IJMS INTERNATIONAL JOURNAL of MEDICAL STUDENTS

Editorial

Should a Scientific Publication be a Prerequisite to Graduate from Medical School?

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Medical research serves as a pivot upon which the advancement of clinical practice oscillates.[1] As the future medicine continues to rely on the transition of medical research from evidence to practice, it becomes imperative that those who are involved in this transition are trained well and mentored diligently to ensure optimal patient care and improved health outcomes.[1] Medical students are important contributors to the body of scientific knowledge. The discovery of heparin, insulin, sinoatrial node, Klumpke paralysis, and sphincter of oddi are some examples of groundbreaking contributions made by medical students, which serve as proof of their role in the research field.[2] Thus, encouraging early engagement of medical students in research assumes primary importance.

Participating in research allows medical students to evaluate scientific literature, analyse data, interpret findings, and enhance their critical thinking and problem-solving skills. By keeping up with recent advancements, students remain updated about current guidelines and treatment procedures.[3] Furthermore, involvement of medical students in research projects during early years in medical schools is also positively associated with sustained publication after graduation.[4] Also, this undergraduate research experience enhances their inclination towards pursuing an academic medical career and enrolling in prestigious academic programs and specialties. Moreover, as advancement of medical knowledge rests on a balance of collaboration between physician-scientists and clinicians, insufficient contribution from one side may restrict the advancement of the other,[1] therefore, to counteract the growing decline of physicians undertaking clinical research, introducing research as a core competency during the formative years gains further relevance.[5]

Challenges to conducting undergraduate research

Prior to introducing research as a prerequisite for graduation, it is crucial to address the challenges that medical students may encounter while pursuing research as a core competency. Several barriers to conducting undergraduate research have been identified. These challenges along with potential solutions have been summarized in *Table 1*. In many academic programs, research training is offered during the later stages of undergraduate studies which is often brief and fails to impart comprehensive knowledge and practical skills. As a result, students have limited exposure to essential aspects of research methodology which may lead to confusion, delays, and compromised research quality.[6] Inadequate support is another significant barrier that medical students may face when it comes to conducting research. One aspect of this support is the availability of funds. Undergraduate students often encounter a lack of financial resources, as there are few funding opportunities specifically targeted at facilitating undergraduate research.[7] Without adequate funding, students may struggle to access research materials, equipment, or specialized software, hindering the quality and scope of their work.

Inadequate support from mentors is another barrier to conducting research among undergraduates. Dedicated mentors play a crucial role in guiding students through the research process, offering valuable expertise, and providing constructive feedback. However, in many cases, undergraduate students find themselves lacking supportive mentors to offer them the necessary guidance.[7] Structural challenges pose additional barriers that hinder undergraduate research efforts. One such challenge is the scarcity of time allocated for engaging in research activities. This can be primarily attributed to the demanding nature of university curricula, which prioritize coursework and other academic requirements.[8] Furthermore, the lack of well-established structures and programs to facilitate and promote undergraduate research within many universities exacerbates the issue. Without clear guidelines, initiatives, and support systems in place, undergraduates may struggle to navigate the research

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landscape and access the resources necessary to conduct impactful research.[6]

Ways forward: how to enhance medical students' involvement in research

To guarantee that the intended outcomes of establishing scientific publication as a prerequisite to graduation are achieved, the role of relevant stakeholders becomes imperative. This role includes ensuring undergraduates are exposed to research as early as possible, which can be achieved through interactive training programs and workshops specifically designed to motivate and engage students in research activities.[6,8] Small research grant opportunities, specifically tailored to the needs of students, could be established as part of a larger fund obtained from an institution or organization. These provide a means for students to obtain necessary resources, ultimately enhancing the quality and scope of their projects.[7] Strengthening the mentor-mentee relationship in universities is crucial to establishing a framework that values and reinforces this vital relationship.[6-8] By acknowledging and rewarding effective mentorship, universities can create a supportive environment that motivates mentors to actively engage with undergraduate students and encourage them to invest their time, knowledge, and expertise.[6] Additionally, universities can create dedicated platforms for undergraduate medical students to share their research activities. This can be in the form of research symposiums, poster sessions, conference attendance or online platforms. Furthermore, incentives such as awards can serve as powerful motivators for undergraduate researchers which can inspire students to strive for excellence, fuel their passion for research, and reinforce the value placed on research endeavours within the university community.[6]

In order to establish research as a prerequisite for graduation, it is crucial to devise appropriate metrics that can measure current understanding of students regarding the technicalities of research which can help identify areas where improvements are needed and to make informed decisions about the most effective strategies.[9] Evaluating research comprehension among medical students often entails assessing their perspectives and abilities linked to research methodology, critical evaluation, data processing skills, and results dissemination and scientific communication. These metrics may differ across universities, but they may include creating a research proposal, study design, methodology, literature review, research ethics, data collection, scientific writing, and publishing. Participation in oral or poster presentations, participation at research conferences, and research partnerships are also significant indicators for assessing not only the degree of research knowledge among medical students but also for developing competent worldwide researchers.[10,11] Thus, students' capacity to think critically, analyze the evidence, and apply scientific reasoning in research-related settings may be examined to assess their research knowledge.[12-14]

Emphasizing research as a core competency in the medical school curriculum demands ensuring its full implementation, namely reaching the stage of publication. Publishing research projects serves as the only true measure for evaluating the effectiveness of the strategies aimed at addressing barriers to conduct research at the undergraduate level. The delay may become especially longer for medical students as they lack expertise in scientific writing.[15,16]

Table 1. Summary of Barriers to Conducting Undergraduate Research and Potential Solutions.

Barriers to Conducting Undergraduate Research and Potential Solutions			
	Imparting Knowledge and Skill	**Providing Adequate Support**	**Introducing Structural Programs**
Barriers	Lack of trained faculty. Research training offered during later stages of undergraduate studies.	Few funding opportunities specifically targeted at facilitating undergraduate research. Lack of mentorship.	At institutional level, lack of well-established structures and programs to facilitate and promote undergraduate research.
Consequences	Limited exposure and understanding of essential aspects of research methodology. Compromised research quality.	Due to lack of funds, students struggle to access research materials, equipment, or specialized software and travel expenses. Without guidance from mentors, students struggle with designing their studies, analyzing data, and interpreting their findings accurately.	With greater focus on course, undergraduates struggle to dedicate themselves fully to research projects.
Potential Solutions	Interactive training programs for both the students and the staff should be introduced Workshops specifically designed to motivate and engage students in research activities should be held.	Organizing small research funding opportunities Strengthening the Mentor-mentee relationship by acknowledging and rewarding effective mentorship	Create dedicated platforms for medical students to share their research activities such as research symposiums, poster sessions, conference attendance or online platforms. Incentives such as awards can serve as powerful motivators.

It is also important to highlight the inequalities that emerge when students undertaking research from high-income countries (HICs) and low-income countries (LICs) are compared.[17-19] Students belonging to institutions based in HICs benefit from easily accessible research infrastructure, modern laboratories, and an abundance of tools that promote their research involvement. HICs encourage scientific inquiry and incorporate research into their curriculum, building important abilities and providing early exposure to research opportunities.[20] On the other hand, LICs encounter many challenges that prevent students from conducting research in their institutions.[21-23] Additionally, the focus on research in HIC and LIC varies. Certain HICs incorporate research from elementary through secondary school, encouraging a research-oriented attitude and developing research-related abilities. In contrast, LICs concentrate academic

information and tests, giving students little experience in research technique, critical thinking, and scientific inquiry.[24-26] Efforts are being made to bridge the gap and advance research in LICs. Organizations, institutions, and multinational partnerships are all actively participating in capacity-building projects. These projects offer training, mentoring, and resources to improve research opportunities, skills, and culture in LICs.[27, 28] Students belonging to institutions based in LICs can achieve a research edge by expanding resource accessibility and incorporating research into the instructional system. Prioritizing research empowers students, promotes scientific curiosity, and allows them to make significant contributions to scientific advancement and solve local healthcare concerns.[29, 30]

Articles in this issue

In their cross-sectional study, Mediboina and Bhupathi examined the impact of COVID-19 on the health of police personnel in Eluru, India. Data were collected from 82 personnel using a three-part questionnaire. The findings revealed significant levels of stress (30.4%) and anxiety (17.07%) among the police personnel due to the pandemic, although no significant levels of depression were observed. The findings highlight the importance of addressing the mental and physical health issues faced by police personnel during this challenging time and emphasize the need for further research in this area.[31]

Haiy A ul et al. in their study aimed to investigate the patterns of coronary artery dominance and explore the relationship of these patterns with coronary artery disease. They analysed data from coronary angiographies of 631 patients. The researchers concluded that there is a positive correlation between right dominance and the severity of coronary artery disease. Their results also indicated that the distribution of coronary dominance in Pakistan differs from what has been reported in the existing literature suggesting that individuals with right coronary artery dominance may be more susceptible to developing severe forms of coronary artery disease. Furthermore, it highlights the need for further investigations and studies to gain a deeper understanding of coronary artery dominance patterns specific to the Pakistan population.[32]

In their original research titled 'Global Impact of the COVID-19 Pandemic on Medical Students in 2021 and 2022', the authors discuss how the pandemic impacted medical students' knowledge, experiences, perspectives on relevant policies and resources. The authors highlight perspectives of both US and international students in addition to comparing how these outlooks may have changed as the pandemic progressed from 2021 and 2022.[33]

In the systematic literature review, Patra investigated the relationship between psoriasis and pregnancy, specifically examining potential treatment options. The review analyzed 14 articles and identified five major themes: immunology, general sex hormones, estrogen, progesterone, and the HLA-Cw6 allele. The findings emphasize the individual nature of psoriasis and shed light on the role of genetics and hormones in its development.[34]

Yu Xuan Lee presents a case of a 54-year-old man, with a prolonged history of a prolapsed intervertebral disc, presenting with symptoms of tetraparesthesia and paraparesis, which were initially misdiagnosed. However, further laboratory tests confirmed the diagnosis of Guillain-Barre Syndrome (GBS). The patient was then treated with immunoglobulin therapy, resulting in significant improvement. This case report emphasizes the challenges in diagnosing GBS in patients with underlying neurological comorbidities. It highlights the importance of conducting a comprehensive physical examination and obtaining a detailed medical history in diagnosing GBS in patients with underlying neurological conditions.[35]

Mićić et al. describe a case of a 32-year-old woman presenting with left-sided common peroneal nerve palsy located at the knee level resulting from open reduction and internal fixation of acetabular fracture. The patient was surgically managed via external neurolysis, decompression, and complete nerve deliberation, with the preservation of all nerve branches.[36]

The article by Tzioti recounts a Greek medical student's experience in an IFMSA research exchange program in Argentina. The student studied vitamin D and antioxidant effects on vascular function in hypertension models at the biomedical physiology department at the Medical Faculty of the National University of Tucuman. The exchange experience improved self-confidence, perspective, and progress. The student urged people to pursue overseas adventures for personal and professional growth despite language and cultural limitations.[37]

The article by Jigish et al. focuses on a medical student's experience learning Latin and Greek, especially in the context of medical terminology. Prior to entering medical school, the student earned a Concurrent Certificate in the Language of Medicine and Health. By using roots, the learner reduced the amount of rigorous memorizing required and gained a contextual understanding of new ideas. The use of medical etymologies has been proven to improve learning in anatomy lessons, with classical language students surpassing their counterparts in anatomical examinations. However, it is crucial to recognize that classical roots should only be used for basic explanations and not as a basis for clinical judgment. Applying these early definitions requires clinical context and more instruction, and the formulaic method has trouble with non-classical eponyms and drug names.[38]

In light of increased use of medical masks during the pandemic years and consequently an increase in production of plastic waste, Suteja et al. share their experience of organizing a community service that was directed at counselling the community regarding proper disposal of medical masks and their reuse as a step to introduce small and sustainable ways to enhance environmental awareness. Later, invited to speak at a local radio station, the authors were able to educate the community about the impact that improper handling of medical waste may have on their physical health.[39]

Wei Zhuen Chew et al., share their experience regarding the changing regulations and disinformation hindered evidence-based medicine (EBM) during the COVID-19 epidemic. The

COVID-19 Evidence Retrieval Service (CERS) was created to provide doctors with reliable information. Librarians, physicians, public health professionals, and medical students analyzed medical literature and answered COVID-19-related queries from practicing clinicians. CERS deployment demonstrated that EBM must be adapted to the pandemic, online work methods are efficient, and resource-limited healthcare systems require services like CERS. Medical students helped establish an integrated evidence-based retrieval service, which proved feasible and effective.[40]

Conclusion

Prior to introducing research as a prerequisite for graduation, it is essential to address institutional, financial, and intellectual barriers that hinder students from conducting research at their institutions. A thesis or a paper should only be made mandatory for graduation when barriers to conducting and executing sound research are recognized and relevant measures are set in place to ensure that students are equipped to conduct studies that are truly impactful. Mandating scientific publication at undergraduate level instills scientific rigor, advances medical knowledge, develops transferable skills, fosters professionalism, and promotes career prospects. Thus, through establishing research as a prerequisite, medical schools can cultivate a generation of physicians who are not only skilled clinicians but also actively contribute to the growth and advancement of medical science.

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Acknowledgments

None.

Conflict of Interest Statement & Funding

The Authors have no funding, financial relationships or conflicts of interest to disclose. Dr. Juan C. Puyana work is partially funded by the National Institute of Health (NIH) of the United States with the grant UH3HL151595. The opinions expressed in this article are the author's own and do not reflect the view of the National Institutes of Health, the Department of Health and Human Services, or the United States government.

Cite as

Nawaz I, Thomas JA, Gupta P, Shellah D, Găman MA, Puyana JC, et al. Should a Scientific Publication be a Prerequisite to Graduate from Medical School?. Int J Med Stud. 2023 Apr-Jun;11(2):102-6.

ISSN 2076-6327

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