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The Prime Curriculum

Clinical Research Training During Residency

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AIM: The Primary Medical Education (PRIME) program is an outpatient-based, internal medicine residency track nested within the University of California, San Francisco (UCSF) categorical medicine program. Primary Medical Education is based at the San Francisco Veteran's Affairs Medical Center (VAMC), 1 of 3 teaching hospitals at UCSF. The program accepts 8 UCSF medicine residents annually, who differentiate into PRIME after internship. In 2000, we implemented a novel research methods curriculum with the dual purposes of teaching basic epidemiology skills and providing mentored opportunities for clinical research projects during residency.

SETTING: Single academic internal medicine program.

PROGRAM DESCRIPTION: The PRIME curriculum utilizes didactic lecture, frequent journal clubs, work-in-progress sessions, and active mentoring to enable residents to “try out” a clinical research project during residency.

PROGRAM EVALUATION: Among 32 residents in 4 years, 22 residents have produced 20 papers in peer-reviewed journals, 1 paper under review, and 2 book chapters. Their clinical evaluations are equivalent to other UCSF medicine residents.

DISCUSSION: While learning skills in evidence-based medicine, residents can conduct high-quality research. Utilizing a collaboration of General Internal Medicine researchers and educators, our curriculum affords residents the opportunity to “try out” clinical research as a potential future career choice.

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The Prime Curriculum

INNOVATIONS IN EDUCATION

The Primary Medical Education (PRIME) program is an outpatient-based, internal medicine residency track nested within the University of California, San Francisco (UCSF) categorical medicine program. Primary Medical Education is based at the San Francisco Veteran’s Affairs Medical Center (VAMC), 1 of 3 teaching hospitals at UCSF. The program accepts 8 UCSF medicine residents annually, who differentiate into PRIME after internship. In 2000, we implemented a novel research methods curriculum with the dual purposes of teaching basic epidemiology skills and providing mentored opportunities for clinical research projects during residency.

The primary medical education (PRIME) program is an outpatient-based, internal medicine residency track nested within the larger University of California, San Francisco (UCSF) categorical medicine program, based at the San Francisco Veteran’s Affairs Medical Center (VAMC). The VAMC is 1 of 3 affiliated teaching hospitals at UCSF. This track enables UCSF interns to select a 2-year program that focuses on outpatient clinical training, behavioral medicine and clinical research skills. The program accepts 8 residents per year who divide their time evenly between the standard categorical inpatient rotations and the PRIME outpatient blocks.

In 2000, we implemented a new program in evidence-based medicine (EBM) and clinical research training for the PRIME program. The goal of this curriculum is to teach residents the fundamentals of clinical evidence by giving them the skills in clinical research methods, mentoring, and protected time to complete a clinical research project during residency. Our goal is to give the residents a chance to “try out” a career in clinical outcomes research during residency by completing an academic “PRIME project,” while ensuring that they gain necessary clinical skills. This curriculum supplements the preexisting evening journal clubs, EBM luncheon lectures and outpatient seminars that are available to all UCSF medicine residents.

“Primary Medical Education projects” can be any academic project that the resident is motivated to complete. Thus far, they have ranged from educational interventions (e.g., an examination of residents’ screening habits for domestic violence) to secondary data analyses in outcomes research (e.g., evaluation of kidney disease as a predictor of revascularization outcomes),3 to meta-analysis (e.g., examination of the test characteristics of 2-feto protein levels in screening for hepatocellular carcinoma).4 Residents pursue topics that they feel passionate about and that can be utilized to become experts in their field. Building this expertise also enables them to decide whether the “nuts and bolts” of executing a clinical research project are exciting enough to encompass their future career.

Primary Medical Education is evaluated using several metrics; the number of resident publications, the number of residents entering careers in clinical outcome research, and the number of our residents elected to be chief residents, the number of our residents elected to be chief residents, the
percentage of residents who pass the internal medicine board exam and the clinical and teaching evaluations of our residents during residency.

Our purpose in this paper is to show that inclusion of a rigorous clinical research curriculum during residency can enhance clinical training by helping residents decide whether clinical research should be part of their future careers. Furthermore, we have found that resident training in clinical research has helped unify our General Internal Medicine (GIM) section by bringing clinician-educators and clinician investigators together as partners for resident training and career development.

**PROGRAM DESCRIPTION**

Primary Medical Education residents rotate every 3 months throughout the year in 2 teams. For 6 months each year, PRIME residents perform the typical inpatient duties of an internal medicine house officer. While on outpatient block, the typical weekly PRIME schedule is a mix of 3 half days of primary care clinic, 3 to 4 half days of subspecialty elective clinics, 2 half days of didactic time, and 1–2 half days of research time. PRIME residents become well known to the physician staff at the San Francisco VA Medical Center and are heavily relied upon for staffing (with appropriate attending supervision) of both our primary and subspecialty clinics. Our residents see a large volume of patients seeking primary and specialty care, and serve an important role in access to care for our veterans. The clinical relationships built with generalist and specialist attendings have frequently led to research projects and career mentoring.

Didactic time is divided evenly between clinical outpatient topics, behavioral medicine, and epidemiology/research methods training. Our clinical didactics cover the ACGME recommended core topics that are not covered in other learning opportunities provided by the residency. The behavioral medicine program, run by Drs. Calvin Chou and Kewchang Lee, focuses on important skills for improving patient care and utilizes videotaped and interactive group feedback sessions.

The epidemiology/research methods section of the PRIME didactic curriculum has 4 components that we repeat in different forums to reinforce the key concepts of EBM. The curriculum is a synthesis of the Advanced Training in Clinical Research (ATCR) research training program available to clinical fellows at UCSF, with curriculum used by the Robert Wood Johnson Clinical Scholars Program Fellowship at the University of Washington. The first component is the epidemiology didactic lecture series. This 12 seminar series is provided in consecutive weekly 90-minute sessions. Concepts are presented practically, augmented with assigned reading from the chosen textbook and reinforced with short homework assignments. The curriculum sequentially introduces key concepts in a practical manner building from the basics to progressively more difficult concepts as listed in Table 1.

This lecture series is repeated twice yearly, every year, to ensure all the residents have the opportunity to participate. The seminar leaders are members of our clinical investigator faculty. This interaction early in the year fosters future collaborations between residents and faculty. In later blocks other research topics are presented to the residents depending upon their needs. Topics that have been covered in past years include: power calculations, qualitative research methods, survey research, decision analysis and treatment thresholds, cost-effectiveness analysis, use of standardized patients in research, community-based research and process evaluation, international research, administrative data utilization, and deciphering a spreadsheet.

The second component of our EBM/clinical research program is weekly afternoon small group journal clubs. This curriculum reinforces the concepts from the didactic seminar series by discussing the full range of common clinical research study types. During the first half of the year, diagnostic test evaluation, case-control studies, cohort studies, randomized control trials, meta-analysis, decision analysis, cost-effectiveness analysis, practice guidelines, and clinical overviews are covered. The second half of the year, we move to weekly "classic" journal clubs where residents choose articles that they frequently hear quoted on the medical wards. After reading the article the residents evaluate the quality of the "classic" to understand if and how they should apply the study in daily practice.

This journal club series has assigned background reading on the various epidemiology study types. Each week, a resident leads the seminar and prepares a 15-minute presentation that highlights the key learning points for each study type. The discussion is led on their chosen article to reinforce the key points that have been presented. We use a journal club format with a list of questions to be addressed as described in Table 2. We find this format useful as it is simple to remember, easy to apply, and applicable to each study type we review. The journal clubs are precepted by a program director to help with the flow of the session, and to answer questions that arise.

The third component involves presentation of the "PRIME projects." Residents present their projects quarterly in 90-minute work-in-progress sessions that are attended by the residents on outpatient block, the 2 program directors and a rotating member of the GIM clinician-investigator faculty. These sessions are similar to those utilized by research divisions across the academic community. They are collegial,

**Table 1. The PRIME Epidemiology Curriculum**

<table>
<thead>
<tr>
<th>Topic</th>
<th>Material Covered</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Overview of epidemiology study types</td>
<td>Observational study types and randomized trials</td>
</tr>
<tr>
<td>B. How epidemiology data are presented</td>
<td>Rates, risks, odds, attributable risk</td>
</tr>
<tr>
<td>C. How to design a research question</td>
<td>Predictor and outcome variables</td>
</tr>
<tr>
<td>D. Study design and sampling</td>
<td>Defining study populations, validity</td>
</tr>
<tr>
<td>E. Issues in measurement</td>
<td>Statistical significance and precision of measurement</td>
</tr>
<tr>
<td>F. Causal inference</td>
<td>Truth, chance, bias, confounding</td>
</tr>
<tr>
<td>G. Qualitative biostatistics #1</td>
<td>Types of data; data comparisons, $2 \times 2$ tables</td>
</tr>
<tr>
<td>H. Qualitative biostatistics #2</td>
<td>Introduction to multivariate regression analyses</td>
</tr>
<tr>
<td>I. Computer skills</td>
<td>Medline search skills Endnote</td>
</tr>
<tr>
<td>J. Research ethics</td>
<td>History of research ethics to function of human subjects committees</td>
</tr>
<tr>
<td>K. Systematic review</td>
<td>Overview of steps to perform rigorous review of the literature</td>
</tr>
<tr>
<td>L. Meta-analysis</td>
<td>Statistical methods of comparison for rigorous literature review</td>
</tr>
</tbody>
</table>

PRIME, Primary Medical Education.
Table 2. Simplified criteria for Journal Article Reviews

<table>
<thead>
<tr>
<th>Question</th>
<th>Criteria</th>
</tr>
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<tbody>
<tr>
<td>I. What is the research question?</td>
<td>(a) Identify the predictor and outcome variables and the specific population being evaluated in the study</td>
</tr>
<tr>
<td>II. What is the study design?</td>
<td>(b) Or in a trial, does intervention X cause outcome Y in population Z</td>
</tr>
<tr>
<td>III. What are the possible reasons the study findings might be wrong?</td>
<td>(c) Identify strength and weaknesses of the study type</td>
</tr>
<tr>
<td>IV. How will the results affect my practice of medicine?</td>
<td>(d) Are groups for comparison really comparable?</td>
</tr>
</tbody>
</table>

Table 3. Criteria for PRIME Program Selection

1. Commitment to ambulatory medicine. Measured by stated career goals, demonstrated outpatient interests from CV, reviews by outpatient clinic preceptors and ambulatory staff.
2. Commitment to an academic career. Measured by stated career goals to be clinician researcher or clinician educator.
3. Commitment to evidence-based medicine/clinical research. Measured by stated career goals, demonstrated work (either research or volunteer that points to research).
4. Potential for academic leadership. Measured by stated career goals, demonstrated work (either research or volunteer).
5. VA core faculty experience with intern applicants.
6. PRIME residents’ experience with intern applicants.
7. Commitment to community leadership.

Each of these criteria is judged on a 5-point Likert scale. Each applicant interviews with the program director, a PRIME resident and a GIM faculty member and their scores are tabulated. Final decisions are made in consultation with the Director of the UCSF Categorical Residency.

PRIME: Primary Medical Education; GIM: General Internal Medicine; UCSF: University of California, San Francisco.
at our annual Floyd Rector Resident Research Symposium. In large part because of presentations from the PRIME residents, the average number of resident publications at the Rector Symposium rose from 6 to 9 presentations per year in the 1990s to 13 to 21 presentations since 2001. Importantly, this production represents creative ideas and hard work. Residents are nearly always the lead authors of these original research articles, which is a position they earn by leading every aspect from conception and design to manuscript production under the guidance of their mentor.

CONCLUSION

The VA PRIME Program at UCSF utilizes a novel curriculum for giving academically motivated internal medicine residents an experience in clinical research. PRIME residents had at least equivalent clinical competency and satisfaction scores when compared with other UCSF categorical medicine residents. The significance of this is 2-fold. First, it demonstrates that PRIME residents’ clinical skills did not suffer while participating in our clinical research curriculum. Second, it shows that residents are motivated by the opportunity of performing mentored clinical research projects and take personal satisfaction from accomplishing this task during residency.

Our descriptive study has an important limitation. We lacked a comparison group for research productivity for our residents as they are clearly “self-selected” to produce projects during residency. Second, we cannot determine the extent to which the curriculum contributed to the resident’s research productivity beyond the talent of the individual mentee and mentor. We believe, however, that the residents’ success depends heavily on the structured curriculum, willing mentors and their own enthusiasm.

We believe that creating opportunities for resident research during residency fosters critical evaluation skills, provides insights into the benefits and limitations of practicing evidence-based clinical medicine and empowers residents to shape their academic careers from a position of insight into the joys and sorrows of clinical research. We believe that similar programs can be adopted at many academic teaching programs by combining the skills and energy of dedicated clinician educators and clinician investigators into a productive partnership.

Because of the popularity of PRIME, we have decided to expand access to our curriculum throughout the UCSF Categorical Residency program. Beginning in the current academic year, we accepted all applicants from the internship class to provide them access to the clinical experience, didactics, teaching and mentoring at the San Francisco VA Medical Center, that have made PRIME successful.

REFERENCES


Calvin Chou, MD, PhD, Kewchang Lee, MD, Patricia Cornett, MD, Sharad Jain, MD, Mary Whooley, MD, Tracy Minichillo, MD, Robert Baron, MD, MPH, Elizabeth Harleman, MD, Thomas Koeppel, MD, MPH, and Richard Deyo, MD, MPH. We also appreciate the input and leadership of Dr. Harry Hollander, the Internal Medicine Residency Director at the University of California, San Francisco.