The Resident Outcome Project: Increased Academic Productivity Associated with a Formal Clinical Research Curriculum

Thomas J. Miner, MD, Pamela Richardson, William G. Cioffi, MD, and David T. Harrington, MD

Department of Surgery, Rhode Island Hospital/The Warren Alpert Medical School of Brown University, Providence, Rhode Island

PURPOSE: A formal 2-year clinical research project in conjunction with a system-based practice and practice-based learning and improvement curriculum was initiated for all residents in our program. Within the structure of this formal clinical research curriculum, residents are required to develop a research hypothesis, develop an appropriate study design, collect and analyze data, and present a completed project.

METHODS: At the end of the PGY1 year, residents select a project with an emphasis on quality improvement or clinical outcomes. The first 6 months of the 2-year program are dedicated to the identification of a faculty mentor and submission of a formal proposal to both the departmental education committee and to the institutional IRB. Over the following 12 months, residents meet monthly for required group research meetings. The final 6 months are focused on data analysis and project completion.

RESULTS: Seventy-five residents have successfully completed the clinical research program since it was initiated in 2002. Completed projects led to abstracts accepted at 33 national or regional meetings and 11 peer reviewed publications to date. In addition, 3 major hospital wide quality improvement measures were initiated based on project findings. Following the first peer reviewed publication associated with these research projects in 2006, there have been significant increases in not only the number of accepted abstracts from these resident projects (3/18 [17%] vs 30/57 [53%], $p = 0.008$) but also the total number of all accepted resident clinical research (mean accepted abstracts per year 7.9 vs 1.0, $p = 0.009$ and mean peer reviewed publications per year 6.8 vs 2.0, $p = 0.003$.)

DISCUSSION: Increased academic productivity was observed after a formal resident clinical research program was initiated in our program. Resident research efforts extended beyond the specific initial outcome projects as skills gained allowed for future independent clinical research. (J Surg Ed 76:e161–e166. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Surgical education, Scholarly activity, Resident research, Academic productivity and surgical curriculum

COMPETENCIES: Systems-Based Practice, Practice-Based Learning and Improvement, Professionalism, Medical Knowledge

Key Points

1- Question: Can a formal resident clinical outcome project improve resident academic productivity?
2- Findings: There have been significant increases in not only the number of accepted abstracts but also the total number of all accepted resident clinical research and mean peer reviewed publications per year.
3- Meaning; Skills gained during the Resident Outcome project allowed for future independent clinical research and was associated with increased academic productivity.

INTRODUCTION

Providing residents with the core knowledge to improve patient care through practice-based learning and improvement is an essential component of surgical training. Emphasis on teaching and demonstrating these skills continues to challenge educators to meaningfully and effectively incorporate this ACGME core competency into their

Correspondence: Inquiries to Thomas J. Miner MD, Warren Alpert Medical School of Brown University, Rhode Island Hospital, Department of Surgery, 593 Eddy St- APC 439, Providence, RI 02903; fax (401) 868-2310; e-mail: thomas.miner@brownphysicians.org

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program's curriculum.[1] Although many programs use a morbidity and mortality conference or depend on medical record audits to help learners evaluate potential errors and think about ways to improve their practice,[2-6] these activities do not teach residents about the science of improvement which involves a cycle of 4 steps—identifying areas for improvement, engaging in learning, applying new knowledge and skills to practice, and checking for improvement.[7] The deliberate and judicious application of these skills requires a good understanding of research methodology and evidence-based medicine which can be taught at all levels of training.[8]

Although not all surgeons want to pursue a career in research, integration of research activities into Graduate Medical Education remains a requirement for surgical residency training. A common citation (especially for small programs) has been a lack of scholarly activity.[9] There are many advantages and benefits to the resident and program that embrace scholarly activity.[10] Evidence suggests that performing research during residency correlates with an academic surgical career after postgraduate training. Robust resident research can improve critical appraisal skills, clinical reasoning, and lifelong learning as well as improve faculty engagement through mentorship and advisement.[9] Not only do research programs promote strong academic reputations that may facilitate faculty development and promotion, they also may result in more competitive resident and fellowship recruitments. The challenges of publishing research for surgical residents are frequently observed regardless of program size. Academic productivity can be highly variable and based on the personal interest and time investment of individual residents. Obstacles to resident participation in research include lack of time, infrastructure, mentoring, and financial support. Even programs advantaged with established and robust academic and research opportunities can struggle to teach the clinical research methodology and biostatistics crucial to applying evidence-based findings in clinical practice.[8-11]

To support our curriculum in system-based, practice-based learning and improvement and enhance clinical research opportunities we developed the Resident Outcome Project. This mandatory program provides high-level clinical outcomes and quality improvement training supported by formal instruction, clinical investigation and analysis, and faculty mentoring. The Resident Outcome Project is divided into multiple phases which progressively provide residents with the requisite knowledge and skill to support meaningful scholarly activity.

METHODS

With the first-year class of 2002-2003, an outcomes project requirement was added to the curriculum of the General Surgery Residency Program at the Warren Alpert Medical School of Brown University. The project is performed during clinical training and is not meant to require additional "research years." The intended focus of these projects is quality improvement; encouraging the resident to assess a practice in surgery, to design a project further investigation, and to conduct that project to completion. After participating in a basic clinical research curriculum during the PGY1 year (which include sessions on statistics for surgeons, critically reading a journal article, effectively presenting your work, asking the right clinical questions, maximizing a mentoring relationship,) residents select a project with an emphasis on quality improvement or clinical outcomes. As outlined in Figure 1, the first 6 months of the 2-year program are dedicated to the identification of a faculty mentor and submission of a formal proposal to both the departmental education committee and to the institutional IRB. Residents choose a project based on their individual interests and receive no specialized training on the selected topic. Over the following 12 months, residents gather monthly for required group research meetings (Fig. 2) during which specific clinical research topics are taught, updates are presented on each project, and solutions to individual research problems are discussed. The resident monthly updates are assessed by faculty mentors and Program leadership and real-time feedback is given. Because the curriculum is presented annually, residents are exposed to these topics 3 times as they progress through the program. Meeting minutes and project summaries are provided regularly. The final 6 months are focused on data analysis and project completion. Acceptable projects are selected for presentation at Surgical Grand Rounds. Peer-review submissions are strongly encouraged and supported. All funding for meeting registration and resident travel to present their work was provided by the program.

The outcomes for this study include the number of presentations at local meetings, presentations at regional/national meetings (both oral and poster presentations accepted by peer review), and accepted manuscripts (to included traditional manuscripts and formal quality improvement policies formally accepted either at a Departmental or Institutional level). Review of past Surgical Grand Rounds records, residents' yearly submitted Curricula Vitae, resident travel reimbursement records, and a PUBMED search of all previous residents was used to determine scholarly activity.

RESULTS

Seventy-five residents have completed the clinical research program since it was initiated in 2002. The

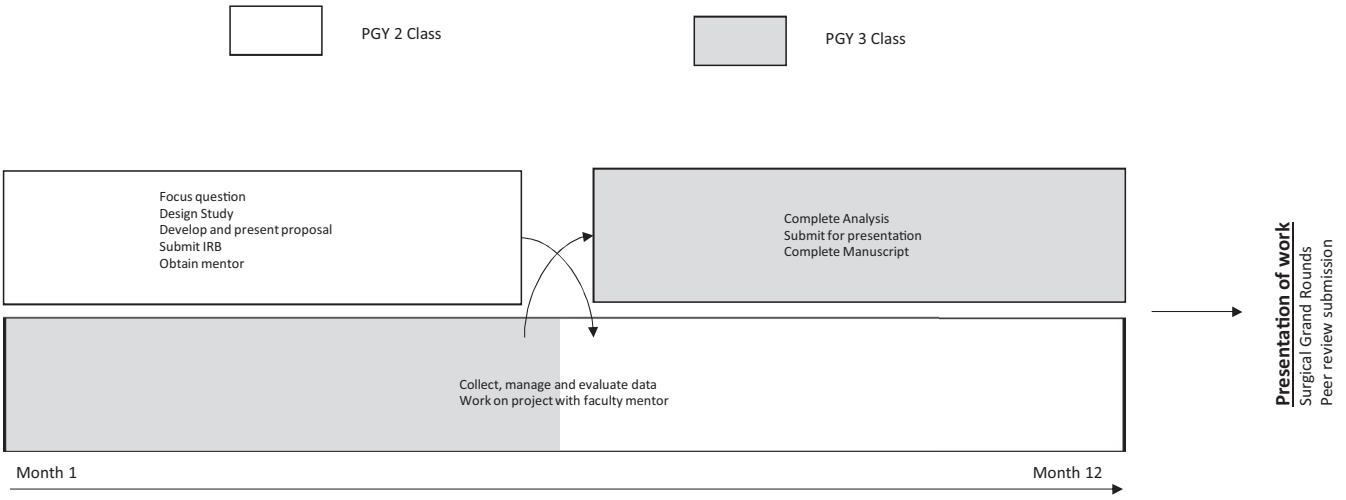

FIGURE 1. Schematic diagram of outcomes project curriculum. Residents participate in the annually repeating curriculum during the clinical PGY 2 and PGY3 years. At the completion of the 3-year program, residents are required to present their work at departmental Grand Rounds. Peer-review submissions are strongly encouraged and supported.

number of residents participating in the program varied slightly year to year in association with the growth of our program from 5 to 7 categorical residents per year, the loss of preliminary PGY2 and PGY3 plastics surgery residents, and a new requirement 3 years ago to include residents who completed a voluntary 3 to 3-year basic science experience. At the completion of the Resident Outcome Project, 80% (60/75) residents submitted work suitable for Surgical Grand Rounds. Residents were excused from completing this requirement at the discretion of the Program Director to focus on individual remediation programs (7/15 [47%]) and to facilitate transition from their preliminary positions to other programs or specialties (3/15 [20%]). Five (5/15 [33%]) residents presented submissions that were unacceptable for Grand Rounds presentation and were given the opportunity to improve their work prior to presentation at other departmental venues. All Surgical Grand Rounds presentations were evaluated formally by faculty and found to have met expectations. Residents were given immediate feedback on their performance. Table 1 summarizes the topics of Resident Outcome projects.

Completed projects led to abstracts accepted at 33 national or regional meetings and 11 peer reviewed publications. In addition, 3 major hospital wide quality improvement measures were initiated based on project findings. Following the first peer reviewed publication associated with these projects in 2006, there have been significant increases in not only the number of accepted abstracts from these resident projects (3/18 [17%] vs

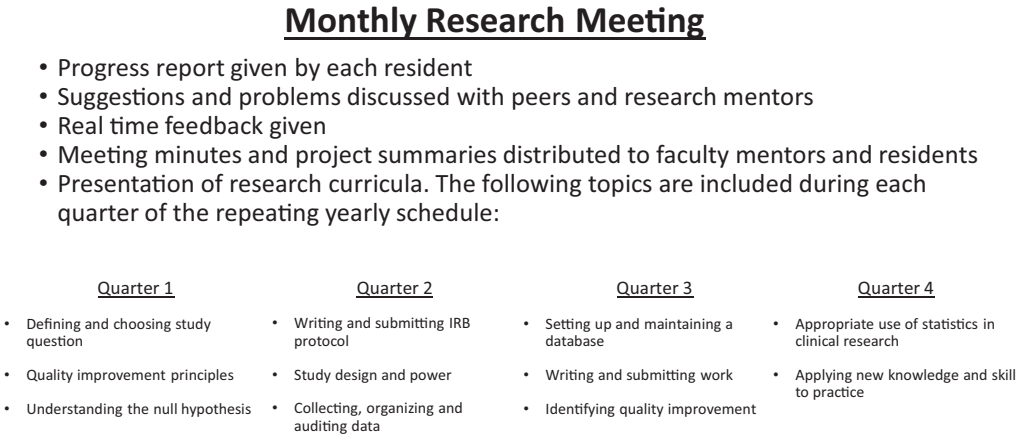

FIGURE 2. Monthly meetings support maturation of projects and allow presentation of necessary topics. Specific clinical research topics are presented to supplement discussions and address common problems. These resident monthly updates are assessed by faculty mentors and program leadership and real-time feedback is given.

TABLE 1. Resident Outcome Projects

Process based: Insurance status and functional outcomes (hand flexor injuries); Time to operation in emergency procedures (delays to OR, delays to diagnosis); Effect of early discharge and readmissions, Effect of weight loss surgery on dependent minors; Improving resource utilization (blood draws, supplies), Skills training (learning attitudes, handoffs); Heparin induced thrombocytopenia reduction in the ICU; Intra-cranial pressure placement and socioeconomics; Influence of structured educational conference on standardized tests scores; Influence of intraoperative neo on subsequent resuscitation; Influence of admitting service and acute pancreatitis, Improving postoperative follow up after trauma.

Disease based: Influence of sarcopenia (rib fractures, palliative surgery); Failure to rescue and medical comorbidities; National surgical quality improvement program risk calculator and palliative oncology operations; Impact of splenic salvage (immune state, vaccination use); Local vs national parathyroidectomy practices; Breast reconstruction following mastectomy; Trauma in the elderly (rib fractures, falls on coumadin); Significance of bowel pneumatosis on CT, Predicting success in nonoperative management of Small bowel obstruction.

Procedure based: Gastrostomy tubes (utility of procedure, ability to reach volume based and caloric feeding goals); Nasogastric tube placement (natural history, preventing reinsertion); Liver function following liver directed therapy for HCC; Accuracy of touch preps in sentinel node biopsy; Utility of pouchograms following ileoanal procedures; Intraoperative ultrasound during breast conservation therapy; Use of percutaneous tracheostomies; Patient satisfaction following RFA for varicose veins; Complications and donor nephrectomy; Graft function after sequential kidney transplants; Mediastinoscopy and Positron emission tomography; Tissue plasminogen activator and empyema; Stents for esophageal cancer.

Quality Initiative

Perioperative Colorectal Bundle; Code Rupture (AAA); Small Bowel Obstruction Clinical Pathway; Integrated Outpatient Burn Clinic.

30/57 [53%, p = 0.008). As summarized in Figures 3 and 4, the total number of all accepted resident clinical research increased as well. During this period the mean number of accepted abstracts per year increased from to 1.0 to 7.9 ($p < 0.001$) and the mean number of accepted peer reviewed publications per year increased from 2.0 to 6.8 ($p < 0.001$.) During the same period, the productivity of residents performing 3 years of dedicated laboratory research remained relatively constant (mean 1.8 basic science publications per year and mean 3.6 basic science abstracts per year.)

DISCUSSION

The 6 ACGME core competencies on which all programs teach and evaluate residents—patient care, medical knowledge, communication, professionalism, system-based practice and practice-based learning—forced program directors to look at all areas of competency and not just the areas that would normally draw the closest scrutiny—knowledge and patient care. Before the introduction of the 6 core competencies, training programs certainly taught and evaluated residents in these

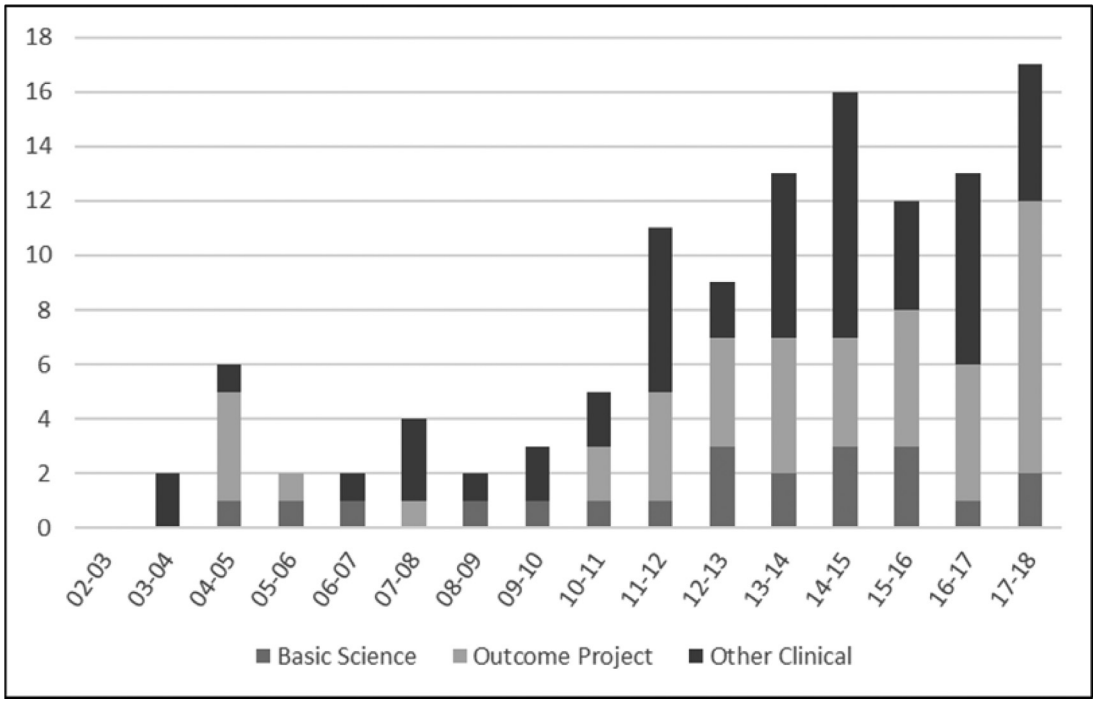

FIGURE 3. Number of accepted peer review publications by general surgery residents per year.

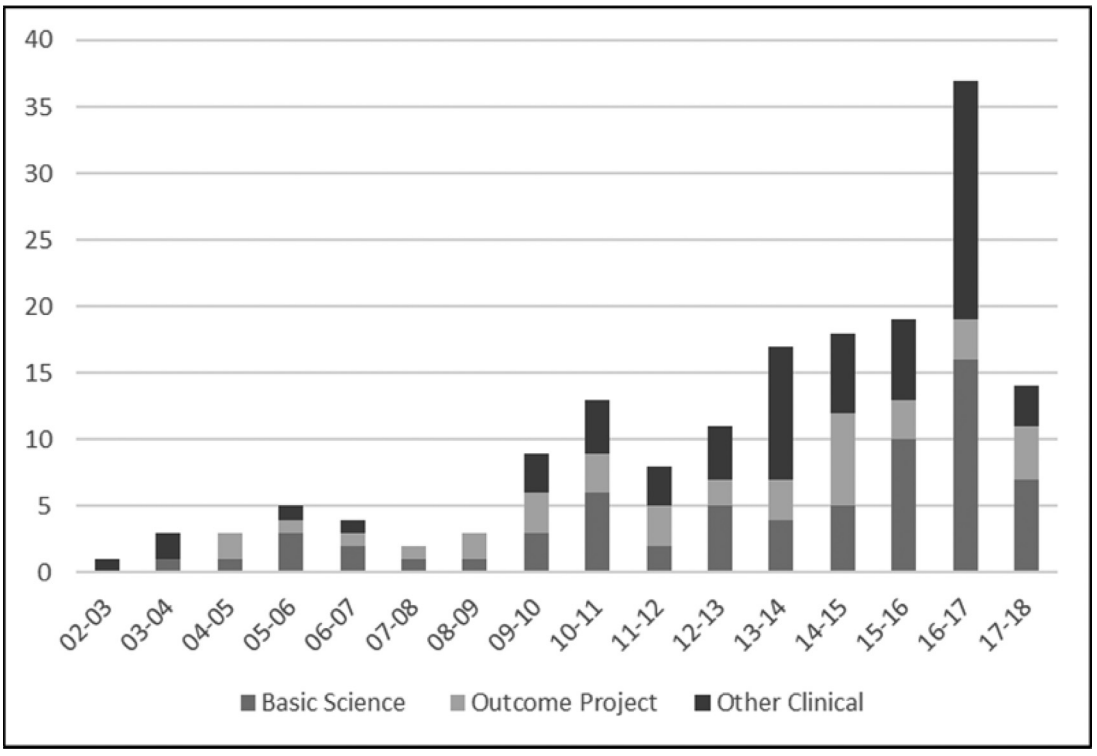

FIGURE 4. Number of accepted abstracts by general surgery residents per year.

domains, but more precise definitions of these areas challenged modern program directors to refine their methods.[2,12] Our Program instituted the Resident Outcome Project over a decade ago intending to improve competency in practice-based improvement and system-based practice. We believe that this curriculum has benefited our residents by giving them both the knowledge and practical experience to support a career-long ability to identify areas for improvement, engage in new learning, apply new knowledge and skills to clinical practice, and check interventions for improvement. In addition to participating in common educational practices to learn system-based practice such as Morbidity and Mortality presentations and chart audits, completion of this 3-year program provides our residents not only with a comprehensive and robust knowledge based but provides a rigorous educational capstone to enhance their abilities in system-based practice and outcomes science. Because demonstrating competency in system-based practice is poorly defined and traditionally challenging to programs, we have found that progression through this program allows for collection of useful performance measures (to include IRB submission, Grand Round Presentation, Presentation at group research meetings) that greatly supports the work of our Clinical Competency Committee.

The curriculum included both formal instruction and faculty mentoring to support the research component of this program. Although resident academic productivity has steadily increased since the start of the Resident Outcome Project, multiple confounding variables make it impossible to assign causality to this observation. The variable influence of individual resident motivation, inquisitiveness, professional aspirations, antecedent research experience, faculty experience and productivity on specific topics, and personal obligations are impossible to assess in this analysis. The influence of changing expectations within the program as the standard of academic success and productivity increased similarly limits full evaluation of this program. Since the total number of journals that each project was submitted to before eventual submission was not recorded, it is not known whether this program was associated with better manuscript acceptance rates. Nevertheless, we feel that the process of developing and supporting the Resident Outcome Project has established a structure within our program conducive to academic productivity. Experience gained by participating in this program during the first half of residency training extended beyond the specific initial outcome projects as skills gained allowed for future independent clinical research later in residency. Additional opportunities later in residency might come about following mentoring relationships developed while working on the project.

Although the overall structure of the program has remained stable over time, subtle modifications were made to improve it. These include consistency in the PGY 1 research curricula, inclusion of only categorical

general surgery residents, and required participation of basic science laboratory residents in recognition of the distinct difference in basic science and clinical research. To encourage manuscript submission following presentation at meetings, program leadership instituted a policy requiring residents to submit manuscripts prior to approving travel funding to future presentations. This intervention was associated with the only noticeable decrease in academic output as seen last year in the number of presentations given. Following a "catch-up" period, midway through the current academic year, presentation numbers appear to have returned to normal levels. Because of the overall academic productivity of residents in our Program and the observation that failure to publish during residency was rarely seen among our graduating chief residents, program leadership has not supported a publication requirement as suggested by other authors.[10]

Change in surgical education is constant. Program leaders are inundated by proposed initiatives and published requirements by our certifying and accrediting bodies. The impact of each change must be assessed in the setting of current program structure and available local resources. This forces a careful assessment of the "core business" of surgical education and surgical residency design to maximize efficiency. Moving from the traditional apprenticeship model of training, where residents participated in all aspects of surgical care required to become a competent surgeon without concern for the hours of training, surgical educators have had to evaluate the specific educational value of each resident's experience. As the curriculum becomes more streamlined, educators are forced to come to the difficult conclusion that they are working on a fixed income (if something is to be added, what is to be discarded?) and are increasingly forced to look for curricula that serve multiple purposes.[12] By combining resident research with deliberate teaching of systems-based surgical practice, we have found that programs such as the Resident Outcome Project have been particularly valuable to achieve that goal.

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SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.jsurg.2019.07.016.