

Residents as Researchers: Expectations, Requirements, and Productivity

INTRODUCTION

The academic triad within which we train medical students, medical residents, and fellows involves clinical service, medical education, and research. Within the field of internal medicine, the tradition of research by subspecialty fellows is well-established and widely accepted. But what is the role of research in the educational training of resident physicians? As Henry Schultz states, “although the rationale for resident research may at first seem inconsistent with clinical training . . . the theoretical basis for this requirement is both rational and compelling . . . Resident research might be an indication that a program’s service-education dichotomy is appropriately balanced” (1). Chalmers summarized his perspective as follows: “The practice of medicine is in effect the conduct of clinical research. . . . Every practicing physician conducts clinical trials daily as he is seeing patients. The research discipline known as the “clinical trial” is the formulization of this daily process” (2). Active participation in clinical or laboratory research investigation directly exposes residents to the scientific method, stimulates intellectual curiosity, enhances critical appraisal skills, and generates new knowledge for the medical frontier.

EXPECTATIONS FOR RESEARCH

How important is the acquisition of research skills and the conduct of research investigation during residency training? The Accreditation Council of Graduate Medical Education (ACGME)—the governing body responsible for establishing special requirements of graduate medical training programs—emphasizes the involvement of residents in “scholarly activities” during their training, yet its specific mandate for research is largely broad and unstructured and with a minimum of standards (3). Institutional requirements for accredited residency programs state that, “the curriculum must (also) provide an appropriate introduction to communication skills and to research design, statistics, and critical review of the literature necessary for acquiring skills for lifelong learning. There must be appropriate resident participation in departmental scholarly activity, as set forth in the applicable Program Requirements” (3).

For internal medicine, training programs must comprise, “a schedule of prescribed learning experiences accomplished through teaching rounds, conferences, lectures, and discussions that ensure the residents’ mastery of the knowledge, skills, and attitudes needed to practice general medicine or to progress in subspecialty research or a teaching career in internal medicine. . . provide an environment of inquiry and scholarship in which residents participate in the development of new knowledge, learn to evaluate and apply research findings, and develop habits of inquiry as a continuing professional responsibility” (3).

Before the completion of training, each resident must, “demonstrate acceptable scholarly activity such as original research, comprehensive case reports, or review of assigned clinical and research topics and should have basic science literacy and understand the fundamental principles of clinical study design and evaluation of research findings” (3).

Thus, while the expectation for a research initiative exists for medical residents, specific and structured research requirements are left to the individual residency training program, taking into account the variable human and institutional resources across such programs.

The educational outcomes for resident research as perceived by program directors (4), in decreasing order of importance, include becoming a more critical consumer of research, learning research skills, completing a research project, having publications and giving presentations, and contributing new knowledge. Furthermore, residents also acknowledge that research is a worthwhile ingredient of quality medical education, even though program directors and resident alumni are even more likely than current residents or residency candidates to perceive research as valuable to long-term career goals (5). For interns or second-year residents striving to compete successfully for fellowship training positions (especially those in non-university-based programs), or those pursuing careers in academic medicine, substantial research credentials and peer-reviewed journal publications are increasingly perceived as necessities to be acquired during residency.

In a survey of 112 recent alumni and current residents at the University of Michigan, most alumni felt that their required senior resident research project was a valuable

learning experience, particularly in improving their abilities to review the medical literature critically (5). Twenty percent of residents chose basic science research projects, 74% chose clinical investigations, 4% selected history of medicine projects, and 2% conducted surveys as their scholarly endeavors. In citing reasons for their choice of research experience, 69% stated that their research advisor was the most influential variable. Almost 33% believed that their research experience had influenced their choice of academic versus private practice careers; only about 10% of residents reported that research imparted minimal value to their postgraduate training. In fact, the overall learning of the research project was rated higher than any other single component of the residency training program. Sixty-five percent of current residents supported making the required senior resident research project optional, while 64% of resident alumni opposed such a change ($P < 0.001$). Similar evaluations of residency requirements for scholarly activity by housestaff have been reported by Smith and colleagues (6).

BARRIERS TO RESEARCH

The American Board of Internal Medicine (ABIM) has defined postgraduate residency training in internal medicine as a period of expected mastery of a number of “core competencies”, a time when physicians-in-training must acquire career-long professional building blocks. These competencies include patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice. The amount of time demanded for acquisition of these skills leaves little room for the pursuit of scholarly activities, particularly research, in a resident’s day-to-day schedule. Lack of dedicated time is cited by both residents and program directors as the single most important barrier to research endeavors, especially at university-based programs (4,7). The converse, however, is that education in research for residents does not compete with the core competencies in medicine, but rather helps physicians-in-training better attain most, if not all, of them.

Interestingly, in a survey of accredited training programs, Alguire and colleagues found that research productivity (defined by numbers of oral and poster presentations at local, state, and national professional meetings) was greater among non-university-based programs than among those that were university-based (4). This finding is likely related to heavier patient workloads for residents at university and county teaching hospitals compared with counterparts based at community hospitals. Many medical school-affiliated county and inner-city hospitals rely heavily on residents for high-quality, low-cost labor; insufficient time for research because of residents’ clinical

Table 1. Barriers to Resident Research According to Program Directors of 271 Internal Medicine Training Programs, in Decreasing Order of Citation:^{*}

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- Lack of resident time
 - Lack of resident interest
 - Lack of money
 - Lack of teaching program or materials
 - Lack of faculty time[†]
 - Lack of computers or software
 - Lack of faculty role models and mentors[†]
 - Lack of faculty interest[†]
 - Lack of a research director
 - Lack of research consultants
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^{*} From Alguire PC, et al (4).

[†] Especially at non-university-based programs.

service commitments and nonclinical “scut” work seems to outweigh the faculty, technical, and personnel support and resources that are generally more available in university settings.

In a survey of program directors from 271 internal medicine training programs, Alguire and coworkers determined other obstacles to resident research (Table 1). Over-committed faculty with inadequate protected time for research guidance and supervision and related lack of “academic preparedness” also limits residents’ participation or productivity in research (1). Finally, a perception exists among some faculty members that mandatory research requirements might be detrimental to the recruitment of the residents and could discourage potential applicants interested in primary care (1); at our community-based medical school, however, we have found that an expanded research agenda actually attracts higher-quality applicants.

EMPOWERING RESEARCH

How can research and other types of scholarly activity for residents be enhanced? The programmatic components for empowering research include research leadership as well as academic and technical support. Major aspects of technical support include personal computers, statistical software, research design consultants, visual and graphic design consultants, and data collection support (research technicians, research nurses, and students). A comprehensive research curriculum includes a research committee and structured research requirements, available and committed faculty mentors, clinical research rotations and laboratory research modules, courses in research methods and biostatistics, journal clubs, technical support and resources, and available staff support. Instruction in and pursuit of evidence-based medicine helps residents continually explore the most recent advances in clinical and laboratory medicine, a process that benefits them both as clinicians and researchers.

Table 2. A Model for Resident Research Requirements

Requirement	Significant participation* in a clinical or basic science research project, either as principal investigator or co-investigator with appropriate dissemination of the results through submission of a research abstract (to a regional/national/international scientific meeting) or a manuscript for peer-review publication with appropriate write-up deemed suitable by the departmental Resident Research Committee.
Structure	<p><u>R1 year:</u> Begin gathering ideas for research project and methodology; consider potential mentors; consider scheduling research rotation during the R2 year or early R3 year.</p> <p><u>R2 year:</u> Narrow down the idea list; contact potential faculty mentor to discuss project and arrange supervision; develop the proposal with mentor and submit to the Research Committee; compile data.</p> <p><u>R3 year:</u> Complete data gathering and analysis; write up findings in consultation with mentor; submit research abstract to scientific meeting; submit report to Research Committee which reviews the report and notifies resident of successful satisfaction of research requirement; submit full manuscript for peer-journal review.</p>
Procedure	Residents elect a 1-month research rotation during their R2 and R3 years for the completion of their respective projects

* Significant participation defined as conception and design, collection, assembly, analysis and/or interpretation of project data, and drafting of the manuscript.

Significance of a Structured Research Requirement

The establishment of a Resident Research Committee that formally outlines research goals, expectations, and timetables for residents can play a major role in enhancing scholarly productivity, especially if a dedicated director can commit at least a 10% to 20% effort to teaching, mentoring, and supervising research activities. At the University of North Dakota School of Medicine, with 25 categorical and 8 transitional residents, implementation of a structured research requirement with an accompanying curriculum (Table 2) resulted in a marked increase in the research output of our physicians-in-training (Table 3). Research projects were predominantly clinical, with few opportunities for basic science laboratory investigation. Schultz has described a similar success in the

Mayo Clinic's resident research program, which has an institutionally developed resident research curriculum that has been copyrighted and widely distributed to other residency programs (1). In a survey of resident research content areas, program directors reported that projects at their hospitals included hypothesis-driven research (clinical or bench; 18% ± 22%); non-analytic literature reviews (15% + 27%), descriptive case series (9% ± 12%), and descriptive population studies (6% ± 14%) (4).

Dedicated Research Rotations

Trying to complete research projects during clinical rotations can take a resident away from critical service responsibilities. Allocation of separate rotations for protected research time and concentrated planning, conduct, and write-up of research projects can help residents focus on clinical and scholarly needs. These dedicated blocks of time for initiating and completing a research project can take the form of research electives or required rotations. Research block time provides opportunities and forums for residents to perform and present their research projects and data. It must be noted, however, that while the absence of protected time is frequently cited as a barrier to research, the presence of protected time has not been consistently associated with increased scholarly productivity in internal medicine or other training programs (4).

Research Methods and Biostatistics Courses

Most university- and non-university-based programs teach basic research skills in lectures, seminars, and journal clubs. More intensive research topics and courses, taught by epidemiologists or individuals trained in clini-

Table 3. Effect of a Resident Research Curriculum and Requirement on Research Productivity

Productivity	Precurriculum (1992–1997)	Postcurriculum (1998–present)
Publications by internal medicine residents in peer-reviewed journals	4	35
Published abstracts and oral/poster presentations at regional, national, or international scientific meetings	7	62
TOTAL	11	97

cal epidemiologic and statistical methodology, can further enhance learning in critical areas. Content areas include the skills of critical appraisal, literature retrieval, computer use (word processing, graphic, statistical analysis), survey design, epidemiology, biostatistics, research methodology, scientific communication (abstract and manuscript writing, poster design, oral presentation), and medical informatics.

Faculty and Senior Residents as Mentors

Fletcher has observed that true mentors are a rare breed—“. . . people who will view the research project, and the developing scholar, as a whole, integrate the pieces, and build a coherent outcome” (8). Both faculty and upper-level residents assume critical roles in a research-oriented curriculum. These individuals act as research mentors and collaborators, who, despite their busy schedules, provide needed accessibility and role-modeling to more junior colleagues. Senior residents typically allocate about 20% to 25% of their time to teaching interns and medical students (9). Interns turn to upper-level residents for leadership, guidance, and learning; resident colleagues are generally more approachable and are more cognizant of interns’ problems than are supervising faculty members.

At the University of Pittsburgh, a housestaff team research system was designed and implemented by second- and third-year internal medicine residents with guidance from general medicine faculty (10). Housestaff were involved in all phases of a collaborative research experience, from the development of the protocol to the presentation of the results. The goal of this novel team model, which exposed a large number of trainees (51 of 66 upper-level residents) to an outpatient-based clinical research experience, was not for residents to become sophisticated independent researchers but rather to stimulate them to be receptive to clinical research experiences and opportunities in the outpatient setting.

The Role of Journal Clubs

The medical journal club, as a long-established feature of medical education, is an activity with broad educational benefits. Such sessions have become a regular feature of most residency programs and help physicians-in-training to navigate the voluminous medical literature and expand their medical knowledge base. As or more importantly, however, journal clubs improve residents’ literature-reading skills and provide a venue for inculcating skills of analytical review, teaching research methods, biostatistics, and epidemiology, and, in general, enhancing aptitude for research (11–13). Among residency training programs, journal clubs vary in their format and effectiveness in teaching.

The success of a journal club relies on dedicated and experienced faculty members who can demonstrate to residents how to think, question, and investigate (13,14).

In a survey of 124 internal medicine residency programs to determine what makes journal clubs successful (defined as having a high attendance or long, continuous existence), success was associated with smaller residency programs, mandatory attendance, journal clubs being independent of faculty, provision for formal teaching of the skills of critical appraisal, availability of food, and emphasis on original research articles (14). Attendance should not be considered the only criterion for an effective journal club, and evaluation methods should be refined to determine if this educational activity changes residents’ attitudes and behaviors toward reading the literature and their knowledge of basic principles of critical appraisal (13,15).

SUMMARY

Medical education is a continuous process, and knowledge and experiences gained in medical school and during residency and fellowship training are the foundations of this process. Our efforts at medical education must go beyond an emphasis on clinical skills to incorporate inquisitiveness and investigation at every level, thereby encouraging a lifelong-learning momentum. Given appropriate opportunities and support, internal medicine residents can become skillful clinical and laboratory researchers, and these experiences can benefit them regardless whether they pursue careers in academia or private practice. Most medicine training programs currently have many of the elements associated with scholarly productivity, including a mentored research experience, structured training in research methods, and a work environment that supports research. Teaching research skills is not a one-size-fits-all endeavor, and individual training programs must determine what components of the educational prescription are most relevant to the needs of their trainees.

The exemplary physician is always learning how to improve treatment for future patients on the basis of clinical experience with current patients and familiarity with the medical literature. In the scientifically guided delivery of health care, physicians make observations, test hypotheses, and experiment with different treatments. In this new millennium, the missions of internal medicine—prevention of disease, care of patients with acute and chronic illnesses, reduction in inefficient use of resources, and inculcation of a biopsychosocial view of health and illness—will be carried out by both clinicians and researchers whose effectiveness will be determined by shared educational experiences.

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