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The Importance of Post-Doctoral Program to GME in an Academic Medical Center

Tracy L. Butryn, Parampreet Kaur, Vikas Yellapu, Alyssa Green and James Dalkiewicz

Abstract

Continuous advancements in the medical field and the need to promote scientific evidence has increased the concern for educators to ensure that physician trainees are provided with the appropriate tools and experiences to develop the skills necessary to enhance scientific discovery. To address this requirement, the Accreditation Council for Graduate Medical Education (ACGME) implemented core competencies, inclusive of scholarly activity requirements, for accreditation of Graduate Medical Education (GME) programs. These changes have challenged institutions to educate differently and incorporate scholarly activity and research into their curriculum through novel and creative approaches. One such mechanism is the development of post-doctoral research programs which utilize research fellows to provide the necessary support for research productivity across multiple specialties. In the following chapter, the authors will provide some background information on the goals and function of the ACGME, detail the development of the new research requirements, the utilization of post-doctoral research fellows to support the scholarly activity requirement laid out by the ACGME, and potential measures of performance and success.

Keywords: GME, post-doctoral, fellow, research

1. Introduction

Advancements in field of medicine have long since been established through scientific inquiry. Some would argue that the practice of medicine should be predominantly evidence based [1–3]. As the gap between medical practice and scientific evidence continues to broaden, it became necessary to ensure that the practice of medicine fits hand in hand with scientific discovery as well as staying abreast of current standards of care based on scientific evidence. The question then becomes at what point in medical training should this integration be made—during medical school, residency, or as an attending?

Over a decade ago, the Accreditation Council for Graduate Medical Education (ACGME) began to address the issues surrounding the core competencies necessary to ensure a well-rounded, competent physician by making compliance with these requirements as a condition of accreditation for Graduate Medical Education (GME) programs [4]. These core competencies include: patient care, medical

knowledge, practice-based learning and improvement, professionalism, interpersonal skills and communication, and systems-based practice [4]. In line with these competencies, scholarly activity serves to integrate research and scientific discovery into the educational development of resident physicians [5]. These new requirements are being enforced as more studies are starting to show that participating in scholarly activity increases the scope of evidence based medicine and increases the quality of patient care among all health care professionals [6–9].

With the institution of the scholarly activity requirement comes the challenge of implementing this into the resident curriculum [10]. One novel approach is through the establishment of a post-doctoral research program. In the following chapter, the authors will provide some background information on the goals and function of the ACGME, detail the development of the new research requirements, and give the reader a look into how our institution has developed a program to ensure to support the scholarly activity requirement laid out by the ACGME. It will conclude with ideas on measuring the success of the program.

2. The ACGME and Research

Medicine is both an art and a science. This requires the ability to think critically, evaluate the literature, appropriately assimilate new knowledge, and practice lifelong learning. Physicians convey a distinct clinically focused perspective and perform a very important role in the advancement of evidence-based practice through medical research. They present issues vital to the enhancement of quality in patient care, but in the past have not been properly trained to utilize their unique perspective to enhance the field of medicine through research. GME programs and faculty must create an environment that fosters the acquisition of such skills through training programs and scholarly activity focus.

The ACGME and the American Board of Medical Specialties devised six core competencies for all physicians to address community expectations for advancements in science and thus medical care. This was indicative of the recognition by such agencies that there was a critical need for change in the way we educate and prepare our future physicians. These new requirements are being enforced as more studies are starting to show that participating in scholarly activity increases the scope of evidence based medicine, and increases the quality of patient care among all health care professionals [6, 7]. A recent meta-analysis has shown that medical students who participate in research are three times more likely to show interest in research, six times more likely to engage in research, and twice as likely to outperform academically [6]. Additionally, involvement of physicians during and after medical school education have shown promising growth in research activities and publications, [4, 6] thus it is clear that fresh strategies are needed to grow the size and diversity of the physician-scientist pipeline [7]. Overall, there has been a change in focus to concentrate on the outcomes of such education in a measurable way, as well as collaboration across specialties using an institutional versus programmatic approach to graduate medical learning [4].

3. ACGME accreditation

As the educational models have shifted, scholarly activity in the form of research and quality improvement has become increasingly important in the eyes of the ACGME yet incorporating such activity onto Residency programs remains a challenge. In fact, issues surrounding inadequate scholarly activity are a common

citation for many programs, especially Family Medicine residencies [11]. Across the United States, medical residency and fellowship programs are challenged to remain in compliance with scholarly activity requirements set by the ACGME. The ACGME uses Web Accreditation Data System (WebADS) to track and update faculty scholarly activity [12]. Additionally, since 2014 there was a transition to the next accreditation system (NAS) to promote evidence-based activity and improve reporting. These changes are indicative of the way the ACGME assess Graduate Medical Education (GME) programs [12]. Since the implementation of NAS, all ACGME programs have been required to submit evidence of scholarly activity of both residents and faculty on an annual basis, allowing the Residency Review Committee (RRC) to track performance and identify inadequacies with real-time intervention [12]. The increased frequency of reporting scholarly activity has created new challenges within GME programs. More than ever there is a need for synergetic and integrative approach between the Program Director, Chair, Designated Institutional Official, Faculty, and coordinator to address these challenges [12].

In response to these changes and the importance of receiving and/or maintaining accreditation, several Residency programs have had to modify their educational models and methods of measuring performance and outcomes [4]. To ensure accreditation standards are consistently met, there must be a spotlight on adequate performance measures, thus institutions need to ensure accountability and quality

ACGME requirements pertinent to research	
	<ul style="list-style-type: none">• Knowledge of the basic principles of research• How to evaluate research• How research is applied to patient care• Publication or presentation of scholarly activity.• Development of leadership skills• Strengthening interpersonal skills• Strengthening communication skills

Table 1.
List of requirements that residents should to meet prior to graduation per ACGME.

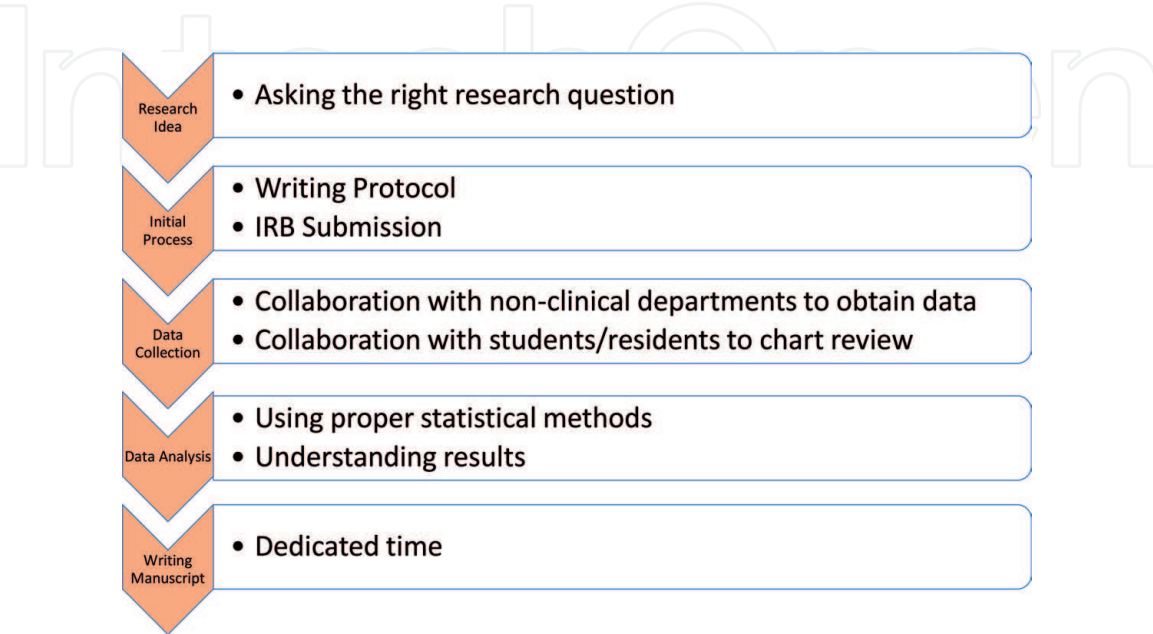


Figure 1.
Barriers faced by residents when performing research.

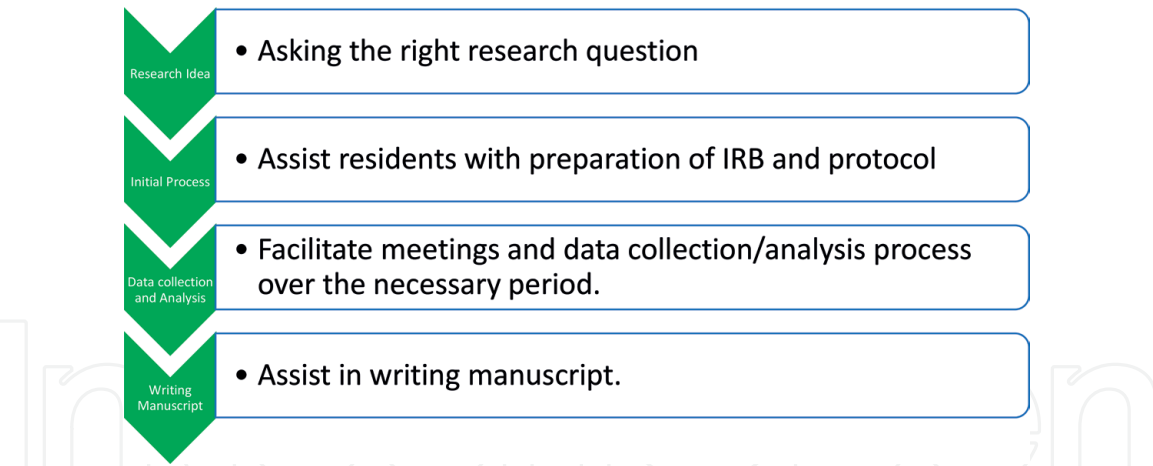


Figure 2.
Process with a post-doctoral fellow.

improvement are at the forefront of their culture [6]. Practically speaking, GME programs must have a clear understanding of what the scholarly activity requirements are with mechanisms for assessing performance, the ability to collect and report a full accounting of scholarly activities to the ACGME, and program leaders must stay abreast of new and upcoming changes in scholarly activity requirements to ensure compliance [12]. Scholarly activity metrics have historically included number of grant submissions, grants awarded, publications submitted, presentations, and awards which were tracked before and after the implementation of a new program which was then titled the “Baby Steps” program for faculty and residents [6]. The Resident Review Committee (RRC), in multiple specialties, has provided guidelines on how it interprets scholarly activity for compliance with the Program Requirements (**Table 1**). These guidelines include definitions and expectations, as well as examples of scholarly activities recognized by the Review Committee [11] (**Figures 1 and 2**).

4. Post-doctoral program in GME

Given these new competency models, the increasing need to adequately measure performance/scholarly activity and the growing value of being an accredited program, adaptation in the professional development of our future physicians is critical. The ACGME requires all accredited residency training programs to facilitate resident scholarly activities, thus GME programs must remain agile in their approach to meet these demands through novel educational approaches as well as flexible infrastructures [13, 14]. This can be done by having dedicated research blocks or protected time from clinical responsibilities to complete research projects; however, clinical education is still the focus of Graduate Medical Education in most training programs. Residency programs are challenged with designing the structure, process, and outcome evaluation of the ACGME research requirement [8, 15]. There must be support provided by the institution to ensure protected time for residents and faculty to focus on scholarly activity production [8, 14, 16, 17] **Figure 1**.

One mechanism for driving such educational models and support mechanisms is the use of a post-doctoral research training programs. Post-doctoral research fellows can add value to residency and fellowship programs at teaching hospitals by providing support in research productivity across multiple specialties [18, 19] **Figure 2**. Productivity generated by post-doctoral research fellows align well with what the ACGME defines as scholarly activity. According to a 2012 study published in the Journal of Graduate Medical Education (JGME), the addition of a mentored

post-doctoral researcher was associated with improvements to both resident and faculty research activities [20]. While the original intent of the post-doctoral role was prominently to benefit the trainee through active mentorship, and to help secure future career goals through acquisition of additional skills and credentials, these roles have become essential in most research settings [18, 21] such as Graduate Medical Education in which scholarly activity is a core component. Therefore, it is not surprising that such post-doctoral research programs have become a key element within many institutions serving as a distinct phase of career succession in most scientific fields [21]. Post-doctoral training has been considered a critical component of research training, allowing the acquisition of the necessary skills to become an independent researcher [19]. A post-doctoral program enriches any robust research enterprise at an academic center. Overall, post-doctoral fellows play a crucial role in an academic institute; they supplement the research expertise of the faculty by teaching and advising undergraduates, residents, and fellows; contribute new research and quality improvement techniques; collaborate with other institutions; and help manage the daily research operations. They have deep expertise and knowledge to support faculty and residents, while also enhancing their own professional skills during their training. This type of environment boosts their research knowledge and skills for career advancement, developing a pipeline of future research-minded clinicians.

The post-doctoral scholars should be able to demonstrate broad knowledge of the research area and should be able to understand the gaps, limitations and challenges within the research [22]. Post-doctoral programs are common and have served as a standard stepping stone in other doctoral pathways. In other professions a post-doctoral position is used as a bridge to develop professional gaps that were not taught in an academic setting. ACGME has always encouraged the development of programs that will allow residents to develop core competencies. It recognizes the diversity of post-doctoral education programs, and anticipates that programs prepare specialists for a variety of roles, including contributors to clinical care, scientists, and educators. It is expected that the program's scholarship will reflect its mission(s) and aims, and the needs of the community it serves. For example, some programs may concentrate their scholarly activity on quality improvement, population health, and/or teaching, while other programs might choose to utilize more classic forms of biomedical research as the focus for scholarship [22]. There have been institutions that have developed various strategies to tackle this. A Mayo Clinic family medicine residency program in Arizona had implanted a "collaborative care" curriculum that allowed for critical thinking, cost-benefit analysis, professional development, mentorship, and leadership development [23]. This program has been considered a success and many programs have adapted this curriculum. However, this curriculum only targets family medicine residents in their final year. These core competencies should extend over the course of the residency program. Our program is set up to combine all the aspects of the "collaborative care" curriculum and have it available to residents and fellows at all times.

At our institution, the post-doctoral research program was created to help health science graduates gain research and leadership experience in a clinical and nonclinical setting, while also assisting residency programs meet their GME requirements. Few of the skills that GME requires from residents include: working in groups, understanding risk benefit analysis; engaging in quality improvement projects; developing strong leadership skills, and participation in scholarly activity. We will discuss in greater detail how the formation of a post-doctoral research program employing recent medical graduates can assist the GME in achieving their requirements as well as cultivating competitive residency candidates armed with the skills, knowledge and professional competence to continue contributing to future scholarly activities. We will also address potential metrics to gauge success of the program.

The post-doctoral research program is a two-year program dedicated to providing hands-on experience in clinical and quality research. Our program creates a research group that enables them to practice working in a professional group outside a clinical setting and promotes leadership growth. With the introduction of a post-doctoral candidate, we were able to create a liaison between residents and various key research departments. This allowed for residents the opportunity to work with a diverse group of healthcare professionals in a research setting. There have been studies that show that residents that engage in scholarly activity find their residency more fulfilling and are happier [24]. In one of the surveys done in Department of Radiology and Radiological Sciences at the Medical University of South Carolina, majority of faculty members (86%) and residents (51%) thought that residents should be required to engage in a scholarly activity [14]. Many studies expressed a key component was the availability of mentors who are knowledgeable in research [10, 14, 25]. Our program has created this setting with program directors and other key research personnel as part of a council that assist in scholarly activity throughout the network. By creating opportunities for residents to interact with different members at different levels within the network allows them to learn about system organization and culture outside of a clinical environment [26]. It is important that residents understand the challenges and see how these challenges are overcome outside of a clinical situation. Interacting with other health professionals and administrators will instill a sense of teamwork that extends beyond the patient room, an effective trait of a strong leader. Residents are given a chance to develop other skills during residency, and through these valuable experiences can be well rounded physician leaders in the future. Studies have shown that there is a significant relationship between strong physician leaders and improved outcomes among patients [11].

The more obvious benefit of the post-doctoral research training program is that individuals in the program can be trained and placed in various departments where there is a need for assistance with keeping up with accreditation requirements. Our program trains post-doctoral candidates in the areas of IRB preparation, project feasibility, research statistics, and research presentations. They help design the research protocol early from the inception of idea and team formation, estimate sample size, safely conduct the research, analyze the data, and eventually write the manuscript. Along with this, they assist in IRB review, search and evaluate the literature, and present at various scientific conferences. None of these skills are taught in medical school, yet they play a vital role in the clinical setting. The leadership and management skills and techniques honed during their training period also facilitate effective team work and establish collaborations among various specialties/industry to conduct multidisciplinary research. Creating exposure to these skills and resources early in a physician's career can create a well-rounded clinician with strong leadership skills. By establishing a program with fellows that are knowledgeable in these areas it benefits everyone within the network. Assistance from post-doctoral research fellows provides a concrete structure and resource for faculty, residents and fellows; it allows them to generate further research and quality improvement projects; and it generates a significant impact on GME requirements for residency. Their research support and mentorship can play a significant role to maintain an active research programs in the teaching institutions. They are considered the major engine of driving the research in an academic center [27].

Post-doctoral program can give an exponential growth in the publication pool in an academic center. The cost of capitalizing in this kind of programs may be initially intimidating for institutions, yet the productivity and growth in research centers who adopt such a model is extremely valuable. Without active backing from faculty and post-doctoral scholars, advances in patient care, our departments, our institutions and society can experience significant inaction. The fellows themselves will meet the

ACGME core competencies, the residents that take advantage and interact with the program will develop key skills, and the network will benefit from the increase in scholarly activity. In this instance, the fellow could act as a research coordinator of sorts and help educate faculty on the importance of their involvement in the process as well as facilitating collaboration among clinical staff and resident/fellows. The research fellow can also provide guidance on appropriate study design, statistical methods, as well as manuscript writing. Even in the case of residency programs that have no issue meeting GME requirements for scholarly activity, the post doc fellow can provide support throughout the research process as a coordinator, from IRB approval to manuscript writing, thus warranting clinicians with their clinical duties and alleviating some of the unknown and stress associated with the process of conducting research.

Many medical professionals matriculate without engaging in any scholarly activity so as a resident it may be the first time they are required to participate in research [28] which without proper mentorship can be a daunting task especially with the adjustment to clinical responsibilities. One potential way to counter this is to involve residents early in the research process starting with quality improvement projects. The importance of patient safety and quality health care cannot be overstated. While the resident is becoming accustomed to their new roles and responsibilities as an integral part of the health care team, it is reasonable to also stimulate their curiosity in research and innovation. As residents are often the “eyes and ears” of attending physicians, they have a unique perspective on quality and patient safety issues. Utilizing their perspective and linking them with good mentors can accomplish the objective of all involved.

ACGME outlines that programs must engage residents in projects that challenge them and enhance their skills outside of clinical practices. Residents are expected to participate in identifying system errors and implementing solutions. Working outside of patient care in research and QI allows them to broaden their scope to other systems at play in the health network and possibly implement efficient solutions. Our ongoing QI/research projects provide an excellent QI activity and even awards exceptional QI projects every year. Residents get first-hand knowledge regarding the principles of high value care, cost efficiency and healthcare utility by participating in these QI projects. Many QI projects also require residents to have a strong grasp of testing modalities, first line management, and diagnostic testing metrics (specificity, sensitivity, negative predictive value, etc.). While these topics are briefly discussed in board exams and in medical schools, still participating in QI projects allows them to develop skills needed to critically assess these topics. It is vital that these skills are acquired prior to graduating from residency. This importance stems from the new measures and metrics that hospitals and insurance companies now look at for every physician. Ever since the implementation of Medicare there has been a premium placed on high value that is beneficial for both patients and hospitals. This has created a challenging position for practicing physicians. Physicians are constantly being forced to make cost effective decisions, even though their training and beliefs have guided them to make decisions that are beneficial for patients at any cost. Therefore, it is vital that residents are exposed to this expectation prior to graduation so they can navigate better when seeing patients as an attending physician.

Along with the post-doctoral research program, we have created a collaborative environment that is highly encouraging for such scholarly activities. The post-doctoral research fellow program has developed a solid framework and resources for residents to use and build upon. A survey study from a family medicine residency in Wisconsin showed while 85% of residents believed research was important only 8% were active in research. One of the biggest reasons for this discrepancy was the lack of time and resources available to the residents [25]. Having a research fellow to assist with various research tasks can help alleviate the pressure and

time constraints on residents. Innovation is of increasing importance in Graduate Medical Education which includes new ways of increasing resident awareness and participation in research [29, 30]. Our program is an innovative approach in increasing scholarly activity and interest among residents. Residents that can participate in these scholarly and leadership activities tend not only to be more satisfied with their career but also more confident in their knowledge base. Another key ACGME criterion for residents to develop prior to graduation includes professional development. It has been shown the professionalism goes hand in hand with high standard of clinical care [31]. The post-doctoral research program creates an excellent opportunity for the fellows and residents interacting with the fellows to develop professional standards and relationships.

With the implementation of a program such as this, there comes a necessity to objectively evaluate its utility as the effectiveness of such programs remains a topic of debate due to a need for consistent and effective methods of measuring performance. That said, it has been reported that there are over 50,000 post-docs in the United States alone regardless of the inconsistency in opinion as to whether such training programs are beneficial [21]. The importance of creating more description and structure to the training environment has been acknowledged by various professional organizations including National Postdoctoral Association and NIH. According to a recent publication, a project was started to develop a list of competencies without any comparison to any previous competencies. The 10 core competencies for assessment of post doctorates were established regardless of discipline or career route; broad conceptual knowledge of a scientific discipline, deep knowledge of a specific field, critical thinking skills, experimental skills, computational skills, collaboration and team science skills, responsible conduct of research and ethics, communication skills, leadership and management skills, and finally, survival skills. Further, each competency was multidimensional and could be divided into sub competencies for the rubric [32]. These core competencies not only contribute to their professional research development but can also prepare them for leadership roles within the organization and pay dividends in complementing the individual's scientific research program.

Based on this evidence, a focus on the establishment of standards and expectations of the trainee, as well as the mentor, is a critical and necessary piece of these post-doctoral training programs and their continued pervasiveness [21]. There is literature to suggest development of some sort of research curriculum with faculty mentorship and regular research meetings as a method to not only ensure that residents meet their scholarly activity requirements [33], but it also aids in tracking the progress and completion of these projects [34]. The post-doctoral fellow can be an integral part of this program which can accomplish the goal of facilitating mentorship relationships, tracking and completing scholarly activity.

Another option used by the department of Anesthesia at Pittsburg Medical Center is implementing a scoring system to objectively weight the difficulty, significance, and level of resident involvement in scholarly activity [35]. They presented a novel way to measure their scholarly activity, which could be utilized by our program to determine whether the post-doctoral research program is accomplishing the goal of increasing scholarly activity in their respective departments. It also allows for objective measurement of the degree of post-doc, resident and faculty involvement. This data could be used to determine where additional resources and support can be distributed to ensure everyone is doing their part. This scoring system can also give data on the quality, complexity and significance of the work being produced.

In 2000, the U.S. National Academies' Committee on Science, Engineering, and Public Policy (COSEPUP) reported and concluded that there is far too much variability in post-doctoral training programs, and recommended the following: (1) development of well-defined goals, policies and standards; (2) institutional recognition,

status, and compensation to support such programs; and (3) occupational counseling to prepare post-docs entering the workforce [21]. If the aim of the ACGME is to clearly define expectations for scholarly work, coupled with how to adequately document these initiatives [36], it seems inherent to align not only the residency programs with these goals, but also the support systems such as post-doctoral training programs with clearly defined goals and expectations, and adequate scales of measurement. In a sense, the fundamentals housed within a residency program should not significantly differ from those within a post-doctoral research program as it pertains to scholarly activity. Besides these competencies, it has been shown in various studies that when a post graduate medical student participates and authors in various research projects, they tend to show higher match rates in their residency spot [37].

A basic conceptual framework of post-doctoral research programs should include institutional support both financially and culturally, adequate mentorship, clearly defined goals and expectations with corresponding measures of performance, opportunities for utilization of critical thinking skills; forums for education and didactics with timely review and feedback on current and future projects; and overall leadership and professionalism development. These programmatic characteristics are very much aligned and/or mirror images of the programmatic needs for GME as evidenced in the Clinical Scholars Program that was implemented at the Trident/Medical University of South Carolina (MUSC) Family Medicine residency over two decades ago [34]. Aligning such programs allows for shared responsibility for meeting scholarly activity requirements and allows residents and attending physicians to pull support from the post-doctoral trainees while focusing on clinical responsibilities, with increased scholarly activity output as the outcome. Yet the question remains, what is the best measure of such academic performance, and the overall business case for support staff such as post-doctoral research trainees.

It has been a longstanding tradition to measure scholarly activity performance and overall academic performance via publication lists and scholarly activity point systems. It has been shown that the best predictor of sustainable future scientific success was the number of publications completed as a post-doctoral trainee [19]. This is also used in the hiring process for new faculty in most Institutions, with scientific advancement being at the forefront of the institutional mission, thus assessing candidates by how likely they will advance the field of medicine [38]. With this in mind, it seems inherent that the incorporation of post-doctoral research fellows to support such scholarly activity output is beneficial. That said, it is critical that academic success is not simply measured by objective numbers, but also the quality of such publication output, as well as other diversified metrics beyond raw numbers of publications, citations, and impact factors which are outdated measures dating back to the mid-twentieth century [38]. Several institutions have developed their own creative measurement tools, aligning clinical goals with research and educational activity that are continuously reviewed to drive strategy and early identification of any issues to be addressed, understanding that academic success cannot be evaluated by strict numbers [38]. This new-age form of measuring academic achievement requires a wide-range team of faculty, program directors, administration and leadership, mentors, and trainees comprised of residents, fellows, and Post-Docs with each component being an active contributor to scholarly activity output. Therefore, defining the expected number of publications and the level of contribution of the researcher, coupled with providing adequate infrastructure and support, as well as regular review of progress toward meeting these goals, are all necessary components of a post-doctoral research program [19] and the overall goal of developing future physician researchers.

The development of future physician-investigators is especially important as it has been noted that there is a decline in the ability to recruit and retain clinical researchers who are adequately trained and qualified [39]. The post-doctoral

research training pathway is even more critical given this notion, as such academically focused instructional programs are essential to developing a pipeline of trained physician researchers. Academic medicine is necessary to continuously test and reform clinical practice and develop new treatment options, and its future is dependent on preparing our trainees and junior faculty for such academic missions [7]. Obstacles in career advancement within the academic setting stem primarily from inadequate training and preparation, inadequate support for research, and clinical performance pressures [7]. Incorporation of a post-doctoral research program fosters growth academically by alleviating these barriers as such programs not only provide additional training and education within the field of research, but also provide an additional layer of research infrastructure support to existing faculty and GME programs thus allowing these existing clinicians to focus on clinical responsibilities. That is not to say that the faculty is not to be intimately involved in such post-doctoral research training, as their mentorship and support of scholarly activity are critical to the academic mission. For example, young trainees need faculty mentors to offer career guidance and support, as well as protection from moving (and oftentimes competing) institutional priorities [7], always ensuring research and scholarly activity are a primary component of overall goals to ensure future academic success.

Although, there has been an acknowledgement of the significance of clinical scientists in evidence based medical practice, still there has been a decline in interest to pursue lengthy medical and research training among medical graduates. The post-doctoral research fellowship provides the baby steps toward being an independent investigator, which can eventually demonstrate a unique role in medicine by connecting the space between scientific research and clinical medicine in their future careers. It can also reduce the training time to develop a successful physician scientist as compared to MD/PhD programs while maintaining the objectivity of training.

5. Conclusion

In conclusion, the authors have presented a novel way to ensure the attainment of scholarly activity requirements for GME programs, as well as a unique way to stimulate academic and scientific discovery among faculty and residents. There was presented some literature on innovative ways to the post-doctoral research program can increase scholarly activity and support the efforts of the GME. We hope that our experience can be duplicated at other institutions.

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References

- [1] Sackett DL. Evidence-based medicine. In: *Seminars in Perinatology*. Philadelphia, PA: Saunders; 1997;**21**:1
- [2] Rosenberg W, Donald A. Evidence based medicine: An approach to clinical problem-solving. *BMJ: British Medical Journal*. 1995;**310**(6987):1122
- [3] Leape LL, Berwick DM, Bates DW. What practices will most improve safety?: Evidence-based medicine meets patient safety. *JAMA*. 2002;**288**(4):501-507
- [4] Accreditation Council for Graduate Medical Education. ACGME program requirements for graduate medical education in pediatrics. 2013;26. Available from: https://www.appd.org/home/PDF/ACGMEPediatricRequirements7_2011.pdf
- [5] Green ML. Evidence-based medicine training in internal medicine residency programs. *Journal of General Internal Medicine*. 2000;**15**(2):129-133
- [6] Amgad M et al. Medical student research: An integrated mixed-methods systematic review and meta-analysis. *PLoS One*. 2015;**10**(6):e0127470
- [7] Applegate WB, Williams ME. Career development in academic medicine. *The American Journal of Medicine*. 1990;**88**(3):263-267
- [8] Kanna B et al. The research rotation: Competency-based structured and novel approach to research training of internal medicine residents. *BMC Medical Education*. 2006;**6**(1):52
- [9] Monn MF et al. ACGME core competency training, mentorship, and research in surgical subspecialty fellowship programs. *Journal of Surgical Education*. 2013;**70**(2):180-188
- [10] Rothberg MB. Overcoming the obstacles to research during residency: What does it take? *JAMA*. 2012;**308**(21):2191-2192
- [11] Blumenthal DM et al. Addressing the leadership gap in medicine: Residents' need for systematic leadership development training. *Academic Medicine*. 2012;**87**(4):513-522
- [12] Batalden P et al. General competencies and accreditation in graduate medical education. *Health Affairs*. 2002;**21**(5):103-111
- [13] Grady EC et al. Defining scholarly activity in graduate medical education. *Journal of Graduate Medical Education*. 2012;**4**(4):558-561
- [14] Amrhein T et al. Instituting a radiology residency scholarly activity program. *Education for Health*. 2015;**28**(1):68-73
- [15] Ledford CJW et al. Resident scholarship expectations and experiences: Sources of uncertainty as barriers to success. *Journal of Graduate Medical Education*. 2013;**5**(4):564-569
- [16] Stevenson MD et al. Increasing scholarly activity productivity during residency: A systematic review. *Academic Medicine*. 2017;**92**(2):250-266
- [17] Robbins MS et al. A dedicated scholarly research program in an adult and pediatric neurology residency program. *Neurology*. 2017;**88**(14):1366
- [18] Manring MM, Panzo JA, Mayerson JL. A framework for improving resident research participation and scholarly output. *Journal of Surgical Education*. 2014;**71**(1):8-13
- [19] Ross RG, Greco-Sanders L, Laudenslager M. An institutional postdoctoral research training

- program: Increasing productivity of postdoctoral trainees. *Academic Psychiatry: The Journal of the American Association of Directors of Psychiatric Residency Training and the Association for Academic Psychiatry*. 2016;**40**(2):207-212
- [20] Penrose LL et al. An incremental approach to improving scholarly activity. *Journal of Graduate Medical Education*. 2012;**4**(4):496-499
- [21] Leshner AI. Standards for Postdoc Training. American Association for the Advancement of Science. 2012;**336**(6079):276-276
- [22] JHU. Core Competencies for Postdoctoral Research Fellows. 2018. Available from: <https://www.hopkinsmedicine.org/som/offices/pda/index.htm>
- [23] Frey K et al. The ‘Collaborative Care’ curriculum: An educational model addressing key ACGME core competencies in primary care residency training. *Medical Education*. 2003;**37**(9):786-789
- [24] Takahashi O et al. Residents’ experience of scholarly activities is associated with higher satisfaction with residency training. *Journal of General Internal Medicine*. 2009;**24**(6):716-720
- [25] Temte J, Hunter P, Beasley J. Factors associated with research interest and activity during family practice residency. *Family Medicine*. 1994;**26**(2):93-97
- [26] Heitkamp DE et al. A leadership development program for radiology residents. *Journal of the American College of Radiology*. 2017;**14**(11):1468-1470
- [27] Bruckmann C, Sebestyén E. Ten simple rules to initiate and run a postdoctoral association. *PLoS Computational Biology*. 2017;**13**(8):e1005664
- [28] Stewart PM. Academic medicine: A faltering engine: Action is needed to respond to growing need and opportunities. *BMJ: British Medical Journal*. 2002;**324**(7335):437
- [29] Residency Review Committee. ACGME Program Requirements for Graduate Medical Education in Internal Medicine. 2012. Available from: https://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/140_internal_medicine_2017-07-01.pdf
- [30] Maizes V et al. The integrative family medicine program: An innovation in residency education. *Academic Medicine*. 2006;**81**(6):583-589
- [31] Elman NS, Illfelder-Kaye J, Robiner WN. Professional development: Training for professionalism as a foundation for competent practice in psychology. *Professional Psychology: Research and Practice*. 2005;**36**(4):367
- [32] Verderame MF et al. Point of view: Competency-based assessment for the training of PhD students and early-career scientists. *eLife*. 2018;**7**:e34801
- [33] Simasek M et al. Meeting resident scholarly activity requirements through a longitudinal quality improvement curriculum. *Journal of Graduate Medical Education*. 2015;**7**(1):86-90
- [34] Carek PJ et al. Addressing the scholarly activity requirements for residents: One program’s solution. *Journal of Graduate Medical Education*. 2011;**3**(3):379-382
- [35] Emerick T et al. Scholarly activity points: A new tool to evaluate resident scholarly productivity. *British Journal of Anaesthesia*. 2013;**111**(3):468-476
- [36] Philibert I et al. Scholarly activity in the next accreditation system: Moving from structure and process to outcomes. *Journal of Graduate Medical Education*. 2013;**5**(4):714-717

[37] Toledo P et al. Evaluation of the foundation for anesthesia education and research medical student anesthesia research fellowship program participants' scholarly activity and career choices. *Anesthesiology: The Journal of the American Society of Anesthesiologists*. 2016;**124**(5):1168-1173

[38] Tachibana C. new tools for measuring academic performance. *Science*. 2017;**355**(6325):651-654

[39] Ranieri V, Barratt H, Fulop N, Rees G. Clinical academics' postdoctoral career development. *BMJ: British Medical Journal*. 2015;**351**(h6945)