

Residents-as-Teachers Publications: What Can Programs Learn From the Literature When Starting a New or Refining an Established Curriculum?

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Abstract

Background Teaching residents how to teach is a critical part of resident education because residents are often the major teachers of medical students. The importance of formal residents-as-teachers (RAT) curricula has been emphasized throughout the literature, yet not all residency programs have such a curriculum in place.

Objective The purpose of our study was to (1) review the medical education literature for established RAT curricula, (2) assess published curricula's reproducibility, (3) evaluate the type of outcomes achieved using the Kirkpatrick model of evaluation, and (4) identify curricula that training programs could feasibly adopt.

Methods We performed a literature review using PubMed, Medline, Scopus, PsycINFO, ERIC, and Embase. Key search words included *residents*, *residents as*

teachers, *teaching*, *internship and residency*, and *curriculum*. In addition, a search of MedEdPORTAL was performed using the same key terms. Articles were evaluated based on the reproducibility of curricula and the assessment tools. Evaluation of educational outcomes was performed using the Kirkpatrick model.

Results Thirty-nine articles were deemed appropriate for review. Interventions and evaluation techniques varied greatly. Only 1 article from the literature was deemed to have both curricula and assessments that would be fully reproducible by other programs.

Conclusions A literature review on RAT curricula found few articles that would be easily reproduced for residency programs that want to start or improve their own RAT curricula. It also demonstrated the difficulty and lack of rigorous outcome measurements for most curricula.

Introduction

Most teaching that medical students receive during their clinical clerkships is performed by residents.¹ Acknowledging the importance of residents as teachers in medical education, the Liaison Committee on Medical Education requires that residents be provided with training and be evaluated to ensure their competency as teachers.² Likewise, the Accreditation Council for Graduate Medical

Education mandates that residency programs provide residents with resources to develop teaching skills to effectively educate patients, families, students, fellow residents, and other health care professionals.³ External requirements notwithstanding, training programs have a vested interest in developing residents into excellent teachers.

The importance of formal residents-as-teachers (RAT) curricula has been noted throughout the literature, yet not all residency programs have such a curriculum in place. In a recent study by Fromme et al,⁴ 87% of pediatrics training program directors reported they have a formal RAT curriculum, but half of programs allocate 10 hours or fewer for it during residency. In addition, only one-quarter of the responding program directors felt their RAT program was very effective.

Using parts of, or full curricula that have already been successfully implemented and published is an efficient way for residency programs to initiate and fine-tune required RAT training. However, few publications on RAT programs are sufficiently detailed to provide enough outcome data to be reproducible. A 2009 literature review by Post et

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al,⁵ looking at interventions and outcome measures, found that one-half of the articles on this topic were descriptive without measurable outcomes or pertained to fellows and faculty, not residents, and thus could not be included in their study. The other 50% of articles involved varying methodologies with most being nonrandomized or uncontrolled.⁵ The lack of measurable outcomes has made it difficult for residency programs to use the literature to initiate or to improve their own RAT programs.

The purposes of our study were to (1) review the extant RAT literature to assess the reproducibility of published RAT curricula, (2) evaluate the type of outcomes achieved in those studies using the Kirkpatrick model of evaluation, and (3) identify curricula that training programs interested in starting or modifying a RAT program could feasibly adopt.

Methods

In 2011, the authors performed a systematic review of the literature using PubMed, Medline, Scopus, PsycINFO, ERIC, and Embase. Key search words included *residents*, *residents as teachers*, *teaching*, *internship and residency*, and *curriculum*. In addition, a search of MedEdPORTAL was performed using the same key terms.

Results from these searches were then reviewed for pertinence to the subject of residents as teachers. The authors identified articles that were deemed pertinent (ie, those that described a RAT curriculum or intervention that was implemented to improve residents' teaching skills).

Selected articles were evaluated based on the reproducibility of the curriculum and the assessment tools and educational outcomes achieved.

Reproducibility was determined by the presence of clearly delineated goals and objectives with descriptions of study design, intervention assessment, lesson plans and materials (videos, PowerPoint slides, handouts, etc), and duration of intervention. To assess our reproducibility scale for interrater reliability, 3 articles that met inclusion criteria were selected at random. All authors then evaluated each article using a 3-point scale (1, not reproducible; 2, partially reproducible; 3, fully reproducible). The authors discussed the articles and an agreement in scoring was achieved through a consensus methodology to ensure that 1 author (K.K.B.) selected and scored articles appropriately.

Educational outcomes were evaluated using the Kirkpatrick model⁶ described in TABLE 1. Interrater reliability was then established for the Kirkpatrick outcomes using the same method described above. One author (K.K.B.) then read all subsequent articles in their entirety and scored each for reproducibility and educational outcomes.

TABLE 1 KIRKPATRICK'S EVALUATION MODEL	
Level	Outcome
1	Reaction
2A	Learning—change in attitudes
2B	Learning—modification of knowledge or skills
3	Behavior—changes in behavior
4A	Results—change in the system or organizational practice
4B	Results—change among the participants' students and peers

Results

TABLE 2 summarizes RAT programs in a multitude of residency programs comprising various specialties. The number of residents in RAT programs ranged from 1 to 443. Duration of the programs ranged from 1 hour to 1 year and included various teaching modalities, including workshops, lectures, feedback sessions, standardized learner training, role playing, and teaching manuals. Some of the programs reported using elective time ranging from 1 month to a year.

The RAT programs used a variety of assessment methodologies, with many combining assessment modalities (eg, self-assessment and learner evaluation of the resident). A frequently used evaluative tool in 36% (14 of 39) of the studies was self-assessment, typically in the form of a preintervention and postintervention questionnaire. Learner evaluation by medical students, peers, or attending physicians was the second most commonly used assessment (28%, 11 of 39). Other assessments included objective structured teaching exercises (OSTEs), objective structured clinical examinations (OSCEs), direct observation, and videotaped evaluation.

FIGURES 1 and 2 summarize the Kirkpatrick scores and reproducibility of the curricula.

Discussion

Reproducible RAT Curricula in the Literature

The primary purpose of our study was to review the RAT literature for published curricula that could relatively easily be modified and/or reproduced by other residency programs. Although there are articles in the literature that delineate the interventions provided, the objectives, and detailed examples of the workshop activities, few of those interventions were randomized, controlled studies. There were articles that provided more rigorous assessment tools (OSTE, direct observation), but they lacked the necessary detail for other programs to use.

TABLE 2 PUBLISHED STUDIES ON RESIDENTS-AS-TEACHERS THAT MET INCLUSION CRITERIA

Source, y	Type of Study	Participants, No.	Specialty	Intervention	Length of Intervention	Assessment	Kirkpatrick Score	Reproducibility Score	Reproducibility
Aliyer et al, ¹⁷ 2008	UC	276	Various	1-d workshop concluding with an OSTE	1 d	SA, DO	1, 2A, 2B, 3	C-1 A-2	C-Curriculum and mini-lectures for the workshop are not described. A-Questions from self-assessment questionnaire included, but no explanation of OSTE provided.
Barth et al, ¹⁸ 1997	UC	6	Surgery	1-h lecture and 1 h of individualized feedback	2 h	SA, VE	2A, 3	C-1 A-2	C-1-h lecture on applied communication theory was used, but no further information about the intervention is provided. A-Communication evaluation scoring sheet used to grade residents is not included; adapted from standardized instrument. ¹⁹
Bing-You, ²⁰ 1990	UC	26	Internal medicine	1-d workshop on teaching skills	8 h	VE, SA	2A, 3	C-1 A-2	C-No description of intervention. A-Videos were scored with a Likert scale for 8 skills (scale not provided, but major skills assessed are listed); self-assessment not provided.
Busari et al, ²¹ 2006	NC	27	Pediatrics and obstetrics and gynecology	2-d workshop	2 d	LE, SA	1, 3	C-1 A-3	C-No explanation of curriculum. A-Workshop questionnaire and Cleveland Clinic's Teaching Effectiveness Instrument provided.
D'Eon, ⁸ 2004	RC	16	Internal medicine and surgical subspecialties	Prereading assignment and 2-d TIPS workshop	2 d	VE	3	C-2 A-3	C-Overview of workshops and mini-lectures provided. A-8-point Likert scale used for scoring videos provided.
Dang et al, ²² 2010	UC	133	Psychiatry	0.5-d teaching-to-teach workshop	0.5 d	SA	1, 2A	C-2 A-1	C-Overall format of workshop explained; role-playing scenarios provided. A-No questionnaire or sample questions provided for evaluation.
Daniels-Brady and Rieder, ²³ 2010	UC	Not available	Psychiatry	Assigned teaching rotation with weekly individualized sessions with program director	2 mo (60% of time dedicated to teaching)	LE, SA	2B, 4A, 4B	C-2 A-3	C-Description of teaching requirements of the teaching resident is provided. A-5-point Likert scale used for learner evaluation and self-assessment included.
Donovan, ²⁴ 2011	UC	78	Radiology	Workshop on teaching skills development	1.5 h	SA	1, 2A	C-2 A-3	C-Objectives of workshops provided, but no further information about intervention discussed. A-Questions for pre-session and post-session questionnaire included.

TABLE 2 PUBLISHED STUDIES ON RESIDENTS-AS-TEACHERS THAT MET INCLUSION CRITERIA (CONTINUED)

Source, y	Type of Study	Participants, No.	Specialty	Intervention	Length of Intervention	Assessment	Kirkpatrick Score	Reproducibility Score	Reproducibility
Dunnington and DaRosa, ²⁵ 1998	RC	62	Surgery	3 sessions provided during 2 d	10.5 h	DO (OSTE), SA	1, 4A, 4B	C-2 A-2	C-Used the curriculum and instructional development framework as described by Posner and Rudnitsky ²⁶ with 7 teaching modules provided. A-Needs assessment questions provided. Skills tested at OSTE stations provided, but no assessment tool for OSTE stations included.
Edwards et al, ²⁷ 1988	RC	22	Obstetrics and gynecology, family medicine, internal medicine	Workshop and feedback provided during PGY-1 and PGY-2	0.5 d	SA, LE, VE	4B	C-2 A-3	C-Basic outline of workshop provided. More thorough explanation of workshop provided elsewhere. ²⁸ A-Standardized, videotaped teaching sessions evaluated using Likert scale for 8 teaching skills; LE and SA were not discussed in this article.
Frattarelli and Kasuya, ²⁹ 2003	UC	17	Obstetrics and gynecology	PBL microskills mini-lectures	4.5 h	LE, SA	1, 2A, 2B, 4B	C-1 A-2	C-Short, inexpensive intervention, but little information on specifics of workshop. A-Self-evaluation provided, but no learner evaluation tool provided.
Furney et al, ³⁰ 2001	RC	57	Internal medicine	Workshop including lecture, role-playing, and debrief	1 h	LE, SA	1, 3	C-2 A-3	C-1-min preceptor model is quick and easy to implement. A-14-item questionnaire provided.
Gaba et al, ³¹ 2007	NC	24	Obstetrics and gynecology	1.5-h introduction; six 1.5-h workshops following 3-function model of teaching (prepare, perform, process)	10.5 h	DO (OSTE), SA	1, 2B, 4B	C-2 A-2	C-The 3-function model of workshops described in depth, but objectives of specific workshops not included. A-Sample rating form for OSTE provided. Clinical educator self-assessment and individual workshop questionnaires not provided.
Grady-Weliky et al, ³² 2010	UC	12	Psychiatry	Two 2-h workshop sessions	4-h workshop	SA	2A, 2B	C-2 A-3	C-Objectives and outline of the day provided. A-Self-assessment questionnaire provided.
Hammoud et al, ³³ 2004	NC	18	Obstetrics and gynecology	Workshop	1-d workshop	LE	1, 2B	C-2 A-2	C-Topics for workshop and feedback model provided. A-Topic areas for questions included, but 24-question survey not provided.

TABLE 2 PUBLISHED STUDIES ON RESIDENTS-AS-TEACHERS THAT MET INCLUSION CRITERIA (CONTINUED)

Source, y	Type of Study	Participants, No.	Specialty	Intervention	Length of Intervention	Assessment	Kirkpatrick Score	Reproducibility Score	Reproducibility
Ilgen et al, ³⁴ 2010	UC	15	Emergency medicine	1-mo teaching rotation	1 mo	DO	3, 4A	C-1 A-3	C-Elctive requiring full-time staff who work one-on-one to create a curriculum and objectives tailored to each resident. List of primary educational source materials included. A-Peer observation checklist included.
Jafri et al, ³⁵ 2007	UC	10	Gastroenterology	Training following the BEST 8 module model	12 h	LE	1, 2B	C-2 A-3	C-The course was based on the Morrison et al ^{16,37} BEST model and includes microskills taught and time spent on each session. A-Questionnaire is included with Likert scale.
James et al, ³⁸ 2006	UC	18	Internal medicine	Workshop	3 h	SA, LE	1, 2B	C-2 A-3	C-Two faculty members taught sessions on 6 specific topics in hopes of improving resident teaching during morning report. Included 1 example of a teaching scenario used in the intervention. Residents received educational materials with advice and recommendations, which was not included. A-Questions from questionnaire included for both SA and LE.
Jewett et al, ³⁹ 1982	RC	55	Pediatrics	1-h orientation, two 3-h workshops, 1-h individual feedback, 1-h group feedback	2.5-d workshops (9 h)	SA, LE	2A, 4B	C-2 A-1	C-Objectives and overview of workshops provided. Outside consultant hired to teach workshops. A-No assessment tools provided.
Johnson et al, ⁴⁰ 1996	UC	42	Pediatrics	Four 1-h workshops during PGY-1 and PGY-2; two 1-h workshops during PGY-3	Ten 1-h workshops	SA, interview	2A, 2B	C-2 A-3	C-Objectives included. Case-based and interactive activities, vignettes with role playing, etc, were not provided. A-Survey and interview questions included in Appendix.
Katzelnick et al, ⁴¹ 1991	UC	32	Psychiatry	1-day workshop that included lecture, small-group work, feedback, and practicing teaching skills	1-d workshop	SA, interview cognitive knowledge test, interview	1, 2A, 2B	C-3 A-1	C-Detailed explanation of workshop, lectures, and activities. A-Assessment tools were not provided; available upon request.

TABLE 2 PUBLISHED STUDIES ON RESIDENTS-AS-TEACHERS THAT MET INCLUSION CRITERIA (CONTINUED)

Source, y	Type of Study	Participants, No.	Specialty	Intervention	Length of Intervention	Assessment	Kirkpatrick Score	Reproducibility Score	Reproducibility
Lawson and Harvill, ⁴² 1980	UC	20	Family medicine/ internal medicine	7-h lecture and group discussion, 4-h practice and feedback, 2-h videotaping and evaluating posttest teaching	13 h (1 h/wk)	VE, SA	1, 2B, 3	C-2 A-2	C-Overall design of the program and overview of content and methods are described; however, specific materials used are not. A-Instructional skills evaluation instrument used to evaluate videotapes and workshop questionnaire explained but are not provided.
Lehmann, ⁴³ 2010	UC	13	Psychiatry	Five 1-h lunch seminars	5 h	SA	1, 2A	C-2 A-3	C-Objectives for each session clearly delineated, but materials and information about activities and materials used not included. A-Questions used in the assessment tool are provided along with the Likert scale.
Litzelman et al, ⁴⁴ 1994	UC	72	Internal medicine	Friday-Sunday workshop	Weekend retreat (3 d)	LE, SA	2B, 3	C-2 A-1	C-General overview of retreat provided, based on the Stanford Faculty Development Program Clinical Teaching Component. A-The LE not provided. The SA not provided, but assessment tool used was based on Skeff et al. ⁴⁵
Martins et al, ⁴⁶ 2010	UC	3	Psychiatry	Individualized elective in PGY-4	6 mo-1 y	LE, DO	2A	C-2 A-1	C-The 3 phases of the elective are clearly explained. A-No assessment tools provided.
Mass et al, ⁴⁷ 2001	RC	24	Obstetrics and gynecology	Feedback provided following teaching	12 mo	LE, SA	1, 2A, 3	C-3 A-2	C-Intervention consists of providing feedback (none versus written versus oral). Resident evaluation form included. No curriculum or workshops used. A-Resident evaluation form provided, but resident surveys to assess importance of teaching and adequacy of feedback is not.
Morrison et al, ⁷ 2004	RC	62 (56 in final analysis)	Internal medicine	3-h miniretreat and ten 1-h lunch conferences	13 h	DO (OSTE)	1, 2A, 2B, 3	C-3 A-3	C-Curriculum is clearly delineated with all resources available online. A-Assessment tools are provided and clearly explained.

TABLE 2 PUBLISHED STUDIES ON RESIDENTS-AS-TEACHERS THAT MET INCLUSION CRITERIA (CONTINUED)

Source, y	Type of Study	Participants, No.	Specialty	Intervention	Length of Intervention	Assessment	Kirkpatrick Score	Reproducibility Score	Reproducibility
Moser et al, ⁴⁸ 2008	UC	16	Various (obstetrics and gynecology, internal medicine, and pediatrics)	Chief residents were trained to subsequently train residents as teachers	8-h resident training; seven 1-h resident-teaching sessions	LE	3	C-2 A-2	C-Overview of train-the-trainers program provided with main components, but no discussion of supporting syllabus provided to residents that contained learning activities, clinical cases, and PowerPoint slides. A-25-item survey based on Stanford Faculty Development Program used, but survey not provided.
Ostapchuk et al, ⁴⁹ 2010	RC	218	Various	6 mini-lectures followed by small-group discussion and practice with standardized learners	1-d workshop	LE, SA, facilitator questionnaire, focus groups	1, 2A, 2B, 3, 4A	C-1 A-2	C-Used modified BEST curriculum ^{23,50} to teach 6 mini-lectures, which were followed by small-group discussion and practice with standardized learners. A-The 11 areas assessed by learner questionnaire included: 4 general topics discussed in focus groups included. Facilitator questionnaires not included.
Pandachuck et al, ⁵¹ 2004	NC	22	Various	2-d workshop	15 h	LE	1, 3	C-2 A-3	C-Timetable and agenda provided as well as a summary of 2-d teaching workshop activities modeled on TIPS workshops. ⁵² A-Questions from student survey provided.
Parrott et al, ⁵³ 2006	RC	12	Family medicine	6 residents (intervention group) received the 90-min workshop on microskills and peer coaching; 6 residents did not (control group)	90 min plus 2 wk peer coaching	DO	3	C-2 A-2	C-The 90-min workshop was designed using modules 3 and 5 of Preceptor Education Project. ⁵⁴ Workshop objectives, microskills taught, and peer coaching not described. A-Observers indicated whether 5 microskills ⁵⁵ were observed or not.

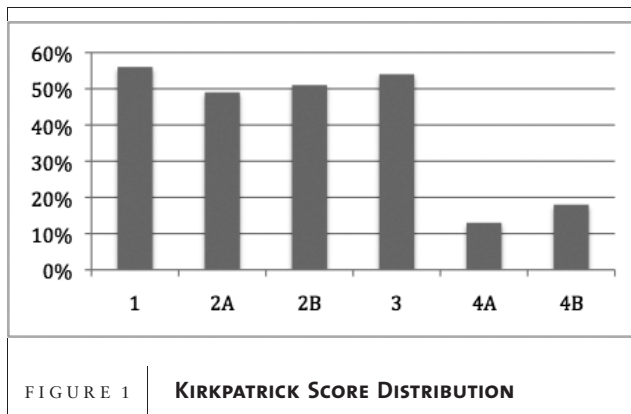
TABLE 2 PUBLISHED STUDIES ON RESIDENTS-AS-TEACHERS THAT MET INCLUSION CRITERIA (CONTINUED)

Source, y	Type of Study	Participants, No.	Specialty	Intervention	Length of Intervention	Assessment	Kirkpatrick Score	Reproducibility Score	Reproducibility
Roberts et al, ⁵⁶ 1994	UC	Not available	Pediatrics	Retreat (Two 4-h sessions) to enable residents to provide clinical precepting skills and to prepare and deliver a brief presentation; 1-h refresher course 6 mo postintervention	9 h	SA, LE	1, 2A, 2B, 3	C-3 A-2	C-Agenda for workshop and explanation of each session with written explanation of each exercise. A-Some assessment questions included.
Rubak et al, ⁵⁷ 2008	NC	243	Internal medicine, orthopedic surgery	The TTC course was mandatory for all physicians in the intervention group	3-d workshop	SA	2B, 3, 4B	C-1 A-1	C-Main topics discussed during 3-d workshop provided but no additional details about format, activities, or implementation of workshop. A-Essay questions provided but no scoring key. General topics for SA questionnaire included, but questions were not provided. (Note-not only for residents. The TTC workshop was for attendings and residents.)
Spickard et al, ⁵⁸ 1996	NC	44	Internal medicine	Teaching skills workshop that included videotaped reenactments, teaching how to give feedback, and written action plans	3 h	SA, LE	2A, 2B, 3	C-2 A-2	C-The workshop was previously described ⁵⁹ but not discussed in detail in this article. Four-model approach of clinical teaching briefly explained. A-Questions for the student questionnaire are provided, but only some of the questions for the resident self-assessment are included.
Swainson et al, ⁶⁰ 2010	UC	22	Psychiatry	Teaching manual that was given to residents	N/A	SA	1, 2A	C-2 A-2	C-General overview of manual's contents provided. A-Quantitative questions provided along with Likert scale; however, qualitative questions not included.
Weissman et al, ⁶¹ 2006	UC	1	Internal medicine	Workshop review, adult learning theory readings, and biweekly meetings with a supervisor	Elective	LE	2A, 3	C-1 A-1	C-Curriculum for the elective is not explained; only the rationale for creating the program is discussed. A-The article indicates that there was formal evaluation by students and mentors, but questions or types of assessments used are not included.

PUBLISHED STUDIES ON RESIDENTS-AS-TEACHERS THAT MET INCLUSION CRITERIA (CONTINUED)

Source, y	Type of Study	Participants, No.	Specialty	Intervention	Length of Intervention	Assessment	Kirkpatrick Score	Reproducibility Score	Reproducibility
White et al, ⁶² 1997	UC	21	Pediatrics	0.5-d workshop focused on 6 key teaching skills.	3.5 h	DO, SA	1, 2B, 3	C-3 A-1	C-Curriculum is well delineated clearly explaining each of the 6 teaching skills to be taught. A-Faculty evaluation checklist and self-assessment are not provided.
Wipf et al, ⁶³ 1999	UC	446	Internal medicine	Three 2-h sessions covering leadership skills, work rounds, feedback, etc	6 h	LE	2B, 3	C-1 A-1	C-Article is focused on evaluation of effectiveness of course; the course curriculum is not discussed. A-Raters used clinical teaching effectiveness form, but questions and data for given skills are not provided.
Zabar et al, ⁶⁴ 2004	UC	65	Internal medicine	10-station OSCE followed with individualized feedback	3 h	DO (OSCE), LE, SA	1, 2B, 4A	C-1 A-3	C-The article focused on the assessment tool used to evaluate success of their new curriculum; new curriculum not discussed. A-Evaluation tools and scenarios for the OSCE provided.

Abbreviations: UC, uncontrolled study; SA, self-assessment; DO, direct observation; C, curriculum; A, assessment; OSTE, observed structured teaching exercise; VE, videotaped evaluation; NC, nonrandomized controlled study; LE, learner evaluation; RC, randomized controlled study; TIPS, Teaching Improvement Project System; PBL, practice-based learning; OSCE, observed structured clinical examination; TTC, "Training for Trainers" course; N/A, not applicable.

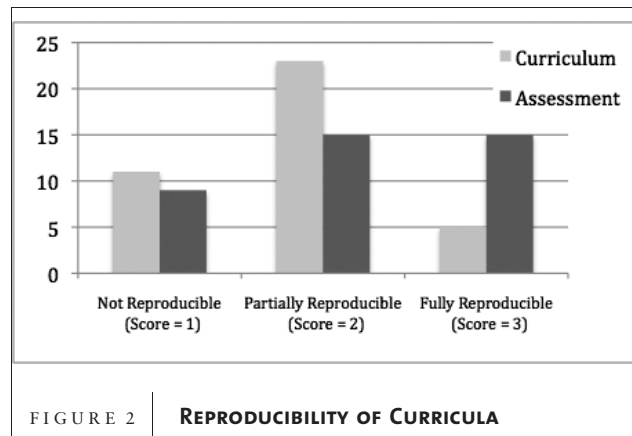


A reproducible curriculum includes a clear set of goals and objectives with descriptions of lesson plans and materials used (videos, PowerPoint slides, handouts, etc), as described above. For example, Morrison et al⁷ clearly delineated the curriculum and provided a website where readers could find additional resources. However, other articles deemed less reproducible simply listed discussion topics without providing clear objectives or describing how readers could incorporate the curricula in their own programs. Although helpful in aiding other programs to develop important topics to include in future workshops, a list of skills was not considered sufficient to replicate the program at different institutions.

Likewise, we considered a reproducible assessment to be one that described in detail the tools used to assess residents and provided examples. If a preassessment and postassessment evaluation were administered to residents, an example of the assessments needed to be included in the article. As an example of a reproducible assessment, D'Eon⁸ evaluated videotapes of residents' teaching following a 2-day workshop using an 8-point Likert scale. The scoring scale was provided in the article, allowing other programs to easily reproduce that assessment.

Most curricula and assessment/evaluations reviewed were "partially reproducible." For example, an overview of the intervention was provided, indicating when mini-lectures or small group discussions were performed, but no objectives or curricular resources were provided. Similarly, some articles stated that a questionnaire was used for assessment with a list of topics being evaluated, but the questionnaire was not published. Most articles used some form of survey, questionnaire, or written learner assessment. Including those assessment tools would help other programs hoping to establish or improve RAT programs to reproduce those curricula or curricular elements in their own institutions.

Although there may be limitations by some journals regarding publishing curricula and assessments in their



entirety, other journals have accepted those items as appendices. Many authors have indicated their willingness to be contacted for readers to obtain materials; however, having them easily and readily accessible for any program to use would be more beneficial.

Educational Outcomes

Of the articles reviewed, just over 25% (10 of 39) had educational outcomes that met Kirkpatrick's fourth level of evaluation, indicating that most of the studies focused on resident reactions, attitudes and knowledge, and/or behaviors, but not more than that. As Miller⁹ pointed out in his classic commentary, performance at the simulation level ("shows how") does not always accurately predict what trainees do in an actual clinical setting. Chen et al¹⁰ commented that educational studies need to consider all the stakeholders in the outcomes (eg, those who benefit from residents' improved teaching, including other trainees, faculty, and patients). We have highlighted those programs that sought these higher-level outcomes as models to emulate in a start-up or advanced RAT curriculum.

RAT Programs

TABLE 2 provides an overview of the articles reviewed and important information for programs hoping to create or improve their own RAT program. Although we recognize that a single article may not satisfy every program's potential needs for resources, duration of intervention, number of residents, and other attributes, TABLE 2 is intended as a resource to quickly locate articles that may provide helpful resources for enhancing current RAT programs or starting a program de novo. Specific articles may not contain all curriculum and assessment tools in their entirety, but some authors do provide contact information so that specific materials may be requested. Encouraging all authors to upload their resources to MedEdPORTAL or establishing a clearinghouse website as a resource for residency programs would allow program

directors easy access to those materials without having to contact several different authors.

TABLE 2 provides a concise review of published articles in the literature; however, searching the published literature is not the only modality for locating materials and ideas that would be helpful in curriculum development. MedEdPORTAL also serves as a valuable resource for RAT resources. Simpson et al¹¹ published their interactive teaching method “From Madness to Methods,” an engaging exercise for teaching educators new instructional methods. The short exercise can easily be adapted to fit into any current or new RAT program. Online modules,^{12,13} PowerPoints,¹⁴ and videos¹⁵ have all been published on the MedEdPORTAL site and allow programs to incorporate multimedia into their RAT curriculum. Finally, MedEdPORTAL provides some descriptive manuscripts and facilitator’s guides, complete with sample schedules and assessment tools, such as that provided by Fromme.¹⁶

Future Directions

With the current duty hour limitations, educators should be seeking to develop RAT programs with abbreviated class schedules (ie, a more blended learning approach). Having residents prepare for a workshop allows faculty to focus on application versus theory and, most important, allows residents to practice skills learned.

Conclusion

Our review of the medical education literature on RAT curricula, including peer-reviewed resources in MedEdPORTAL, identified a number of RAT curricula, yet only 1 published resource provided a reproducible approach to curriculum and assessment. This suggests a need for further research/scholarship that allows for improved reproducibility of the curriculum, as well as efforts to develop approaches for curricular evaluation at the educational outcomes level, which may require a multicenter, collaborative approach.

References

- Bing-You RG, Sproul MS. Medical students’ perceptions of themselves and residents as teachers. *Med Teach*. 1992;14(2–3):133–138.
- Liaison Committee on Medical Education. *Functions and Structure of a Medical School: Accreditation and the Liaison Committee on Medical Education, Standards for Accreditation of Medical Education Programs Leading to the M.D. Degree*. Washington, DC, and Chicago: Association of American Medical Colleges and American Medical Association; 2000.
- Accreditation Council for Graduate Medical Education. ACGME program requirements for graduate medical education in pediatrics. http://www.acgme.org/acgmeweb/Portals/o/PFAssets/2013-PR-FAQ-PIF/320_pediatrics_07012013.pdf. Accessed March 26, 2014.
- Fromme HB, Whicker SA, Paik S, Konopasek L, Koestler JL, Wood B, et al. Pediatric resident-as-teacher curricula: a national survey of existing programs and future needs. *J Grad Med Educ*. 2011;3(2):168–175.
- Post RE, Quattlebaum G, Benich JJ. Residents-as-teachers curricula: a critical review. *Acad Med*. 2009;84(3):374–380.
- Hill AG, Yu TC, Barrow M, Hattie J. A systematic review of resident-as-teacher programmes. *Med Educ*. 2009;43(12):1129–1140.
- Morrison EH, Rucker L, Boker JR, Gabbert CC, Hubbell FA, Hitchcock MA, et al. The effect of a 13-hour curriculum to improve residents’ teaching skills: a randomized trial. *Ann Intern Med*. 2004;141(4):257–263.
- D’Eon MF. Evaluation of a teaching workshop for residents at the University of Saskatchewan: a pilot study. *Acad Med*. 2004;79(8):791–797.
- Miller GE. The assessment of clinical skills/competence/performance. *Acad Med*. 1990;65(suppl 9):63–67.
- Chen FM, Bauchner H, Burstin H. A call for outcomes research in medical education. *Acad Med*. 2004;79(10):955–960.
- Simpson D, Fenzel J, Rehm J, Marcante K. Enriching educators’ repertoire of appropriate instructional methods. Washington, DC: Association of American Medical Colleges; 2010. MedEdPORTAL publication 7968, version 1.
- Cottrell S. Addressing practice-based learning: an examination of an online course to assess residents’ training in education. Washington, DC: Association of American Medical Colleges; 2006. MedEdPORTAL publication 230, version 1.
- Hosokawa M. Teaching and learning education for new teachers (TALENT). Washington, DC: Association of American Medical Colleges; 2006. MedEdPORTAL publication 198, version 1.
- Yudkowsky R, Riddle J, Gelula M, Cannon B. Teaching skills program for residents, part I. Washington, DC: Association of American Medical Colleges; 2008. MedEdPORTAL publication 224, version 1.
- Fulton T, Burke C, Hyland K, Kruidering-Hall M, Masters S. Workshop in a box: visual demonstration of small group facilitation techniques for faculty development. Washington, DC: Association of American Medical Colleges; 2010. MedEdPORTAL publication 5103, version 1.
- Fromme B. Pediatric senior resident teaching elective. Washington, DC: Association of American Medical Colleges; 2007. MedEdPORTAL publication 766, version 1.
- Aiyer M, Woods G, Lombard G, Meyer L, Vanka A. Changes in residents’ perceptions of teaching following a one day “Residents as Teachers” (RaST) workshop. *South Med J*. 2008;101(5):495–502.
- Barth RJ Jr, Rowland-Morin PA, Mott LA, Burchard KW. Communication effectiveness training improves surgical resident teaching ability. *J Am Coll Surg*. 1997;185(6):516–519.
- Rowland-Morin PA, Burchard KW, Garb JL, Coe NP. Influence of effective communication by surgery students on their oral examination scores. *Acad Med*. 1991;66(3):169–171.
- Bing-You RG. Differences in teaching skills and attitudes among residents after their formal instruction in teaching skills. *Acad Med*. 1990;65(7):483–484.
- Busari JO, Scherpier AJ, van der Vleuten CP, Essed GG. A two-day teacher-training programme for medical residents: investigating the impact on teaching ability. *Adv Health Sci Educ Theory Pract*. 2006;11(2):133–144.
- Dang K, Waddell AE, Lofchy J. Teaching to teach in Toronto. *Acad Psychiatry*. 2010;34(4):277–281.
- Daniels-Brady C, Rieder R. An assigned teaching resident rotation. *Acad Psychiatry*. 2010;34(4):263–268.
- Donovan A. Radiology resident teaching skills improvement: impact of a resident teacher training program. *Acad Radiol*. 2011;18(4):518–524.
- Dunnington GL, DaRosa D. A prospective randomized trial of a residents-as-teachers training program. *Acad Med*. 1998;73(6):696–700.
- Posner GJ, Rudnitsky AN. *Course Design: A Guide to Curriculum Development for Teachers*. 3rd ed. New York, NY: Longman Group, UK; 1986.
- Edwards JC, Kissling GE, Brannan JR, Plauché WC, Marier RL. Study of teaching residents how to teach. *J Med Educ*. 1988;63(8):603–610.
- Edwards JC, Marier RL, eds. *Clinical Teaching for Medical Residents: Roles, Techniques and Programs*. New York, NY: Springer Publishing Company; 1988.
- Frattarelli LC, Kasuya R. Implementation and evaluation of a training program to improve resident teaching skills. *Am J Obstet Gynecol*. 2003;189(3):670–673.
- Furney SL, Orsini AN, Orsetti KE, Stern DT, Gruppen LD, Irby DM. Teaching the one-minute preceptor: a randomized controlled trial. *J Gen Intern Med*. 2001;16(9):620–624.
- Gaba ND, Blatt B, Macri CJ, Greenberg L. Improving teaching skills in obstetrics and gynecology residents: evaluation of a residents-as-teachers program. *Am J Obstet Gynecol*. 2007;196(1):87.e1–87.e7. doi:10.1016/j.ajog.2006.08.037.
- Grady-Weliky TA, Chaudron LH, Digiovanni SK. Psychiatric residents’ self-assessment of teaching knowledge and skills following a brief “psychiatric residents-as-teachers” course: a pilot study. *Acad Psychiatry*. 2010;34(6):442–444.
- Hammoud MM, Haefner HK, Schigelone A, Gruppen LD. Teaching residents how to teach improves quality of clerkship. *Am J Obstet Gynecol*. 2004;191(5):1741–1745.

- 34 Ilgen JS, Takayesu JK, Bhatia K, Marsh RH, Shah S, Wilcox SR, et al. Back to the bedside: the 8-year evaluation of a resident-as-teacher rotation. *J Emerg Med.* 2010;41(2):190–195.
- 35 Jafri W, Mumtaz K, Burdick WP, Morahan PS, Freeman R, Zehra T. Improving the teaching skills of residents as tutors/facilitators and addressing the shortage of faculty facilitators for PBL module. *BMC Med Educ.* 2007;7:34. doi:10.1186/1472-6920-7-34.
- 36 Morrison EH, Rucker L, Boker JR, Hollingshead J, Hitchcock MA, Prislis MD, et al. A pilot randomized, controlled trial of a longitudinal residents-as-teachers curriculum. *Acad Med.* 2003;78(7):722–729.
- 37 Morrison EH, Hollingshead J, Hubbell FA, Hitchcock MA, Rucker L, Prislis MD. Reach out and teach someone: generalist residents' needs for teaching skills development. *Fam Med.* 2002;34(6):445–450.
- 38 James MT, Mintz MJ, McLaughlin K. Evaluation of a multifaceted "RAT" educational intervention to improve morning report. *BMC Med Educ.* 2006;6:20. doi:10.1186/1472-6920-6-20.
- 39 Jewett LS, Greenberg LW, Goldberg RM. Teaching residents how to teach: a one-year study. *J Med Educ.* 1982;57(5):361–366.
- 40 Johnson CE, Bachur R, Priebe C, Barnes-Ruth A, Lovejoy FH Jr, Hafner JP. Developing residents as teachers: process and content. *Pediatrics.* 1996;97(6, pt 1):907–916.
- 41 Katzelnick DJ, Gonzales JJ, Conley MC, Shuster JL, Borus JF. Teaching psychiatric residents to teach. *Acad Psychiatry.* 1991;15(3):153–159.
- 42 Lawson BK, Harvill LM. The evaluation of a training program for improving residents' teaching skills. *J Med Educ.* 1980;55(12):1000–1005.
- 43 Lehmann SW. A longitudinal "teaching-to-teach" curriculum for psychiatry residents. *Acad Psychiatry.* 2010;34(4):282–286.
- 44 Litzelman DK, Stratos GA, Skeff KM. The effect of a clinical teaching retreat on residents' teaching skills. *Acad Med.* 1994;69(5):433–434.
- 45 Skeff KM, Stratos GA, Bergen MR. Evaluation of a medical faculty development program: a comparison of traditional pre/post and retrospective pre/post self-assessment ratings. *Eval Health Prof.* 1992;15(3):350–366. doi:10.1177/016327879201500307.
- 46 Martins AR, Arbuckle R, Rojas AA, Cabaniss DL. Growing teachers: using electives to teach senior residents how to teach. *Acad Psychiatry.* 2010;34(4):291–293.
- 47 Mass S, Shah SS, Daly SX, Sultana CJ. Effect of feedback on obstetrics and gynecology residents' teaching performance and attitudes. *J Reprod Med.* 2001;46(7):699–704.
- 48 Moser EM, Kothari N, Stagnaro-Green A. Chief residents as educators: an effective method of resident development. *Teach Learn Med.* 2008;20(4):323–328.
- 49 Ostapchuk M, Patel PD, Miller KH, Ziegler CH, Greenberg RB, Haynes G. Improving residents' teaching skills: a program evaluation of residents as teachers course. *Med Teach.* 2010;32(2):e49–e56. doi:10.3109/01421590903199726.
- 50 Morrison EH, Hitchcock MA, Harthill M, Boker JR, Masunaga H. The online clinical teaching perception inventory: a "snapshot" of medical teachers. *Fam Med.* 2005;37(1):48–53.
- 51 Pandachuck K, Harley D, Cook D. Effectiveness of a brief workshop designed to improve teaching performance at University of Alberta. *Acad Med.* 2004;79(8):798–804.
- 52 TIPS modules: documents prepared for the Teaching Improvement Project System Workshops. Lexington, KY: College of Allied Health Professions, University of Kentucky. Updated 1990.
- 53 Parrott S, Dobbie A, Chumley H. Peer coaching shows promise for residents as teachers. *Fam Med.* 2006;38(4):234–235.
- 54 Sheets K, Garrett E; PEP2 Committee Preceptor Education Project., PEP2: A Guide for Teaching in Your Practice, Workbook And Facilitator's Guide. 2nd ed. Leawood, KS: Society of Teachers of Family Medicine; 1999.
- 55 Neher JO, Gordon KC, Meyer B, Stevens N. A five-step "microskills" model of clinical teaching. *J Am Board Fam Pract.* 1992;5(4):419–424.
- 56 Roberts KB, DeWitt TG, Goldberg RL, Scheiner AP. A program to develop residents as teachers. *Arch Pediatr Adolesc Med.* 1994;148(4):405–410.
- 57 Rubak S, Mortensen L, Ringsted C, Malling B. A controlled study of the short- and long-term effects of a Train the Trainers course. *Med Educ.* 2008;42(7):693–702.
- 58 Spickard A III, Corbett EC Jr, Schorling JB. Improving residents' teaching skills and attitudes toward teaching. *J Gen Intern Med.* 1996;11(8):475–480.
- 59 Spickard A III, Wenger M, Corbett EC Jr. Three essential features of a workshop to improve resident teaching skills. *Teach Learn Med.* 1996;8(3):170–173. doi:10.1080/10401339609539790.
- 60 Swainson J, Marsh M, Tibbo PG. Psychiatric residents as teachers: development and evaluation of a teaching manual. *Acad Psychiatry.* 2010;34(4):305–309.
- 61 Weissman MA, Bensinger L, Koestler JL. Resident as teacher: educating the educators. *Mt Sinai J Med.* 2006;73(8):1165–1169.
- 62 White CB, Bassali RW, Heery LB. Teaching residents to teach: an instructional program for training pediatric residents to precept third-year medical students. *Arch Pediatr Adolesc Med.* 1997;151(7):730–735.
- 63 Wipf JE, Orlander JD, Anderson JJ. The effect of a teaching skills course on interns' and students' evaluations of their resident-teachers. *Acad Med.* 1999;74(8):938–942.
- 64 Zabar S, Hanley K, Stevens DL, Kalet A, Schwartz MD, Pearlman E, et al. Measuring the competence of residents as teachers. *J Gen Intern Med.* 2004;19(5, pt 2):530–533.