Impact of the Surgical Research Methodology Program on Surgical Residents' Research Profiles

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OBJECTIVE: To evaluate whether implementing the formal Surgical Research Methodology (SRM) Program in the surgical residency curriculum improved research productivity compared with the preceding informal Research Seminar Series (RSS).

METHODS: The SRM Program replaced the RSS in July 2009. In the SRM Program, the curriculum in Year-1 consisted of 12 teaching sessions on the principles of clinical epidemiology and biostatistics, whereas the focus in Year-2 was on the design, conduct, and presentation of a research project. The RSS consisted of 8 research methodology sessions repeated annually for 2 years along with the design, conduct, and presentation of a research project. Research productivity was measured as the number of peer-reviewed publications and the generation of studies with higher levels of evidence. Outcome measures were independently assessed by 2 authors to avoid bias. Student *t* test and chi-square test were used for the analysis. Frequencies, mean differences with 95% CI, and effect sizes have been reported.

RESULTS: In this study, 81 SRM residents were compared with 126 RSS residents. The performance of the SRM residents was superior on all metrics in our evaluation. They were significantly more productive and published more articles than the RSS residents (mean difference = 1.0 [95% CI: 0.5-1.5], $p < 0.001$) with an effect size of 0.26. The SRM residents presented significantly more projects that were of higher levels of evidence (systematic reviews/meta-analyses, randomized controlled trials, and prospective cohorts) than the RSS residents (52.5% vs 29%, $p = 0.005$). In addition, the research performance improved 11.0 grades (95% CI: 8.5%-13.5%, $p < 0.001$) with an effect size of 0.51 in favor of the SRM Program.

CONCLUSION: Although not all surgeons opt for a career as surgeon-scientist, knowledge of research methodology is crucial to appropriately apply evidence-based findings in clinical practice. The SRM Program has significantly improved the research productivity and performance of the surgical residents from all disciplines. The implementation of a similar research methodology program is highly recommended for the benefit of residents' future careers and ultimately, evidence-based patient care. (J Surg 71:513-520. © 2014 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: education, research methodology program, surgical residents, assessment, epidemiology, biostatistics

COMPETENCIES: Professionalism, Practice-Based Learning and Improvement, Interpersonal and Communication Skills

INTRODUCTION

Evidence-based medicine (EBM) is clinical expertise that uses the best scientific evidence for decision making.[1] The conscientious and judicious application of EBM requires a good understanding of research methodology. This is best accomplished early in training by teaching residents the fundamentals of research methodology and coaching them through the research projects required by their programs.[2] Several studies have emphasized the importance of and need for a course in research methodology for medical and surgical trainees of all levels.[3-6] Specific research courses and programs of varying length have been proposed, and their effectiveness in improving the research activity and productivity of medical trainees has been discussed.[6-15] However, a published formal curriculum focusing on teaching research methodology and

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stimulating research interest among junior surgical or medical residents does not currently exist.

We must train future physicians in research methodology to serve the prospective societal needs for clinician-scientists and to use EBM in clinical practice.[16] Best and Laskin[17] surveyed oral and maxillofacial surgical residents and concluded that many lacked sufficient knowledge in biostatistics and interpretation of research results. Many residents indicated that a course in these areas would give them the knowledge and skills to use EBM in practice and conduct high-quality research.

To promote the research profiles and EBM practice of our surgical residents, we embedded a formal 2-year educational research curriculum within the surgical residency protected teaching time of the Surgical Foundations (SF) curriculum titled "Surgical Research Methodology (SRM) Program." This cohort study aimed to assess whether implementing the formal SRM Program increased surgical residents' research productivity and performance compared with the preceding informal Research Seminar Series (RSS) at McMaster University. We hypothesized that the SRM residents would publish a greater number of peer-reviewed articles with higher levels of evidence.

METHODS

Based on a predefined protocol, we analyzed a retrospectively collected data set at the Department of Surgery between the academic years 2005 and 2013.

Study Population

Participants included surgical residents in their first postgraduate year (PGY). Approximately 25 to 30 surgical residents per year attended the programs and were from the following specialties: cardiac surgery, general surgery, neurosurgery, orthopedic surgery, plastic surgery, otolaryngology and head and neck surgery, urology, thoracic surgery, vascular surgery, and ophthalmology.

Interventions

SRM Program—Concept, Design, and Implementation

The SF curriculum is mandated by the Royal College of Physicians and Surgeons of Canada for surgical specialties. Residents must successfully complete the 2-year SF curriculum to become eligible for the Royal College of Physicians and Surgeons of Canada final certification examination in their surgical specialty (www.royalcollege.ca). Research education and practice for residents are highly recommended, but the content and the extent are not mandated in the curriculum. Thus, teaching and practicing research in surgical residency programs differ from institution to institution in Canada.

TABLE 1. SRM Course Topics

1	Orientation session
2	Systematic literature search
3	Ethics of conducting human and animal research
4	Research question and objectives, case-series and surveys
5	Descriptive statistics, distributions, and probabilities
6	Outcome measures
7	Sampling and hypothesis testing
8	Estimations and confidence intervals
9	Case-control studies
10	Cohort studies
11	Randomized controlled trials
12	Systematic reviews and meta-analyses
13	Diagnostic accuracy studies

We implemented a formal 2-year SRM curriculum in July 2009. This curriculum was designed through informal focus group meetings of surgical research experts. We used clinical epidemiology textbooks as guides for planning the program.[18,19] In Year-1, PGY1 surgical residents must attend a 1-year interactive and progressive course on the principles of clinical epidemiology and basics of biostatistics (Table 1). The SRM Program started with an orientation session followed by 12 modules. Each module included a large-group lecture encompassing surgical research examples, followed by small-group assignments and a short quiz. The reading materials, slides, and assignments were e-mailed to the residents and posted on a website before each session. Residents who have an acceptable reason for missing a session received an e-mail reminder that they must complete a make-up quiz before the next session. Otherwise, they had to attend the missed session and complete the quiz in Year-2.

In Year-2, PGY2 surgical residents used the protected time to design a research project, write up a protocol, obtain ethics approval and funding if required, and embark on their project. Residents met regularly with their research and clinical supervisors to refine the research methodology of their projects as needed. Each PGY2 resident made a formal presentation for 1 of the 3 half-day SRM research presentation days. Residents presented either a proposal or a completed study. The content and format of the presentations followed a predefined criterion that was sent to the residents *a priori*. Residents received feedback to refine their project before completion. The program itself is constantly evaluated and improved based on the feedback received from the residents.

Research Seminar Series

The RSS preceded the SRM Program and ran from July 2005 to June 2009. Starting in July, both PGY1 and PGY2 surgical residents attended a series of large-group lectures on sporadic research methodology topics. A 1-hour quiz of