Editorial

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Medical Education and Research; Addressing Challenges and Solutions with Pragmatism

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"Research is to see what everybody else has seen, and think what nobody has thought."

Dr. Albert Szent-Györgyi, Nobel Laureate

Research is a cornerstone of a knowledge-driven economy, where information, innovation, and intellectual capital are primary drivers of growth. Nations and industries that invest in research and development (R&D) tend to be more resilient and competitive in the global marketplace.[1] As the world continues to evolve, the pursuit of knowledge through research remains a fundamental strategy for addressing challenges and unlocking opportunities for positive change. Information in science is being produced at a pace never seen before. Nowadays, everyone is continuously exposed to both useful and irrelevant information on a wide range of subjects while living their life online. There is no exception to this worldwide trend in medicine as numerous articles are published in various journals and databases every day, contributing to the ongoing advancement of medical knowledge.

Evidence-based medicine remains the cornerstone of clinical practice decision-making in the ongoing search for safe and efficient care for the requirements of the global health community. Ensuring that students and general practitioners acquire the necessary information and skills is crucial in upholding quality standards and minimizing malpractice errors. Research has demonstrated that involvement in scientific publications and research beginning at the undergraduate level, particularly in the areas of data analysis, question posing, critical literature reading, and scientific writing, significantly contributes to the development of the bare minimum of skills.[2] Although there is no single definition that scientists can agree upon, research at undergraduate level is defined by the Council on Undergraduate Research (CUR) as "an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline".[3] Some argue for a broader, more encompassing definition. Australian scientist Angela Brew broadens the definition of CUR to include research-based initiatives, which would enable advancements in the field and/or comprehension.[4]

People's perceptions of research and education are shifting as a result of the deluge of information. Students studying medicine are being impacted by that. The number of so-called physician-researchers is declining globally. Zemlo *et al.*,[5] showed that the number of physician-researchers has decreased over the last few years, with a considerable decrease in the interest of students to remain involved in research during their professional career. Students no longer believe that a research-based career is achievable for them in the future.

The requirements for studying medicine are very high. So why is it that doing health and medical research is so crucial, above and beyond anything else that has to be learned? It is especially crucial to take this topic into account at a time when medical schools around the world are requiring or strongly encouraging research projects as part of their curricula. A number of medical schools have embraced integrated curricula and begun offering undergraduate research methods courses. However,

research is still not commonly incorporated into undergraduate medical curriculum,[6,7] although it is globally acknowledged to be a fundamental component of medical training.[8] In countries like the United States and the United Kingdom, medical students are still not required to conduct research. However, in Germany, for instance, a research project is required of medical students in order for them to receive their medical doctor title; data indicates that approximately 66% of these students are able to publish their work in journals that are indexed.[9]

The main response to a 2016 study that looked into the motivations behind medical students' decision to conduct research and publish scientific articles was "to increase competitiveness to apply to residency," primarily in specialties having high competition like surgical residencies.[10]

A key strategy for improving medical students' interest in and attitude towards research is to introduce them to its importance early in their education. Not all of the great scientists in history had a college degree when they started their careers. Indeed, there is a long line of scientists throughout history whose work as undergraduates helped to shape the world. Their visionary goals of devising workable answers to global health problems have yielded remarkable achievements. Some extraordinary examples where students got engaged as undergraduates in research include Lorenzo Bellini[11] from Italy (discovered kidney papillary ducts), Niels Steensen[12] from Denmark (discovered parotid or Stensen's duct), Joseph Black[13] from Scotland (discovered fixed air, now called CO_2), Jay Mclean[14] from USA (discovered Heparin), and Charles Herbert Best[15] from Canada (discovered pancreatic hormone insulin), among others.

The College of Physicians and Surgeons of Pakistan (CPSP) and the Higher Education Commission (HEC) have mandated that 'Research Methodology' be studied for post-graduate examinations leading to the FCPS, MCPS, MPhil, MS, MD, and PhD degrees. Teaching research and its methodologies, however, is sporadic at the undergraduate level, MBBS and BDS, and is typically student-driven by dedicated medical students hoping to improve their prospects of being accepted into post-graduate programmes overseas.[16]

In a 2019 study from Karachi, Pakistan, Kumar *et al.*, identified barriers and challenges facing medical students' involvement in research. The primary barrier was lack of knowledge while the second most common barrier reported was lack of time, followed by lack of mentoring.[17] In a 2022 study from Bangladesh, majority of the respondents reported that insufficient time and priorities, insufficient guidance, insufficient familiarities with research methodology and statistical analysis were the obstacles of research.[18] In India, the students reported that they had trouble in choosing topic, difficulty in gathering data, and allocation of time during academic activities as an obstacle to their involvement in research.[19] Memarpour *et al.,* from Iran reported insufficient financial support as the main barrier, followed by a preference for academic instruction over research, inadequate time and poor research skills and knowledge.[20]

At the undergraduate (MBBS/BDS) level, formal research techniques instruction must be introduced. As far as the students are concerned, they are aware of the necessity of research training and want their curricula to offer greater possibilities for hands-on learning.[21] The cross-sectional study involving 500 medical students and 50 research mentors recently reported conclusive results that underscore the mutually beneficial nature of research activities. The study suggested that the collaboration between medical students and research mentors is beneficial for both parties. The positive results seen in this research partnership support the notion that similar arrangements could be valuable for medical schools beyond the scope of this study.[22]

Some questions are brought up by the discussions above, such as 'whether students should simply be using the results of scientific study as a source of information or should they be doing their own research?' Are medical students' potential researchers? The answers to these questions are in the affirmative; medical students are future researchers, and they ought to and are required to conduct research as part of their education for the following reasons:

1. *Getting post-graduate training opportunities is becoming more and more dependent on research experience in medical school. Such training opportunities are highly competitive, and research experience is a clear benefit.*[23]
2. *For some students, a research experience may be their first opportunity to write and document intelligibly, concisely, and accurately about what they do, think, and discover. This may help cultivate enduring critical thinking practices. C. Wright Mills*

observed in his article that he was constantly working on an idea and there was never a time when he was not thinking, analyzing, and writing.[24]

3. *It is common knowledge that conducting research while a medical student and publishing the findings, especially in an indexed journal, have a positive impact on the career advancement of the student in terms of pay, academic recognition, and scientific repute.*[25]
4. *Faculty members have the chance to strengthen their research strategy by having additional assistance, potentially resulting in heightened effectiveness in overseeing projects, obtaining research grants, delivering presentations, and producing publications.*[26]
5. *Research is seen as the foundation of medical practice and helps medical students become better future clinicians.*[27]
6. *Students who conduct research are more equipped to practice evidence-based medicine and produce the knowledge needed to support decisions made during their residency and in their future careers.*[28]
7. *Clinicians are needed to comprehend and value the research process. They need to be capable of evaluating the literature critically. This is crucial in the modern world, as patients have access to a wealth of information via the Internet, and the bulk of articles are published for financial gain without any quality or validity checks. Physicians need to be aware of what is and is not authentic, as patients may inquire about information they have read in journals, newspapers, social media, or online.*[29]

Now that it is evident that research is crucial for medical students, how can they be provided with suitable research training? The primary resource that medical schools and training programmes ought to offer their students is "protected time," which allows them to undertake research. Whether the research is being conducted as an independent study or is an integral part of a student's course, this should still be undertaken. Fresh graduates doing house job in affiliated teaching hospitals should be permitted to engage in research as well. According to an Australian study, the biggest obstacle to productive research initiatives was a lack of “protected time" for research.[30]

Time is not the only item that should be provided by medical schools and hospitals. The second most crucial prerequisite to guarantee the finest research outcomes, is to receive guidance from "experienced research mentors." The chance of high-quality research outputs will rise with the combination of guaranteed time and expert guidance.

In conclusion, practicing medicine in the twenty-first century requires lifelong learning more than in the past. Beyond the strengthening of their resumes as future physicians, the research and publication of scientific projects throughout undergraduate studies is a crucial pillar that all medical students should learn to develop from the start of their careers. Through this educational experience, they will be able to build significant skills and abilities that will enable them to respond to the demands of global health in the most efficient manner possible. Reiterating this interest is vital to promote a culture of good quality research, since students who conduct research and publish during their undergraduate studies typically go on to produce more and better quality articles after graduation.

The government is lifting its investment in health and medical researchers like never before. The research funding opportunities are available through the (1) Health Research Institute, National Institutes of Health; (2) Pakistan Science Foundation; and (3) NRPU (National Research Program for Universities) and IRSIP (International Research Support Initiative Program) from the Higher Education Commission. This signals the Government’s commitment to developing physician-researchers for the future.

I urge all students to take advantage of research opportunities in medical school, not only for the personal and professional rewards, but in order to improve the health of their patients and the overall Pakistani community.

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