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AOA Critical Issues in Education

A Dedicated Research Rotation Increases Orthopaedic Residency Scholarly Activity

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Introduction: Although clinical research has traditionally been a part of orthopaedic residency, there are now certain core requirements created by the Accreditation Council for Graduate Medical Education (ACGME), which outline the type of research activities to be completed during residency. However, there are no specific details included in the ACGME guidelines regarding how these milestones are to be met. Nor is there specificity regarding expectations of scholarly activity to be completed by the time of graduation. There is a paucity of literature demonstrating the effectiveness of implementing a dedicated research block in an orthopaedic surgical residency, especially in the community setting where limited research-related resources are available.

Methods: We implemented a dedicated research rotation along with a set of research milestones and guidelines at our single orthopaedic surgery community residency program. A search was performed through PubMed using residents' and faculty members' names to find publications included a 7-year period from 2015 to 2022 to determine number of publications by residents and faculty. Scholarly activity of faculty was analyzed and quantified using self-reported annual surveys.

Results: The average annual number of resident publications (by all 25 residents) increased from 2 to 26 after implementation of a dedicated research rotation. Faculty's scholarly activity, as measured by the following criteria, increased as well: number of publications (from 22 to 55), conference presentations (from 51 to 83), and other presentations (from 43 to 72).

Conclusion: Implementation of a dedicated research rotation in a community orthopaedic residency program is associated with an increased publication rate in major academic journals among residents and faculty. There is also an observed association with implementation of a dedicated resident research rotation and an increase in faculty scholarly activity satisfying ACGME faculty requirements.

Introduction

Research is integral to the training and professional growth of a resident physician. The ACGME core requirements for graduate medical education in orthopaedic surgery state that "*Each resident must demonstrate scholarship through at least one of the following activities: participation in sponsored research; preparation of an article for a peer-reviewed publication; presentation of research at a regional or national meeting, or participation in a*

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structured literature review of an important topic"[1]. These requirements facilitate an improved resident education model because research has been shown to impart skills related to critical judgment, the ability to view and observe situations without bias, and the ability to maintain open-mindedness without defaulting to preconceived notions[2]. Moreover, active participation in clinical or laboratory research investigation directly exposes residents to the scientific method, the process of ascertaining statistically significant results, and stimulates intellectual curiosity while contributing new knowledge to the medical field[3]. In fact, there is evidence to suggest residents who receive research training have a greater appreciation for evidence-based medicine and receive better clinical competence scores[4]. Finally, publishing research can increase standing among peers, present opportunities to travel and share findings, and provide the opportunity to bolster one's curriculum vitae before applying to fellowships[2]. Given these findings, it is our belief, and the belief of the ACGME, that scholarly activity and engagement in research are extremely beneficial for orthopaedic residents.

Given the rigorous schedule of a surgical resident, between clinical obligations, call obligations, and preparing for and performing surgical cases, there is often little time made for research. Therefore, we believe it is beneficial to implement a dedicated protected research rotation in orthopaedic residency programs to maximize resident engagement in scholarly activity and research. This article describes a practical approach for program directors, faculty mentors, and residents to optimize the clinical research experience. The focus is on clinical research because the time required to conduct a basic science project is often prohibitive[5].

To evaluate the effectiveness of a dedicated research rotation, we compared the number of resident publications in major academic journals before and after the implementation of said research rotation. We also evaluated how the implementation of a designated resident research rotation affected faculty engagement in scholarly activity and resident education. All residents and faculty were from an established ACGME-accredited community-level orthopaedic residency training program. The aim of this study is to propose a structured set of guidelines for a dedicated research rotation in orthopaedic residency in the community setting with limited research-related resources and support. We believe that our results could be relevant to traditional orthopaedic residency programs that are looking to successfully implement more research opportunities into their programs in an organized, cost-effective, and productive way.

Materials and Methods

This study is a case study comparing the annual number of resident publications in PubMed-indexed academic journals before and after the implementation of a dedicated research rotation in a community-based orthopaedic residency program that consists of 25 residents. We also evaluated how the implementation of a dedicated research rotation affected faculty engagement in scholarly activity and resident education as demonstrated by number of publications, conference presentations, and other presentations given. The data for this analysis were collected over a period of 5 years before implementation (July 2015 to July 2020) and 2 years after implementation (July 2020 to July 2022) of the dedicated research rotation guidelines.

A search was performed using resident and faculty names in PubMed to obtain number and date of resident and faculty publications. To quantify faculty engagement in scholarly activity in the areas outlined above, an annual self-reported survey was sent to all attending surgeons who were approved by our curriculum committee to be a part of the residency program. These attendings were chosen because they were involved with either our education and training curriculum or collaborated with residents on research projects in the past. Those attendings included were employed in our 3-hospital community setting or at our 3 away rotation sites at larger academic centers. Sixty faculty members were sent identifiable surveys through email, and there was a 100% response rate.

During the dates analyzed in this study, there was no change in research-related resources available to residents or faculty. There was also minimal turnover in faculty during this time with only 2 attendings who left the hospital systems.

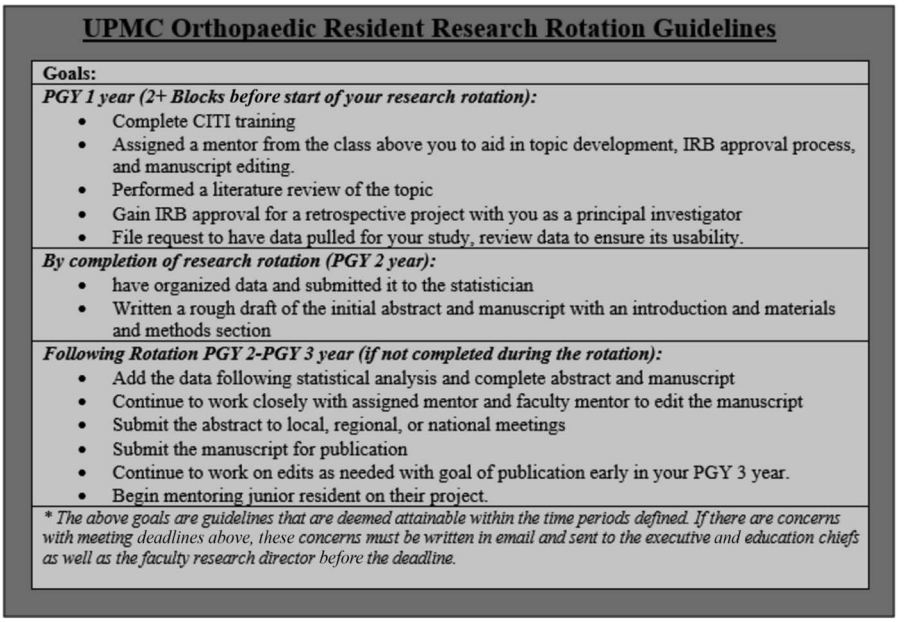
Structure of Dedicated Research Rotation

Our research rotation was implemented at a community-level orthopaedic residency program, which has 5 residents per year. Before implementation of this research rotation, there was no dedicated time for resident scholarly activity. The residency program had minimal allocated funding dedicated to publication fees, but no other funding for other research-related endeavors. There was no research coordinator. The healthcare system did employ one full-time statistician who was used by all services throughout 3 different hospitals. The library available to the residents in our program consists of one faculty member. In addition, there was very limited access to medical students to aid in the collection or processing of data.

In 2020, in a collaborative effort that included chief residents, our residency program director, and 2 core faculty attendings, we created guidelines for a research rotation and included milestones to be completed before, during, and after the said research rotation. We also included recommendations on how these milestones could be met. These guidelines were instituted and enforced by the above-mentioned chief residents, residency program director, and core faculty members.

The guidelines, as depicted in Fig. 1, include goals for postgraduate year (PGY) 1 to 3 in the time leading up to, during, and after the protected research rotation. In PGY 1, residents complete the Collaborative Institutional Training Initiative program. This training is necessary at our institution for any investigators performing research involving human subjects before receiving Institutional Review Board (IRB) approval. They are also assigned a mentor from the PGY class above. They are expected to choose a research topic, perform a literature review, and gain IRB approval for a retrospective project on which he or she is the principal investigator. In addition, they are expected to have obtained and reviewed data for their respective project.

In PGY 2, residents have their dedicated research rotation which lasts 6 or 7 weeks. There are 2 goals to accomplish by completion of the research rotation. First, they aim to organize



UPMC Orthopaedic Resident Research Rotation Guidelines

Goals:

PGY 1 year (2+ Blocks before start of your research rotation):

- Complete CITI training
- Assigned a mentor from the class above you to aid in topic development, IRB approval process, and manuscript editing.
- Performed a literature review of the topic
- Gain IRB approval for a retrospective project with you as a principal investigator
- File request to have data pulled for your study, review data to ensure its usability.

By completion of research rotation (PGY 2 year):

- have organized data and submitted it to the statistician
- Written a rough draft of the initial abstract and manuscript with an introduction and materials and methods section

Following Rotation PGY 2-PGY 3 year (if not completed during the rotation):

- Add the data following statistical analysis and complete abstract and manuscript
- Continue to work closely with assigned mentor and faculty mentor to edit the manuscript
- Submit the abstract to local, regional, or national meetings
- Submit the manuscript for publication
- Continue to work on edits as needed with goal of publication early in your PGY 3 year.
- Begin mentoring junior resident on their project.

** The above goals are guidelines that are deemed attainable within the time periods defined. If there are concerns with meeting deadlines above, these concerns must be written in email and sent to the executive and education chiefs as well as the faculty research director before the deadline.*

Fig. 1

Guidelines and recommendations for orthopaedic residency research rotation

data and submit it to the statistician. Second, they are to complete a rough draft of the initial abstract and manuscript.

During research rotations, residents still had operative responsibilities. However, these only included coverage of one attending at one hospital for only 2 to 3 days per week (satisfying operative and office requirements). Residents were still required to fulfill the ACGME requirement of 1 to 2 half days of clinic per week as well. It was also mandated that a weekly schedule was made to ensure that the resident who was on the research rotation had at least 2.5 protected workdays dedicated to research per week without any other operative or clinical responsibilities during that time.

In PGY 2 after the dedicated research rotation and in PGY 3, residents complete the manuscript for their study and continue to make edits with the help of their assigned mentor. The abstract is submitted for presentations in local, regional, or national meetings. This is also the time that the manuscript is submitted to journals for publication. The guidelines culminate with the end goal of having a publication by early in PGY 3 and to begin mentoring junior residents in their research process. Because most research projects were retrospective in nature, case studies, and review articles, this was ample time to complete at least one study and perhaps start a prospective study or randomized controlled trial.

In addition to the above guidelines, we also designated one faculty member to be head of residency research and scholarly activity. Residents were required to attend a quarterly meeting with this faculty member. These were group meetings with all residents present where each resident takes a turn describing their research progress to the group. At these meetings, goals associated with these projects, obstacles to publication, and potential solutions to overcome these obstacles. These meetings serve as group brainstorming activities and facilitate peer-to-peer accountability, which helps ensure completion of projects in a timely manner. It was also mandated that at least one attending physician was involved in each resident's research project in some capacity.

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Results

Data involving 40 residents and 60 faculty members over a period of 7 years were obtained. A period of 5 years of data before and 2 years after implementation of a dedicated research rotation was evaluated.

Resident Publications

Based on a PubMed search, a notable increase in the number of total publications in major academic journals by residents was observed after the implementation of a dedicated resident research rotation. The total number of publications by the entire 25 resident program was 9 before implementation of a dedicated research rotation and 52 after implementation. There was an increase in the average annual number of publications by the entire 25 resident program as well from 2 to 26 (Table I). There did not seem to be any significant outliers who provided most publications. Rather, they were divided relatively evenly among the residents.

TABLE I Total Number and Average Annual Number of Publications by Residents Before and After Implementation of a Dedicated Research Rotation

	Before Implementation	After Implementation
Total number of publications	9	52
Average annual number of publications	1.6	26

Faculty Scholarly Activity

Table II shows the results of the Faculty Scholarly Activity survey, which was administered to 60 faculty members approved to be a part of the residency. The survey was sent in an identifiable self-reported email format. There was a 100% response rate. There was a notable increase in faculty academic and scholarly activity in all surveyed parameters after the resident research rotation was implemented.

The annual number of publications by faculty before implementation of a dedicated resident research rotation was 22. This increased to 55 after implementation. There was an increase in the annual number of faculty conference presentations from 51 to 83. This could include local, regional, or national conferences. The annual number of other presentations by faculty members which could include less formal, resident-directed presentations also increased from 43 to 72.

Discussion

Research has been universally recognized as an integral part of orthopaedic residency training[6-13]. When started early in one's career, participation in research activities has been shown to correlate with future involvement in academic endeavors and improved quality of outcomes[13-16]. It is also correlated with increased acceptance into fellowship programs[17]. However, incorporating research into an orthopaedic residency program and developing resident interest in research has become increasingly challenging[6,18,19].

Bechtold et al. identified several barriers to completing research in residency programs including funding, lack of interest, and the emphasis on clinical productivity over scholarly productivity. He also outlined recommendations for overcoming these barriers. One such recommendation was to incorporate protected research time into residency curriculum[18]. Other authors have described the implementation of a required research rotation in residency and have even outlined how this could achieved to increase funding and peer-reviewed publications[12-14,20,21]. However, to the best of our knowledge, no specific actionable plan or set of guidelines for implementing a dedicated research rotation has been described that pertains to residency programs in a community setting without extensive academic resources or affiliation with a large tertiary medical center. In this article, we have outlined such a plan and have demonstrated a secondary benefit of increasing faculty scholarly activity and involvement in a residency program.

In this 7-year analysis, we demonstrated that after implementing a dedicated resident research rotation, there was an increase in resident peer-reviewed research publications as well as an increase in faculty publications, presentations, textbook authorship, leadership, and teaching roles. These are quantitative and qualitative indicators of improvement related to residency program research and education. During the investigative period, there were no major changes in our institution related to research, faculty employment, or funding.

Granger et al. described how restructuring an orthopaedic residency research rotation correlates to increased academic productivity in teaching faculty[21]. We have demonstrated how this is possible in a community-setting program where faculty may not have an extensive history of research or scholarly activity. We have also demonstrated how this increased productivity among residents and faculty alike can be maintained through faculty mentorship and scheduled quarterly meetings as described initially by Holoyda et al[22].

Faculty academic and scholarly activity was based on an email survey sent to 60 different faculty members. The parameters listed in Table II are exactly as each response category was worded in the surveys. Therefore, there were no specific details regarding what each category entails, and thus, there may be a lack of standardization in responses. However, we believe that given the breadth of activities that could be involved in the survey, and the fact that there was an improvement in every category regardless of providing no incentives for productivity, this represents an overall improvement in faculty involvement in the academic and scholarly activity related to our residency program. This improvement is also chronologically associated with the implementation of our dedicated resident research rotation. It is worth noting although every faculty member surveyed contributed to scholarly activity related to the residency, some contributed more than others. The attendings employed at the academic centers where our residents travel for away rotations contributed most to the increase in faculty scholarly activity participation, mostly in the annual number of faculty publications. However, some of these publications involved the residents from our community residency program and oftentimes were spearheaded by these residents. Further developing these resident-attending

TABLE II Faculty Academic and Scholarly Activity Based on Annual Self-Reported Email Survey

	Before Implementation (Annual Ave Rounded to Nearest Whole Number)	After Implementation (Annual Ave Rounded to Nearest Whole Number)
Publications	22	55
Conference presentations	51	83
Other presentations	43	72

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relationships through collaboration on research projects also led to more invitations for these attendings to give grand rounds and/or guest lectures at our community hospitals. ■

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