9 (range 6.5–13.5). The RATPs were either lecture based (4/7) or content was distributed electronically (3/7). Change in attitude toward teaching was the most frequently assessed outcome. Highly rated curricular components were individualized feedback and iterative reminders to make teaching part of practice.

**Conclusions:** Few published RATPs in general surgery training exist. The literature suggests that pairing lectures with observation and feedback is successful. Distributing the content electronically is a feasible alternative to class-room based teaching in a busy surgical residency.

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## Introduction

Surgical residents serve an important role teaching medical students performing surgical clerkships and sub-internships. Some of this teaching is formal, i.e. lecture-based or in the simulation center and anchored in a curriculum. However, residents predominantly teach medical students in more informal ways, on the wards, in the operating room, or in clinics. By some estimates residents spend 10–25% of their time teaching medical students<sup>1,2</sup> and residents generally believe that teaching is one of their primary responsibilities.<sup>3</sup> Medical students report that about 30–40% of what they learn is taught by residents<sup>2,4</sup> and rank resident-provided instruction as the third most important source of learning during their surgery clerkship, after reading and participating in organized components of the curriculum, such as tutorials.<sup>5</sup> Despite this, only about half of residents have gained teaching experience through previous exposures, primarily through work as teaching assistants or as sports coaches.<sup>6,7</sup> Fewer,

roughly 15%, have received formal training in education.<sup>6</sup> It therefore falls to residency programs to prepare residents for their teaching role. In fact, the Liaison Committee of Medical Education (LCME) mandates that residents not only be trained to teach medical students but also how to assess medical student performance.<sup>8</sup> Furthermore, the LCME directs that resources to enhance teaching and assessment skills should be provided to residents.<sup>8</sup> Additionally, the Accreditation Council for Graduate Medical Education (ACGME) includes teaching as a practice domain in its General Surgery Milestone Project,<sup>9</sup> highlighting that residency programs should prepare residents for their teaching role.

Resident-as-Teacher curricula or programs (RATPs) have been developed across all disciplines to address the mandates set forth by the LCME. In published reviews of RATPs, the majority of programs are targeted at residents in internal medicine or pediatrics residency programs, while few are aimed specifically at general surgery trainees.<sup>10–12</sup> In these reviews, only three RATPs aimed at surgical residents were identified.<sup>13–15</sup> Surgery residents are a unique population, working more hours than their counterparts in any other specialty, with the exception of neurosurgery<sup>16</sup> and being responsible for teaching in a variety of settings (ward, office, operating room).<sup>5</sup> It stands to reason that surgical residents then

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have unique needs that need to be considered when designing and implementing RATPs. The goal of this study was to review the currently available literature regarding RATPs that are specifically aimed at general surgery residents to determine a starting point for those interested in implementing a program.

## Materials and methods

**Literature Search:** A literature search was performed using PubMed, Embase, Web of Science, and the Education Resources Information Center (ERIC), a searchable online library of education literature. The MeSH terms used were: internship, residency, general surgery, teaching, education, and curriculum. Reference review of included publications was used to identify additional potentially relevant publications.

**Literature Review:** The identified titles and abstracts were reviewed for potential inclusion based on the following criteria: the publications were written in English and described a curriculum designed to improve teaching skills, aimed specifically at surgical residents. Interventions aimed at surgical fellows were also included. Opinion pieces and needs assessments were specifically excluded from review.

For the titles and abstracts that met the inclusion criteria, full text publications were read and appropriateness for final inclusion was determined. For the publications included in final review, the curriculum components and, if applicable, how the curriculum's success was measured were noted. Educational outcomes assessed were assigned a score reflecting the corresponding level in the Kirkpatrick model of evaluation.<sup>11,12</sup> The quality of the studies was scored using the Medical Education Research Study Quality Instrument (MERSQI).<sup>17</sup> Review and scoring of studies was performed independently by the authors and any discrepancies were resolved in a consensus meeting. Of note, details of the qualifications of those who designed or implemented the published RATPs were generally not available and so were not included in review for any of the studies.

## Results

Our initial search yielded 288 hits; upon review of titles and abstracts, we eliminated 256. The remaining 32 articles were read in detail, and four papers met our inclusion criteria. Three additional papers were identified from the reference section of reviewed articles.<sup>7,13–15,18–20</sup> The quality of the studies, target audience, curricular components, and how curricular success was measured are summarized in [Table 1](#). The average MERSQI score for reviewed studies was 9.9 (range 6.5–13.5). One intervention each was aimed exclusively at either interns,<sup>7</sup> senior residents,<sup>14</sup> or fellows.<sup>19</sup> The remainder targeted a mix of interns and residents. All interventions were multisession interventions; all but one<sup>15</sup> were spaced out over time. Delivery of content was either by lecture,<sup>13,14</sup> one-on-one feedback,<sup>14</sup> interactive workshops,<sup>15,19</sup> or electronically-based.<sup>7,18,20</sup> Surveys were used to assess the effectiveness of all interventions. Additionally, review of video-taped teaching sessions<sup>14</sup> and objective structured teaching evaluations (OSTE)<sup>15</sup> were used to evaluate the programs.

Brown et al.<sup>13</sup> described an 8 session seminar for interns and residents, each session lasting 90 min. The sessions were held in lieu of surgical conferences that had established times. The topics covered in each session were theories of learning; the art of good teaching; professional training; a house staff panel on practical perspectives of teaching; instructional materials and media; personality, motivation, and learning; evaluation of learning and performance (grading); and general review. Instruction was provided by instructors from the affiliated graduate school of education. A

test adapted from a course in educational psychology at the graduate school was used as a pre-and post-test for participants (Kirkpatrick 2B). There was no significant difference in performance before or after the sessions. Participants were also surveyed regarding the course (Kirkpatrick 1); they felt that the experience was valuable. The participants found summaries of the lectures more valuable than the textbook. Finally, the highest rated session was that covering evaluation of learning and performance (grading), followed by professional training, and the art of teaching. MERSQI score for this study was 10.

Barth et al.<sup>14</sup> targeted an intervention at senior residents, residents in their 4th and 5th post-graduate years (PGY). The intervention was a single hour-long lecture covering communication theory. This was coupled with self-review of a video-taped lecture each resident gave to group of residents. Each resident then participated in an hour-long, individualized session, in which they met one-on-one with a teaching consultant to review and discuss a video of themselves teaching. Teaching effectiveness was assessed by blinded reviews of teaching effectiveness (scoring content, language, and delivery) in video-taped teaching sessions led by the residents in the intervention group (Kirkpatrick 3). Residents' teaching confidence was also assessed (Kirkpatrick 2A). Teaching effectiveness was significantly improved following the one-on-one targeted teaching intervention, but not the lecture on communication. There was a trend toward increased confidence in residents' own teaching ability, but no statistical difference. The study's MERSQI score was 11.5.

Dunnington et al.<sup>15</sup> developed a RATP to respond to a needs assessment that was performed as the initial step of their work. The program was delivered in three sessions, delivered over two days, lasting 10.5 h total. In the program participants, surgical residents from all PGYs, were asked to outline their personal goals. This was followed by interactive (role-playing, standardized student participation) lessons on adult learning principles, microskills of teaching, teaching at the bedside, feedback skills, teaching psychomotor skills, teaching in the clinic, teaching in the operating room, and senior residents as managers. Following these lessons, participants were asked to develop action plans to achieve their goals based on course information. The program was assessed in several ways. First, with session evaluations (Kirkpatrick 1); second, via evaluation of performance in an objective structured teaching evaluation (OSTE) (Kirkpatrick 3). Finally, the program incorporated institutional changes, including frequent feedback on teaching for the residents, providing them with laminated cards listing teaching skills (Kirkpatrick 4A). The program was generally highly rated, particularly the use of standardized students. Residents who participated in the RATP performed better in several sections of the OSTE than those who had not participated. The MERSQI score for this study was 13.5.

Matzie et al.,<sup>18</sup> following a one-hour lecture on providing feedback, used weekly e-mails to deliver specific statements about feedback to surgical residents in all PGYs. Each e-mail contained one of 15 statements and each statement was sent out repeatedly, but not consecutively. Students' evaluations of the feedback given by residents, specifically usefulness and frequency, was used to assess the program (Kirkpatrick 3, 4A,B). Students rated feedback frequency and quality more highly for those residents who received the e-mails. However, residents who attended the one-hour lecture also were rated to give more frequent and useful feedback, regardless of having received the emails. The MERSQI score for this study was 12.

In a follow up study from the same institution, Pernar et al.<sup>7</sup> used a similar electronic-based approach to deliver statements on providing feedback, learning, teaching skills, and goals specific to the surgery clerkship. E-mails were targeted to interns and sent weekly over the course of the academic year. The program was

**Table 1**  
Summary of included studies.

| Source, y                      | Study Type                   | MERSQI | Participants, n                        | Length of Intervention | Frequency of Intervention              | Intervention   | Assessment   | Kirkpatrick Level | Notes  |
|--------------------------------|------------------------------|--------|--|------------------------|--|--|--|-------------------|--|
| Brown, 1971 <sup>12</sup>      | Non-randomized, uncontrolled | 10     | Interns and residents, 28              | 90 min sessions        | 8 sessions (Over academic year)        | Seminars   | Surveys<br>Reflection pieces   | 1, 2B             | Most valuable session was on Evaluation of Learning and Performance  |
| Barth, 1997 <sup>13</sup>      | Non-randomized, uncontrolled | 11.5   | Senior residents (PGY 4 and 5), 6      | 1 h sessions           | 2 sessions (Over academic year)        | Lecture<br>Individualized feedback based on review of teaching video   | Surveys<br>Video review scoring  | 2A, 3             | No significant change in confidence teaching<br>Significant improvement in video scores after individualized feedback session, not lecture                                       |
| Dunnington, 1998 <sup>14</sup> | Randomized, uncontrolled     | 13.5   | Interns and residents, 30              | 10.5 h (total)         | 3 sessions (Over two consecutive days) | Course incorporating instructional modules, role playing, standardized students  | Surveys<br>Objective Structured Teaching Evaluations (OSTE)            | 1, 3, 4A          | Interactive activities rated most highly<br>Residents randomized to course participation performed significantly better on OSTE than those who did not participate in the course |
| Matzie, 2009 <sup>a,17</sup>   | Randomized, uncontrolled     | 12     | Interns and residents, 55              | —                      | Weekly (Over 9 months)                 | Emails sent containing advice about delivering effective feedback<br>15 emails sent in 2.5 cycles  | Surveys of students regarding receiving feedback frequency and quality | 3, 4A, 4B         | Significant increase in feedback frequency and quality   |
| Pernar, 2013 <sup>7</sup>      | Non-randomized, uncontrolled | 8.5    | Interns, 16                            | —                      | Weekly (Over 12 months)                | Emails sent containing advice about teaching skill, learning principles, delivering feedback, and the goals of the surgery clerkship<br>29 emails sent in 2 cycles | Surveys  | 2A, 3, 4A         | Interns felt more strongly teaching was an important part of their role and valued by their department<br><br>Students rated teaching by interns better after the intervention   |
| Ambani, 2016 <sup>18</sup>     | Non-randomized, uncontrolled | 7.5    | Surgical fellows, 12                   | 90 min sessions        | 8 sessions                             | Workshops; focus on teaching in the operating room   | Surveys<br>Action plan reviews   | 1, 2A, 3          | Improved confidence teaching in the operating room and knowledge of education theory and best practices  |
| Watkins, 2017 <sup>c,19</sup>  | Non-randomized, uncontrolled | 6.5    | Interns and residents, 70 <sup>b</sup> | —                      | Weekly (Over 20 weeks)                 | Emails sent containing teaching tips (10) or manuscripts on education topics (10)  | Surveys  | 1, 2A             | Teaching tips were felt to be more helpful than the manuscripts<br>Subjective increase in teaching frequency by residents; change in teaching style                              |

<sup>a</sup> A one hour lecture on delivering effective feedback was held before the first email was sent.

<sup>b</sup> 30 completed pre-intervention survey, 28 completed post-intervention survey.

<sup>c</sup> Supplement to Resident-as-Teacher curriculum targeted at residents in all specialties training at the authors' home institution.

evaluated by surveys delivered to interns, asking about teaching skill and the institutional teaching culture, and students, asking them to rate the frequency and quality of teaching and feedback received (Kirkpatrick 2A, 3, 4A). Overall the study showed improved perception by the interns of their own teaching skills and the department's support and medical students rated teaching by interns who received the intervention more highly. The study's MERSQI score was 8.5.

Ambani et al.<sup>19</sup> describe a workshop aimed at surgical fellows, specifically to improve teaching in the operating room. Eight sessions, combining lectures and interactive portions, were held over a 9 month period; the session topics were, integrating education into an academic career, feedback, learning theories and assessment, teaching models, direct observation, difficult contexts of teaching in the OR, debriefing, and leading the operative team. The program was assessed regarding feasibility through looking at attendance and surveys regarding the sessions' contents and personal action plan goals and behavior changes (Kirkpatrick 1, 2A, 3). Participation rate was near 60%; the sessions were rated favorably; the fellows reported increased interested in and understanding of educational

theory and teaching practices; finally, following the intervention fellows reported more frequently discussing an operative plan pre-operatively and could more readily identify instances of feedback. The MERSQI score for this study was 7.5.

Watkins et al.<sup>20</sup> also used e-mails to distribute teaching tips to residents at all PGYs. Additionally, residents were sent references to manuscripts relevant to teaching and residents' teaching role; it was up to the residents to download the manuscripts to read them. An email containing either a teaching tip or a manuscript was sent weekly over the course of 20 weeks. Surveys were used to assess residents' perception of the program and how the program had influenced them (Kirkpatrick 1, 2A). The teaching tips were more favorably received than the manuscripts; most residents reported not reading the manuscripts. Residents reported subjective changes in their teaching behavior, including creating teachable moments, being more approachable. However, half of residents reported no changes in their teaching styles. The MERSQI score for this study was 6.5. Of note, this effort was in conjunction with an established RATP that is briefly described by the authors, but not separately published and thus not included in this review.

## Discussion and conclusion

In our literature search we identified only a few RATPs aimed specifically at surgical residents. Three were published before 2000<sup>13–15</sup> and the remainder in and after 2009.<sup>7,18–20</sup> Interestingly, while all the programs published prior to 2000 were lecture or workshop-based, three of the four programs published after 2009 were primarily relying on electronic distribution of content.<sup>7,18,20</sup> The introduction of the 80-h workweek perhaps drove the trend toward electronic delivery. The ready availability of portable electronic devices and a millennial culture that is comfortable with technology<sup>21</sup> facilitates this approach. Comparing the relative efficacy of each program to another is not feasible as each used different assessments. The majority of programs assessed outcomes beyond participant satisfaction or change in knowledge; performance was improved or teaching behavior changed (Kirkpatrick level 3) after individualized feedback,<sup>14</sup> interactive teaching sessions,<sup>15,19</sup> and electronic delivery of content,<sup>7,18</sup> not clearly showing one approach being superior to another. For those who wish to design or implement a RATP, this should be encouraging.

Teaching is indisputably an important skill in academic surgery and often residency presents the first opportunity to develop and hone teaching skills. The benefits of teaching residents to teach are numerous. Not only does it prepare them for their future role as attending surgeons, but it has also been shown that good teaching and role-modeling by surgical residents improves students' performance,<sup>22</sup> their experience on the clerkship,<sup>23</sup> and may prompt students to enter a surgical residency.<sup>23–25</sup>

Identified barriers to teaching by surgical trainees include lack of time, competing interests, and lack of understanding what or how to teach.<sup>4,13,26</sup> RATPs cannot solve the problem that surgical residents have much competing for their time, but they certainly can equip residents with the tools to seize teachable moments and become more effective at providing instruction and feedback. Also, participation in RATPs increases residents' interest<sup>19</sup> and confidence<sup>7,14</sup> in teaching. Interestingly, while the reviewed literature on RATPs aimed at surgical residents reveals that the programs are delivered in a variety of formats, the themes addressed are relatively constant in those programs not focusing on a single skill. These include a foundational background, communication, including feedback and evaluation, and specific teaching skills, including how to teach procedural skills or in the operating room. In designing a RATP, these topics certainly should be included.

How this content is delivered seems not to be very important, as residents generally responded favorably to the RATPs provided. This is a testament to how eager residents are to receive help developing their teaching skills. However, one-on-one interventions seemed more effective than lectures; interactive sessions were rated highly; and concrete tips are utilized while papers written on education were not often read. Presenting theory alone then is perhaps not enough when designing or implementing a RATP; but making the theory personal and specific is useful. Based on our review of the literature, we feel that a combination of interactive lectures, reinforced with electronically delivered content is a useful and feasible format for a RATP aimed at surgical residents. We implemented a RATP at our institution that lays a foundation for all residents through interactive lectures incorporated in to the academic didactic schedule. Residents who have participated in these sessions will be receiving contents delivered electronically to ensure that residents remain engaged with the content and with their learners.

In addition to wanting to learn to teach, residents want to feel that their teaching efforts are recognized and receive institutional support.<sup>26</sup> This can be achieved in multiple ways, including incorporating RATPs longitudinally into the residency curriculum. This

sends the signal that teaching by residents is important and that developing resident teaching skills is taken seriously. A longitudinal, or multi-session, RATP has the added benefit that each session also serves to remind residents of their teaching role. As the feasibility of delivering RATPs electronically has been demonstrated, weaving a RATP in to the academic year can be achieved with little use of additional lecture or academic time. A longitudinal RATP can be combined with rewarding good teaching as an added incentive and recognition.

Residents play an important role in teaching. Predominantly we think of residents teaching medical students; however, residents also teach their co-residents. Preparing residents for their teaching role is really another way to ensure graduating residents are truly well-rounded surgeons. The importance of this is reflected in teaching being identified as a milestone for surgical residents.<sup>9</sup> The importance of preparing residents for their teaching role has come a long way from the 1990s when more than half of queried program directors did not think it was valuable for surgical residents to receive formal training regarding teaching.<sup>1</sup> Our group recently performed an updated query of program directors and found that now nearly 90% of program directors think teaching is an important part of a resident's job and an important part of their career development. Also, while only about 25% of program directors reported offering a RATP, nearly 60% of those who did not indicated interest in establishing one. RATPs aimed at surgical residents of different lengths and formats have been published. As programs aim to build or adopt their own RATP, they can pick that format which is most suitable to the unique circumstances of their own residents and program.

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