

APM Perspectives

The Association of Professors of Medicine (APM) is the national organization of departments of internal medicine at the US medical schools and numerous affiliated teaching hospitals as represented by chairs and appointed leaders. As the official sponsor of The American Journal of Medicine, the association invites authors to publish commentaries on issues concerning academic internal medicine.

For the latest information about departments of internal medicine, please visit APM's website at www.im.org/APM.

Jumpstarting Academic Careers with a Novel Intern Research Rotation: the AIMS Rotation

Tonya L. Fancher, MD, MPH,^a Ted Wun, MD,^{c,d} Christine S. Hotz, DVM, MS,^{b,c} Mark C. Henderson, MD^a

^aDepartment of Internal Medicine, ^bDepartment of Anesthesiology and Pain Management, ^cClinical Translational and Science Center, and ^dDivision of Hematology and Oncology, Department of Internal Medicine, University of California at Davis Health System, Sacramento.

The Accreditation Council for Graduate Medical Education (ACGME) requirements for residency education in internal medicine specifically state that the program must advance residents' knowledge of the basic principles of research, including how research is conducted, evaluated, explained to patients, and applied to patient care.¹ Further, residents should participate in scholarly activity, and the sponsoring institution and program should allocate adequate educational resources to facilitate resident involvement in scholarly activities.¹ The scholarly activity requirement may be satisfied with projects other than research, including journal clubs, presentation at grand rounds, and quality

improvement projects. Some programs have developed structured research training experiences that prepare residents to present their research at professional or scientific meetings, write manuscripts in peer reviewed journals, and publish review articles or book chapters.² Dedicated research activities advance the core competencies and are often highly rated aspects of residency training.³⁻⁵ In fact, most residents feel research should be required.⁶ A recent article suggests that residency program enhancements in patient care, education, community service, and research improve departments of internal medicine and teaching hospitals.⁷ Finally, research experiences might encourage some residents to consider a career in clinical investigation.⁸ Despite these potential benefits, implementing a structured research curriculum in a busy residency program remains a logistical challenge.

In a meta-analysis, Hebert et al⁹ identified 4 features of successful resident research programs: exposure to and guidance from mentors, training in basic research methods, protected time, and an environment supportive of research. The vast majority of internal medicine programs offer 1-2 months of protected research time during postgraduate year (PGY) 2 or 3. An informal e-mail survey of the Association of Program Directors in Internal Medicine listserver participants showed that 121 of 143 programs, or 85%, offered at least 4 weeks for research. However, successful resident research projects require much greater commitment of time, interest, and resources. Pursuit of research interests is often

Funding: Drs. Fancher and Henderson are supported by a Residency Training in Primary Care grant from the Department of Health and Human Services (HRSA D58HP05139). Drs. Hotz and Wun are supported by Grant Number UL1 RR024146 from the National Center for Research Resources (NCRR), a component of the National Institutes of Health (NIH), and NIH Roadmap for Medical Research. The contents of this article are solely the responsibility of the authors and do not necessarily represent the official view of NCRR or NIH. Information on NCRR is available at <http://www.ncrr.nih.gov/>. Information on Re-engineering the Clinical Research Enterprise can be obtained from <http://nihroadmap.nih.gov/clinicalresearch/overview-translational.asp>.

Conflict of Interest: None.

Authorship: All authors had full access to all the data in the study and a role in writing the manuscript.

Requests for reprints should be addressed to Tonya Fancher, MD, MPH, Department of Internal Medicine, University of California at Davis Health System, 4150 V Street, Patient Support Services Building Suite 3100, Sacramento CA 95718.

E-mail address: TLFancher@ucdavis.edu

displaced by patient care demands.¹⁰ We previously described resident research as a 3-year continuum of preparation, investigation, and synthesis phases, in which early preparation is critical.¹¹ Delaying bona fide research experiences to PGY-2 and compressing them into a 1-month block, along with an often ad hoc search for mentors, limits the resident's chances for success. Such frustrating research experiences may even deter residents from careers in clinical investigation.

We recently implemented the 4-week Academic Internal Medicine Scholarship (AIMS) rotation, which introduces all interns to the process of organized inquiry and research. Each intern designs a feasible, scientifically sound research project to be completed over the course of residency. They learn research methodology, cultivate mentoring relationships, and develop interdisciplinary collaborations. Since 2005, all interns in the categorical internal medicine residency program at University of California, Davis, School of Medicine (UC Davis) have completed this rotation. We describe the early success of this novel research curriculum. This project has been approved by the UC Davis Institutional Review Board (IRB).

PROGRAM DESCRIPTION

The UC Davis internal medicine residency is a medium-sized urban university program. Our 87 residents rotate

through 3 inpatient sites (UC Davis, Northern California Veterans Affairs Hospital, and Kaiser Permanente) and 2 outpatient sites (UC Davis and Sacramento County Clinics). Approximately 60% of residents go on to subspecialty fellowship training.

The AIMS rotation occurs in the second half of the intern year and is intercalated into a 4-week ambulatory care block. Although originally conceived as a dedicated research-only experience, integration into an ambulatory rotation emphasizes the interdependence of research and patient care and allows other program requirements to be met during the month. Interns acquire basic research skills through proposal development, oral presentation, and exploration of methods for data collection, collation, and analysis. The rotation consists of facilitated small group research discussions, live and online lectures, and protected time for consultation; interns continue to participate in required residency core didactics and clinics (Figure 1).

The AIMS rotation runs in collaboration with the National Institutes of Health (NIH)-funded Clinical and Translational Science Center (CTSC) at UC Davis Health System. The CTSC education officer (CSH) and the associate program director for research (TLF) coordinate the rotation. Lecturers and mentors include experienced faculty researchers, biomedical informatics experts, clinical research coordinators, biostatisticians, medical librarians, research bioethicists, science and grant writers, librarians, research nurses, and IRB personnel. Beyond lectures and individual consultations, interns meet in weekly small groups with research faculty to discuss challenges and report

PERSPECTIVES VIEWPOINTS

- The Academic Internal Medicine Scholarship rotation promotes development of the Accreditation Council for Graduate Medical Education core competencies, is well received by residents, and ultimately might encourage more residents to pursue a career in clinical investigation.
- In the 3 years since the program's inception, the culture has changed to include an expectation for high-quality scholarship and presentation at local, regional, and national meetings.
- As interns discover opportunities for research and support for clinician-scientist careers through collaboration, training programs gain a population of local resident experts, regional and national exposure, and a scholarly reputation that might enhance resident recruitment.

		Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	AM	AIMS*	AIMS	AIMS	clinic	AIMS
	PM	core didactics [^]	AIMS	AIMS	clinic	clinic
Week 2	AM	AIMS	AIMS	AIMS	clinic	AIMS
	PM	core didactics	AIMS	AIMS	clinic	clinic
Week 3	AM	AIMS	AIMS	AIMS	AIMS	AIMS
	PM	core didactics	AIMS	AIMS	AIMS	clinic
Week 4	AM	AIMS	AIMS	AIMS Research forum	clinic	clinic
	PM	core didactics	clinic	clinic	clinic	clinic

*AIMS includes facilitated small group discussions, lectures, and protected time for consultation and viewing online content.

[^]core didactics refers to required residency didactic conferences.

Figure 1 Sample 4-week schedule for Academic Internal Medicine Scholarship (AIMS) rotation.

Table 1 Competencies Addressed in AIMS

Competency	Accomplished by:
Practice-based learning	Identification of a topic from clinical experience. Use of quality improvement strategies or chart review to examine local practice.
Medical knowledge	Integration of comprehensive background data, specific aims, hypothesis, biostatistics, and study design into proposal.
Interpersonal skills and communication	Cooperative and interactive style during small group sessions, clarity of presentation of proposal at research forum, ability to address audience questions, and clarity of written proposal. Evaluation by mentor.
System-based practice	Integration and use of local resources in proposal.
Professionalism	Completion of NIH training in protection of human subjects. Timely completion of all rotation requirements.

AIMS = Academic Internal Medicine Scholarship; NIH = National Institutes of Health.

progress. A rotation website serves as a repository for course material, including prior research proposals and presentations. Interns are encouraged to attend the regularly scheduled CTSC research seminars and workshops. During the final week of each rotation, interns present their research plan at the AIMS research forum. The audience often includes the department chair, program director, CTSC core directors, research mentor, consulting biostatisticians, and fellow residents. All audience members provide oral and written feedback, which is given to each intern in summary form.

The rotation objectives are similar to other residency research curricula.^{9,12} Through lectures and individual statistical consultation interns learn about research design, biostatistics, human subjects protection, institutional resources, and epidemiology while developing their proposals. Attitudinal objectives include promoting intellectual curiosity through scholarly investigation of clinical questions and enhancing residents' appreciation of biomedical research. Skills objectives include proposal development, scientific writing, and presentation skills. Process objectives include exposure to successful researcher role models and IRB members. In terms of the ACGME core competencies,¹ the rotation adds to the intern portfolio in practice-based learning, medical knowledge, interpersonal and communication skills, systems-based practice, and professionalism (Table 1).

Our long-term objectives are to increase residents' scholarly productivity and promote a culture of scholarship and scientific inquiry within the program. Interns requesting dedicated research time during PGY-2 must submit a revised proposal and obtain written approval from their mentor and the Residency Research Committee (which includes the program director, associate program director for research, department chair, a CTSC leader, and a senior faculty researcher). Residents who meet this requirement may take a 4-week research block during the PGY-2 and PGY-3 year. The Department of Medicine budgets \$750 for each resident

to prepare an abstract and present it at a regional or national scientific meeting. Travel costs are generally shared by the faculty mentor. Other programs fund up to \$1000 per accepted research submission.¹³

PRELIMINARY OUTCOMES

The success of AIMS can be assessed in several ways. A traditional academic benchmark of productivity is the number of scholarly presentations, awards, manuscripts, and grants. As of January 2009, 74 rotation completers have presented 50 case reports and 15 research abstracts at regional or national professional meetings (Figure 2). In just 3 years, we have seen an increase in research abstracts and a decrease in case reports. Residents have won 8 research or case report awards at regional meetings. Successful publication of manuscripts is harder to accomplish during residency, but completers have already published 2 articles. One resident has received a competitive American Board of Internal Medicine Foundation research grant and 2 are pursuing federally funded research fellowships. Our first AIMS class graduated from residency in 2008, so we continue to measure success by tracking presentations at professional society meetings, publications, and rotation-specific outcomes. For the long term, the number of residents who ultimately pursue research careers will be tracked. An intermediate outcome is the proportion of interns that complete a hypothesis-driven project. Of the 74 interns who have completed the AIMS rotation, 46 (62%) went on to complete projects during a PGY-2 research block.

Even if they do not ultimately pursue an academic career, residents with research experience or skills may be better informed consumers of the medical literature. Interns' self-reported knowledge, skills, and attitudes improved in almost all areas, including modest gains in the writing and statistical domains (Table 2).

Although we do not have other nonclinical rotations with which to compare, interns have rated the overall

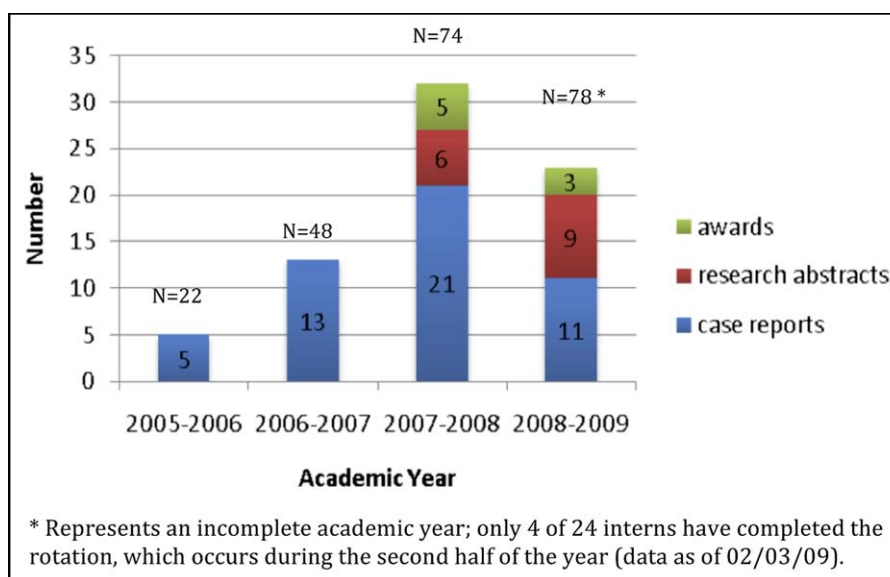


Figure 2 Productivity outcomes to date: number of research abstracts and case reports presented and awards received by residents who have completed the Academic Internal Medicine Scholarship rotation. The total number of residents (N) is included.

experience highly (8.5 on a 10-point rating scale), including the adequacy of time allotted to proposal development. Rotation completers have commented positively on the value of completing research proposals and collaborative small group learning, and reported a renewed appreciation for the challenges of research. Numerous residents also have secured resident travel awards from national organizations including the American College of Physicians, American Association

for the Study of Liver Diseases, American Society of Hematology, American Academy of Allergy, Asthma and Immunology, and others.

DISCUSSION

We describe a structured research experience that promotes development of the ACGME core competencies, is well received by residents, and ultimately

Table 2 Change in Intern (n = 69) Self-reported Outcomes Before and After AIMS Rotation

	Beginning of Intern Year	End of Intern Year	P Value*
Knowledge (1-5 scale, where 1 is strongly disagree and 5 is strongly agree)			
I knew/know of at least one person I could go to with a research proposal idea.	2.7	4.4	<.01
I knew/know how to find a mentor to help with a research program at UC Davis.	2.5	4.1	<.01
I had/have a good grasp of the resources available to me to conduct research at UC Davis.	2.0	3.9	.06 (NS)
I knew/know how to contact the IRB.	1.9	3.8	.04
I understood/understand the importance of the IRB in protecting human subjects.	3.3	4.3	<.01
Skills (1-5 scale, where 1 is poor and 5 is excellent)			
Grant writing	1.7	2.1	<.01
Knowledge of IRB regulations	1.9	3.1	<.01
Literature searching	3.1	3.8	<.01
Manuscript writing	2.2	2.8	<.01
Research design	2.3	3.2	<.01
Statistical analysis	2.0	2.5	<.01
Attitude (1-5 scale, where 1 is strongly disagree and 5 is strongly agree)			
I plan (or planned) to do research during residency	3.8	4.2	<.01

AIMS = Academic Internal Medicine Scholarship; IRB = institutional review board.

*Paired *t* test to compare the means.

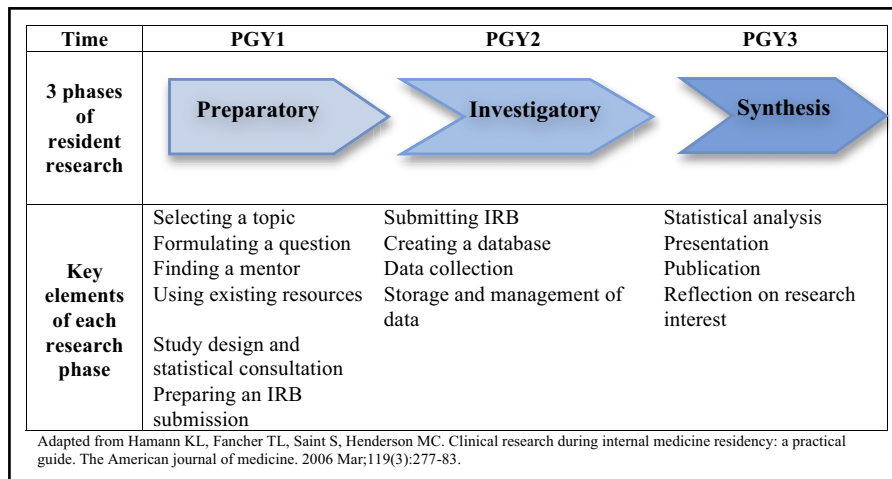


Figure 3 The 3 phases of resident research.

may encourage more residents to pursue a career in clinical investigation. Resident success is often hampered by key early steps such as formulating a question, finding a mentor, and understanding basic research design and methodology. Early structured support of research allows residents to efficiently accomplish these tasks rather than taking several months or more to complete them on an ad hoc basis. We have previously described 3 phases of resident research (preparatory, investigatory, and synthesis) which may take 3 years to complete (Figure 3).¹¹ Our AIMS research curriculum allows residents to complete the preparatory phase during internship. Requiring every intern to develop a research proposal has several advantages: interns are better prepared for research electives during the second and third year of residency; residents learn early in their careers how to report scientific findings; and the culture of the training program may be transformed as research becomes an integral part of residency training. Over 60% of our residents begin the investigatory phase during a protected research block in PGY-2 or PGY-3, a much higher proportion than the 20% reported by internal medicine program directors.² During the research block, residents meet with their mentor, the associate program director for research, CTSC staff (data management and biostatistics support), and medical librarians (reference management tutorials). Residents who take a research block also present their research findings at the annual department Academic Forum, which is attended by community members, faculty, and fellows. Residents then move into the synthesis phase during their PGY-3 year and also dedicate substantial time to writing outside of their research block.

In the nearly 4 years since the program's inception, we have observed a culture change that includes an expectation for high-quality scholarship and presentation at local, regional, and national meetings. Pediatrics

and anesthesiology residents now participate in the AIMS rotation.

Structured research programs encourage interns to access and interpret the medical literature, practice oral and written scientific communication skills, and participate in a multidisciplinary research team. Successful research adds to the resident's portfolio and enhances fellowship and future employment opportunities. Interns discover opportunities for research and support for clinician-scientist careers through collaboration, critical components of the NIH investigator road map.¹⁴ Training programs gain a population of local resident experts, regional and national exposure, and a scholarly reputation that may enhance resident recruitment.

Developing a resident research program presents a number of challenges.¹⁵ Finding curricular time for new programs within an already stretched residency program is not easy. Collaboration with departments and careful integration into the ambulatory block rotation may ease these concerns. Interns may be resistant to doing research while in the midst of intense clinical training. In 2004, we piloted the rotation with 2 highly motivated residents during an elective block, allowing us to develop the rotation on a small scale. In the absence of a contemporaneous control group, we cannot definitively conclude that the satisfaction and increased number of projects is due to the AIMS rotation alone. We suspect, however, that the formal curriculum has had a significant impact. Cultivating a cadre of committed enthusiastic faculty and hiring an associate program director for research to mentor the residents are critical for success.^{16,17} Programs without a CTSC should consider seeking help from other institutions or graduate programs. To promote a culture of scholarship, we have required that all internal medicine interns participate.

The AIMS rotation is a structured research experience for interns that increases the likelihood that residents will

complete a hypothesis-driven research project during residency. Regardless of their ultimate career, the experience likely enhances residents' appreciation for scholarship while contributing to the development of several ACGME competencies.

ACKNOWLEDGMENT

The authors wish to thank Janice Cheng for her assistance and input.

References

1. Accreditation Council for Graduate Medical Education. Program Director Guide to the Program Requirements. Available at: http://www.acgme.org/acWebsite/navPages/nav_commonpr.asp. Accessed June 21, 2009.
2. Levine RB, Hebert RS, Wright SM. Resident research and scholarly activity in internal medicine residency training programs. *J Gen Intern Med.* 2005;20:155-159.
3. Hayward RA, Taweel F. Data and the internal medicine house-officer: alumni's views of the educational value of a residency program's research requirement. *J Gen Intern Med.* 1993;8:140-142.
4. Kanna B, Deng C, Erickson SN, et al. The research rotation: competency-based structured and novel approach to research training of internal medicine residents. *BMC Med Educ.* 2006;6:52.
5. Kohlwes RJ, Shunk RL, Avins A, Garber J, Bent S, Shlipak MG. The PRIME curriculum. Clinical research training during residency. *J Gen Intern Med.* 2006;21:506-509.
6. Rivera JA, Levine RB, Wright SM. Completing a scholarly project during residency training. Perspectives of residents who have been successful. *J Gen Intern Med.* 2005;20:366-369.
7. Rahim A, Anderson RA. Strategies for residency programs that improve medicine departments and teaching hospitals. *Am J Med.* 2008;121:450-455.
8. Association of American Medical Colleges; AAMC's Task Force II on Clinical Research. *Promoting Translational and Clinical Science: The Critical Role of Medical Schools and Teaching Hospitals (Report of the AAMC's Task Force II on Clinical Research)*. Washington, DC: Association of American Medical Colleges; 2006.
9. Hebert RS, Levine RB, Smith CG, Wright SM. A systematic review of resident research curricula. *Acad Med.* 2003;78:61-68.
10. Goldman L, Shea S, Wolf M, Braunwald E. Clinical and research training in parallel: the Internal Medicine Research Residency Track at the Brigham and Women's Hospital. *Clin Res.* 1986;34:1-5.
11. Hamann KL, Fancher TL, Saint S, Henderson MC. Clinical research during internal medicine residency: a practical guide. *Am J Med.* 2006;119:277-283.
12. Rana A, Lainoff D, Weber A. 3 for 1: How to meet faculty scholarly activity, resident scholarly activity and PBL competency requirements. *Acad Intern Med Insight.* 2008;6:6-7.
13. Fischer J, Cation L. Impact of a residency research program on research activity, faculty involvement, and institutional cost. *Teach Learn Med.* 2005;17:159-165.
14. National Institutes of Health. NIH Roadmap for Medical Research. Available at: <http://nihroadmap.nih.gov/initiatives.asp>. Accessed June 21, 2009.
15. Alguire PC, Anderson WA, Albrecht RR, Poland GA. Resident research in internal medicine training programs. *Ann Intern Med.* 1996;124:321-328.
16. Durning SJ, Cation LJ, Ender PT, Gutierrez-Nunez JJ. A resident research director can improve internal medicine resident research productivity. *Teach Learn Med.* 2004;16:279-283.
17. Schultz HJ. Research during internal medicine residency training: meeting the challenge of the Residency Review Committee. *Ann Intern Med.* 1996;124:340-342.