Residency Education

Research in Residency: Do Research Curricula Impact Post-residency Practice?

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Background: The Residency Review Committee for Family Medicine recommends that research during residency be encouraged as a means of preparing residents for lifetime self-education after residency. No studies, however, have demonstrated the influence of these curricula on postgraduate practice. This study identified differences in attitudes, knowledge, or behavior between residency graduates who were or were not exposed to research training during residency. Methods: A survey was mailed to 234 graduates of 13 family medicine residency programs in Michigan; eight of the programs included research curricula. The survey included questions on research training, confidence in reading medical articles, sources used for answering clinical questions, and current teaching and research activities. Responses were compared between graduates from programs with and without formal research training. Results: The response rate was 53%. Graduates with research training reported significantly greater appreciation for research and its importance in guiding treatment decisions. There were no differences between groups in knowledge of statistics, comfort with reading research articles, or sources used for answering clinical questions, with the exception of greater use of Medline searches for research-trained residents. There were also no differences between groups in additional training or research experiences. Graduates with no formal research training reported being more involved after residency with student teaching and practice audits. Conclusions: Formal research training during residency appears to alter attitudes toward research and searches of the medical literature but does not lead to greater participation in teaching or practice audits.

Over the past 2 decades, there has been considerable debate about the value of research training during residency. Despite the difficulties in developing and administering these research training programs, two national surveys of program directors found that the vast majority of family medicine residency programs teach residents to read and understand the medical literature, many provide lectures on research methods, and some provide dedicated research time and research electives.¹ ² Neale reported in 1997 that 49% of programs required residents to undertake research/scholarly projects.¹ Both the Accreditation Council for Graduate Medical Education (ACGME) and the Residency Review Committee (RRC) for Family Medicine state that family medicine programs must provide opportunities for research (including experience in principles of research design, performance, and analysis) and encourage research participation. In fact, research may soon be required prior to graduation.

It is unclear, however, what the outcomes are of these research curricula. For example, Hebert et al, in a systematic review of resident research curricula, identified 41 articles describing research curricula for training house officers. ³ She reported that evaluations of these curricula were rudimentary, with most limited to learners’ self-assessment. However, some of these studies have shown knowledge gains immediately after completion of research curricula, and one study found that residents’ perceptions of these overall academic preparations were associated with their interest in pursuing an academic career. ⁴ ⁶ but no studies have evaluated postgraduate long-term knowledge, attitudes, or behaviors that might be attributed to these research curricula. Conversely, there is ample evidence that these programs are difficult to develop and administer and that faculty and residents complain about lack of time and mentoring.⁷ Prior to making resident research a requirement in family medicine programs, therefore, the effectiveness of such curricula on postgraduate outcomes should be assessed.
In considering the potential benefits of research training on family medicine residents, I chose to investigate whether residents with research training would be more likely to have positive attitudes toward research, better knowledge in interpreting research findings, greater likelihood of reading research-oriented journals and completing searches of the medical literature for answers to clinical questions, and a greater likelihood of pursuing advanced training, research careers, or opportunities for teaching and research participation. This study determined if there were differences in these areas between family medicine graduates in Michigan who were or were not exposed to residency research curricula.

Methods
Sample
All 19 Michigan family medicine residency programs were approached to enroll in the study. The programs were located throughout the state and included rural, urban, and suburban programs.

Thirteen of the programs agreed to participate, and staff from these programs provided names and addresses of graduates over a consecutive 5-year period prior to 1998. If a program was less than 5 years old, addresses for all years of graduates were requested. In one program, which had instituted a research curriculum in the early 1990s, I requested 3 years of graduate names and addresses from before and 3 years after the research training was established. Of the remaining programs, seven had research curricula in place, and five did not have specific research curricula. Information about the presence or absence of a research curriculum was obtained from the program directors.

Instrument
I developed the survey based on a literature review and information obtained during conversations and presentations about resident research and potential outcomes for graduates. The survey instrument was pilot tested on a group of senior family medicine residents and faculty for content and ease of completion, and minor revisions were made. The instrument contained questions about demographics, research lectures provided and projects required during residency training (yes/no format), seven statements about the graduates’ opinions of their research training and importance of research (rated on a 5-point Likert scale from strongly agree to strongly disagree), two questions on knowledge of statistics (single best answer after a clinical scenario; see Appendix 1), the types of journals that graduates read regularly (yes/no format), their comfort with research articles (5-point Likert scale), sources used for answering clinical questions (checklist with responses ranging from will not use this source to would definitely use this source) and importance of these sources (necessary to unimportant), use of e-mail, additional training, and current teaching and research activities (all items using yes/no format). The respondents did not know the purpose of the survey (ie, linking research training during residency to postgraduate practice).

Survey Procedures
The self-administered survey was mailed to graduates of the 13 residency programs in Michigan in 1999. Program coordinators provided names and addresses of graduates or mailed the surveys directly (one program). A second survey was sent to nonrespondents after 3–6 weeks. Attempts were made to update addresses if surveys were returned undelivered using the American Academy of Family Physicians (AAFP) and American Medical Association (AMA) directories. Institutional Review Board approval was obtained for this study.

Data Analysis
The data were summarized using frequency statistics. Responses were compared between graduates from programs with research curricula and those without, using chi-square statistics for program demographics, training content, knowledge, and postgraduate teaching and research experiences and Wilcoxon two-sample test for Likert data comparisons. Two variables were created for types of journals read by respondents. These were coded: research-oriented journals (ie, New England Journal of Medicine, Journal of the American Medical Association, Lancet, and Journal of Family Practice) and clinically oriented journals (ie, American Family Physician, Postgraduate Medicine, and Emergency Medicine). At the time of the study, the Journal of Family Practice published research. Each variable was compared by the group of graduates, using chi-square statistic.

Survey responses from the single program with graduates from before and after implementation of a research curriculum were first analyzed separately (comparing pre-curriculum and post-curriculum data). These data were consistent with the responses from the larger group so the data from this program were then combined with the remaining programs for final analysis (the pre-curriculum survey responses combined with the responses from programs without research curricula and the post-curriculum data combined with responses from programs with research curricula).

Results
Respondents
The overall response rate was 53%, including 55% of graduates from programs with research curricula (128/234) and 51% from programs without research curricula (96/189). Program size for the 13 responding
programs varied from 6 to 16 resident positions offered per year. The number of full-time equivalent (FTE) physician faculty members ranged from 4 to 46. Excluding the two university-based programs with 15 and 46 faculty members each (the latter program including a resident research curriculum), the range of FTE faculty in the remaining programs was 4 to 10. There were no differences in average number of resident positions offered each year between programs with research curricula and those without (6.3 versus 6.6 positions offered per year). There was, however, a difference in average number of FTE faculty positions, with an average of 10.3 versus 8.2 faculty members in programs with and without research curricula, respectively. Excluding university programs, the average number of faculty members in programs with and without research curricula was similar (6.0 versus 6.5, respectively).

Among the six programs that refused participation, three were urban, and three were suburban, with two of these programs having rural offices as well. Residency positions for these programs ranged between 6 and 12, and FTE faculty ranged from 5 to 18 positions.

Demographic characteristics of the respondents are shown in Table 1. Mean age and gender distribution were similar between groups. There was a difference in mean year of graduation, with graduates from programs with research curricula graduating 1 year later on average. About one third of graduates from both groups held faculty positions in some capacity.

### Research Training and Outcomes

Graduates from programs with research curricula reported exposure to significantly more research lectures, research-related readings during residency, time provided for research, and completion of research/scholarly projects (80% completed projects versus 20%) than programs without research curricula (Table 1). Graduates from programs with research curricula also reported significantly greater appreciation for research and its importance and felt greater confidence in their research skills and comfort in doing research projects (Table 2).

There were no differences between groups in knowledge of statistics. Approximately half of each group was able to accurately interpret the meaning of a P value, and two thirds of each group was able to select sensitivity as the relevant test characteristic for the case presented. There were also no differences in correctly answering the knowledge questions when comparing residents who reported that they had specific training in statistics, comfort in undertaking a research project, or had excellent research skills with those who did not agree with these statements.

American Family Physician was the most commonly read journal (88%), followed by the Journal of Family Practice (38%), Journal of the American Medical Association (JAMA) (34%), Postgraduate Medicine (25%), and Family Medicine (20%). There were no differences in the types of journals read by graduates with one exception: graduates of programs with research curricula were more likely to read JAMA (40% versus 27%, P=.04). Sixty-six percent of residents from programs with research curricula read at least one research journal regularly compared to 56% of residents from programs without research curricula (P=.13), while 90% of both groups regularly read a clinically oriented journal regularly compared to 56% of residents from programs without research curricula (P=.13).

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*From strongly disagree (1) to strongly agree (5) on 5-point Likert scale—data are presented as means and analyzed using Wilcoxon two-sample test.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Research Curricula</th>
<th>No Formal Research Training</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (mean)</td>
<td>37.6</td>
<td>39.0</td>
<td>.07</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>58%</td>
<td>42%</td>
<td>.78</td>
</tr>
<tr>
<td>Graduation year (mean)</td>
<td>1995</td>
<td>1994</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Types of lectures (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical appraisal</td>
<td>91</td>
<td>67</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Research lectures</td>
<td>88</td>
<td>55</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Research reading</td>
<td>87</td>
<td>58</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Research time</td>
<td>86</td>
<td>60</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Research project (%)</td>
<td>80</td>
<td>20</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Faculty position (%)</td>
<td>30</td>
<td>38</td>
<td>.25</td>
</tr>
<tr>
<td>Full-time (%)</td>
<td>37</td>
<td>17</td>
<td>—</td>
</tr>
<tr>
<td>Part-time (%)</td>
<td>21</td>
<td>25</td>
<td>—</td>
</tr>
<tr>
<td>Affiliated (%)</td>
<td>42</td>
<td>58</td>
<td>—</td>
</tr>
</tbody>
</table>

* Between graduates of programs with and without formal research curricula.

### Table 2

Agreement* With Lessons Learned About Research and Obtaining Research Skills During Training**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Research Curricula</th>
<th>No Formal Research Training</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appreciate research</td>
<td>3.9</td>
<td>3.6</td>
<td>.003</td>
</tr>
<tr>
<td>Research importance</td>
<td>3.8</td>
<td>3.5</td>
<td>.003</td>
</tr>
<tr>
<td>Taught statistics</td>
<td>3.5</td>
<td>2.9</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Taught design</td>
<td>3.6</td>
<td>3.0</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Critical appraisal skills</td>
<td>4.0</td>
<td>3.5</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Literature searches</td>
<td>4.1</td>
<td>3.5</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Comfort in doing a research project</td>
<td>3.6</td>
<td>2.8</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Interest in learning more about research</td>
<td>3.1</td>
<td>2.6</td>
<td>.001</td>
</tr>
<tr>
<td>Excellent research skills</td>
<td>3.3</td>
<td>2.6</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

** Between graduates of programs with and without formal research curricula.
journal. There was also no difference between groups in the reported comfort with reading research articles or in the completion of computer-based literature searches in the past month (58% of the combined groups reported 0 to one searches, and 7% reported conducting more than eight searches).

Table 3 presents data on the likelihood that a graduate would use a particular source for answering a clinical question on treatment. Overall, textbooks were the information sources most likely to be used, and original research, CD-ROM materials, and pharmaceutical representatives were information sources least likely to be used. There were no differences between groups in use of these sources, with the exception of greater use of Medline searches for graduates of programs with research curricula (mean 3.6 versus 3.2, \(P=.05\)). Similar high percentages in both groups used electronic mail (75%).

The percentage of graduates who reported participation in teaching and research activities and obtained additional training are shown in Table 4. A high proportion of graduates in both groups were involved in teaching medical students and residents. Graduates from programs without research curricula were significantly more involved in supervising medical students in the office (79% versus 66%, \(P<.03\)). There was also a high level of participation in giving lectures on a local level in both groups. No differences were found between groups in giving lectures to a national audience.

There were no differences between groups in numbers of graduates obtaining additional training, including fellowship training (8% versus 12% for graduates of programs with and without research curricula, respectively) and procedural training (27% in both groups). There were also no differences in reported research experiences, including small numbers of graduates in both groups who had published papers or joined research networks. About one fourth of each group reported having participated in a research project since graduation. A higher percentage of graduates from programs without research curricula had completed practice audits (40% versus 25%, \(P<.02\)).

**Discussion**

The study results show a mixed picture of outcomes related to research training in Michigan's family medicine residency programs. Residents exposed to research curricula had more positive attitudes toward research and more reported comfort with research, but they showed no better statistical knowledge and little change in behavior compared to graduates of programs without research training. Although there was greater reported use of Medline searches in this group, this resource was toward the bottom of the list of options used in answering a clinical question. In addition, the frequency of conducting searches and reading research-oriented journals did not appear to be different by group. Residents exposed to formal research curricula were not more likely to pursue advanced training or research careers and did not participate more actively in research activities. In fact, graduates of programs that did not have formal research curricula reported more teaching of medical students and a higher percentage completed practice audits.

In some ways, these results come as no surprise. Research curricula were instituted with many (often unspecified) goals in mind, including gaining knowledge of critical appraisal and the process of research, stimulating intellectual curiosity, increasing willingness to be involved in research, increasing the resident's ability to conduct research, developing a higher degree of clinical proficiency and critical thinking, and uncovering early academic career interests. With so many disparate goals, it is easy to see why the influence of these curricula was diffused. Further, in a review of resident research curricula, Hebert et al found no reported curricular objectives in 44% of the papers identified. While many educators believe that training...
residents to understand research concepts and requiring the completion of research projects should produce more sophisticated research consumers and better clinical decision makers, long-term outcomes such as participation in research and publishing papers after graduation are not clearly delineated curricular goals.

One possible reason for the lack of differences in knowledge and behavior between graduates of programs with and without formal research training is that both types of programs nonetheless provide education in critical appraisal skills. However, despite the near-universal training in critical appraisal and evidence-based medicine concepts, statistical knowledge retention is not great and graduates appear to use the same traditional reference sources for answering their questions. I do not believe that this is likely to change, despite the provision of palm-top computers to residents, unless more training occurs in the use of these instruments at the point of care and more comprehensive sources of evidence-based material become available.

The main product of many research curricula is the completion of a research/scholarly project. In providing hands-on experience in doing research and reporting research results, one might anticipate that this would translate into greater future research participation. In fact, a number of residents do publish papers and some enter academic positions. DeHaven et al reported that 32% of residents from family medicine programs judged as most successful in providing research training published papers, 80% completed projects, and over half had an interest in practice-based research. Whether this interest will result in greater participation in research following graduation remains in question. In this study, despite the same percentage of Michigan graduates from programs providing research training completing projects, few joined research training networks and there were no differences in numbers reporting research participation by group. In looking at the results of this study, I believe that most residents would have benefited more from direct experiences with practice audits and practice quality improvement efforts. These activities use similar tools of research but have a clinical focus that is far more applicable to practice. The fact that more graduates of programs without research curricula reported completing their own practice audits suggests that the research experience may have turned residents off to this important type of self-assessment. Because this will be a future requirement of certification, I encourage faculty who teach critical appraisal and research to focus scholarly projects to this end.

Limitations

There are several limitations to this study. I only surveyed residents from Michigan family medicine programs, and I do not have detailed information about the intensity of research training within each of the programs. Although there were differences among programs in the content and structure of research curricula, it is possible that programs in other states might prove more or less successful in improving residency graduates’ practical research knowledge and behavior. In addition, the high level of involvement of these Michigan program graduates in teaching may make this sample unique. I also do not have observational data on information-seeking behaviors or the clinical outcomes that may be linked with them.

Conclusions

Existing research curricula such as those provided by Michigan programs do not appear to be the missing link in creating “research-savvy” graduates who practice evidence-based medicine and participate in research. If this is our intention, however, we need to create curricula that more clearly teach to these ends. That these curricula do instill more positive attitudes toward research among residents may mean that our early efforts in this area have created a receptive audience for future initiatives in achieving use of evidence at the point of care and increased participation in our developing national research networks.

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REFERENCES


Appendix 1

Statistics Knowledge Questions

1. A study of the effectiveness of a new drug indicates that the difference in outcomes between treatment and placebo was significant with $P<.05$.

   The most accurate interpretation is:
   A. The probability that the drug is better than placebo is at least 95%.
   B. The probability of observing this large a difference would be less than 5% if the drug was no better or worse than placebo.
   C. The drug is better than placebo—unless the advantage of the drug over placebo is actually less than 5%.
   D. The placebo is no more than 5% more effective than the drug.
   E. In a given case, the probability that the placebo will outperform the drug is at most 5%.

2. You are told that 95% of people with pancreatic carcinoma are found in a study to have in their blood a substance called serum factor 23 (SF23). From this information alone we can conclude:

   A. The test for SF23 is a specific test for pancreatic carcinoma.
   B. The test for SF23 is a sensitive test for pancreatic carcinoma.
   C. If a person does not have pancreatic carcinoma, he/she is unlikely to have SF23.
   D. If a person does not have SF23, he/she does not have pancreatic carcinoma.
   E. People who have SF23 in their blood are at high risk for pancreatic carcinoma.

The correct answer to both questions is B.