Review Article

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Undergraduate Research in Medical Education: Are we giving adequate importance?

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Abstract

The contemporary evidence-based practice of medicine is centered on new information gathered from scientifically and ethically valid research studies to ensure the provision of the best healthcare to society. The knowledge, skills, and experience gained by partaking in such research studies and publishing them would form a strong foundation that enables undergraduate medical students to conduct or be involved in research and/or understand new information on diseases/disorders during their medical practice in the future. In addition, contributing to publishing student-run journals through diverse roles as an author, reviewer, editor, and facilitator and being involved in organizing research conferences would train the students to address the scientific inquiry from multiple angles and aid in the development of their inherent leadership qualities, teamwork, time management, communication skills, and other skills deemed essential for undergraduate medical students for their role as medical practitioners in the future. This manuscript reviews the impact of undergraduate research in medical education, highlighting its benefits and limitations and the current state of its integration in medical curricula of universities in Sri Lanka. In addition, it suggests possible ways to overcome the barriers that prevent the successful integration and implementation of undergraduate research in medical education.

Key words. Undergraduate, research, students, education, publications

Introduction

The contemporary evidence-based practice of medicine is dependent on revision of current information and constant updates of research findings gathered from scientifically valid, ethically sound research studies to ensure precise diagnosis, effective management, and prevention of diseases, and more importantly, safety of patients. Therefore, medical graduates presume to have the fundamental knowledge of different types of research studies and be introduced to research methodology preferably at the undergraduate level to serve as a competent medical practitioner.

The Council on Undergraduate Research (CUR) defines undergraduate research as "a mentored investigation or creative inquiry conducted by undergraduates that seeks to make a scholarly or artistic contribution to knowledge" (1). It is obvious that a strong foundation being laid at the undergraduate level by acquisition of proper knowledge on research methodology, ethical principles, and experience in involving in different parts of a research study and preparation of manuscripts for publication would be useful for medical practitioners to conduct or be involved in research studies and/or understand new information on diseases/disorders arising from high quality research studies and notify such novel information to the relevant authorities for their consideration.

Historical view of undergraduate research

From a historical viewpoint, the implementation of an educational philosophy-the integration of research in teaching-dates back to the early 19th century with the establishment of the University of Berlin (in 1810), which served as a precedent for research universities worldwide (2). Later, one of the earliest undergraduate research programmes of this century

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commenced in 1969 at the Massachusetts Institute of Technology (MIT) of the United States with the name of Undergraduate Research Opportunities Program (UROP) (3). The experiences gained from institutions that had incorporated research into their undergraduate curriculum made other institutions consider this educational philosophy for its inclusion in their academic programmes of diverse fields, including medical education.

Benefits of research in medical education

The benefits of undergraduate research for medical students include conceiving innovative ideas related to health care, deep understanding of scientific inquiry, and development of competencies, for example, critical thinking abilities, problem-solving skills, and intellectual independence, which are central for a future medical practitioner, especially in handling medical emergency situations.

Apart from scientific merits, comprising a research component in a medical curriculum enables the students to understand the ethical aspects of research studies, for example, knowledge on obtaining informed consent from the potential participants of different capabilities (educated, illiterate, parents/guardians, etc.) and assent from minors. This would guide the medical students to properly approach patients and others, respecting their dignity, privacy, and difference of opinion related to their health care (i.e., consent or dissent related to treatment protocols, etc.) and maintain confidentiality in their future medical practice.

Participation of medical students in the organizing committee as student members in an undergraduate research symposium (4), or "student executive committee members" with a "student chair" for a medical conference (5), would be an added advantage for students as they benefit from learning regulatory procedures, values of teamwork, respecting others opinions, accepting constructive criticism, and understanding opportunities and challenges that are encountered in organizing an academic event. The invaluable learning experience gained in organizing conferences would be an asset for undergraduate students to organize research conferences or professional meetings or awareness programmes for the general public and discuss their views in an effective manner in their future careers as medical practitioners.

Benefits of undergraduate research are not limited to students and their supervisors/mentors, but also for the relevant institution and public. If the outcomes of undergraduate research are published in the reputed journals, the relevant institution gains its recognition in the scientific world, and it is indeed helpful to obtain/ maintain a higher level in the ranking system of world universities and attract more students to the institution. Society benefits from the acquisition of new information that can be used to improve the health care of a country or, at large, the whole world.

Undergraduate Research in Sri Lankan Medical education

Sri Lankan state universities are governed by the University Grants Commission (UGC), Sri Lanka, which is overseen by the Ministry of Higher Education, Sri Lanka. At present, Sri Lanka has twelve medical faculties, each of which is functioning under a separate state university. The medical faculties in the country promote undergraduate research through their curriculum and other mechanisms. A descriptive, cross-sectional study conducted among undergraduate medical students studying in two Sri Lankan state universities that had a compulsory community research project for students highlighted that 29.2% (no. 101) of the participants preferred research as a career. It is noteworthy that 57.6% (no. 199) of students had research communicated in scientific conferences. However, publication in indexed journals was only 1.73% (6).

Student research in Sri Lankan medical curricula

The medical curriculum of a state university, the University of Jaffna, integrates research in the "Evidence Based Practice and Research Module (EBPRM)" with the aim of providing "knowledge, attitude and skills

required for basic doctor in relation to evidence-based practice" (7). This module is intended to have 11 credits (5.9% of the total credits of the curriculum) and 680 notional hours (about 5.5% of the total notional hours of the curriculum), and passing this module is a requirement to become eligible to sit for the second examination for medical degrees (Part II). Evaluation of this module involves examining the research projects, computer-based practical(s), attendance at journal clubs, and presentation. The medical curriculum of another state university, the Rajarata University of Sri Lanka, consists of the "Research in Medicine" module, successful completion of which is a mandatory requirement to be eligible to sit for the 3rd MBBS Part II examination. This module comprises 400 notional hours, which is 3.53% of the total notional hours of the medical curriculum of the said university (8). These facts unequivocally highlight the importance given by (at least two) Sri Lankan universities for undergraduate research.

Impact of Sri Lankan Ethics Review Committees (ERCs) in undergraduate research

At present, all the universities that have a medical faculty have (at least) one Ethics Review Committee (ERC)/Research Ethics Committee (REC) in Sri Lanka. The ERC (or REC) play a dynamic role in assessing and, if acceptable, assuring the scientific and ethical validity of undergraduate research protocols and others.

A review of the standard operating procedures (SOP) of an ERC functioning at a state university in Sri Lanka, the ERC of the Faculty of Medicine, University of Jaffna, related to undergraduate research clearly states that "undergraduate research projects should be submitted under the responsibility of Heads of departments." Further, the Head/nominee of the department concerned is incorporated as a member of the subcommittee that reviews the undergraduate projects. In addition, the particular ERC states that "Communications related to undergraduate projects will be done through the Heads of the respective departments" and "Once ethical approval is given, the department concerned will be responsible for the conduct and monitoring of the project" (9). These measures taken by the ERC would ensure optimum standards of undergraduate research, minimize repetition of same research, and ensure that the available resources are distributed fairly and used efficiently and appropriately.

It appears that the ERCs functioning at the Sri Lankan universities, for example, that of the Faculties of Medicine at the University of Jaffna and University of Kelaniya, exempt the application fee/review fee for the review of undergraduate research projects submitted by the students of the relevant universities (9,10). It would encourage the undergraduate students to initiate research studies by relieving or reducing the research-oriented financial burden on the students. In addition, handling charges will be waived for undergraduate student protocols (at the discretion of the ERC) at the Faculty of Medical Sciences, University of Sri Jayewardenepura, and the Faculty of Health-Care Sciences, Eastern University of Sri Lanka, if these protocols are a direct requirement of coursework of the respective institutions (11,12).

Guidance of supervisors or mentors in research

Assigning qualified research supervisors or mentors for undergraduate research studies could be a difficult task for universities that have inadequate academic staff members in their medical faculties. As the undergraduate research supervision would impose an additional workload, university teachers may face challenges to accommodate both teaching and research responsibilities and fulfill the obligation with the highest standards. This limitation can be overcome by promoting multidisciplinary research where teachers with different specialties of the same faculty or other faculties of the same university could be involved in research studies. In addition, by other means, for example, considering allocating special marks for undergraduate research supervision in the promotion scheme, for example, for professorship (13) in future revisions, would be a strategy to attract qualified supervisors or mentors towards student research.

Research grant and research awards for undergra duate research

An undergraduate research project may require financial provision for its planning and successful implementation. Therefore, lack of funding to cover the research-oriented expenses may affect the quality of the research. At this juncture, provision of financial support from the institution where the student is attached to or from external sources, for example, alumni of a university concern, could be considered for the above purpose according to the legislation of a country. An example of external source of funding for research is the "student research fund" provided to the medical students at the University of Jaffna, Sri Lanka (14). However, it is less likely that available funding could fulfill the requirement of all projects that deserve financial support.

Provision of awards for research excellence would encourage students to get involved in research more in future. An example of an institution that provides research awards for the student's research is the Faculty of Medicine, University of Jaffna (15).

Presentation and publication of undergraduate research

Research conferences

Sri Lankan universities encourage undergraduate research by providing specific opportunities for presenting the findings of the research in scientific forums. In this case, the undergraduate research symposium(s) organized by the University of Jaffna (16), Rajarata University of Sri Lanka (17), and Sabaragamuwa University of Sri Lanka (18) would serve as examples for such efforts. The guidelines for publication and presentation of the symposium of the University of Jaffna highlight that "The abstract should be presented by a current student of the Faculty of Medicine." It will provide a golden opportunity for students to improve their presentation and communication skills and their participation in these conferences paves the way to meet eminent clinicians and research scholars from different geographical locations and share their ideas with them. The research conference organized by the University of Peradeniya, the Peradeniya Medical School Annual Research Conference (PeMSARC), provides an invaluable opportunity for undergraduate students and others to showcase their research, exchange ideas, and establish academic collaborations with the participants of the conference (5).

Scientific journals

Ketheesan et al (2019) viewed that considering manuscripts arising from undergraduate research is a useful approach for journals particularly those that had a history of sporadic publication, to sustain them as regular periodicals. They suggested having a dedicated section in a journal being allocated to manuscripts authored by undergraduate students in every issue and including an undergraduate student as a member in the editorial board of a journal, stating it will further facilitate training for the student member (19). The knowledge and training gained through this opportunity could be shared in student forums and journal clubs, which would be beneficial for students, especially for those who wish to develop their own academic credentials.

Student journals

Student journals could be authored and/or reviewed and/or edited and/or published by undergraduate students, likely with the guidance and governance of institutions, which hold the legal rights for the particular journal. They are established by universities, professional bodies, and organizations to promoting the scientific achievement of the students and to provide learning experience in one or more of the components of the publication process. The journals that provide (or provided) an opportunity for medical students to publish their work include, but are not limited to, Medical Student Research Journal (MSRJ), Australian Medical Student Journal, BMJ Student, British Student Doctor Journal (BSDJ), Amsterdam Medical Student journal, Turkish Medical Student Journal, Harvard Medical Student Review (HMSR), and International Journal of Medical Students (IJMS), etc., (20-27). In general,

student journals publish manuscripts that arise from undergraduate research, literature review, case reports, short communications, interviews and others.

Publication opportunity for undergraduates: Sri Lankan scenario

In the Sri Lankan context, the "Student Medical Journal" is a peer-reviewed journal, apparently the first of this kind, published by the undergraduate medical students of a state university. It was published by the students of the Faculty of Medicine of the University of Colombo under the guidance of the staff of the said institution. The first issue was published in May 2008 with an editorial, an interview, research papers, clinical notes, quizzes, news, etc. (28). The "Colombo Law Journal" is recognized as a student journal published by the Faculty of Law, University of Colombo, with a double-blind peer review policy. The journal considers the writings of law students for publication along with that of legal luminaries (29). It appears that the first issue of this journal was published in 2016. These student journals serve as a stepping stone for the establishment of journals that aim at publishing high-quality manuscripts arising from undergraduate research and others in the future. Apart from contributing as an author, participation in the student journals as a (student) editor, (student) reviewer and facilitator would give valuable, diverse experience for students at the undergraduate level.

Among the 156 journals listed in the Sri Lanka Journal Online (SLJOL) database, which is managed by the National Science Foundation (NSF) of Sri Lanka, at least three open access, peer-reviewed journals had expressed their readiness to consider the manuscripts arising from (undergraduate) students (30). The Ceylon Journal of Medical Science (CJMS) is open for publication by students in both medical and allied health sciences along with other authors, for example, doctors. It is the official journal of the Faculty of Medicine, University of Colombo (31). Another journal published in the country, the Pharmaceutical Journal of Sri Lanka, aims at dispensing a platform or an avenue for publications by pharmacy undergraduates along with others, for example, university academics, pharmacists, etc. This journal is the official publication of the Pharmaceutical Society of Sri Lanka (32). The Sri Lanka Journal of Dermatology is published by the Sri Lanka College of Dermatologists. It serves as a platform for publications by undergraduates and postgraduates, dermatologists, and other clinical professionals through a double-blinded review process with two independent reviewers (33). As many journals (if not all) published in Sri Lanka do not precisely exclude the manuscripts authored by undergraduate students, one may argue that they could still be considered if the editorial team of a journal is satisfied with the quality of the manuscript and the research or other work that led to the preparation of the manuscript were carried out according to the scientific, ethical, and other prescribed standards.

Factors affecting undergraduate research

As the medical curriculum becomes enriched with the inclusion of new areas, *allocating time* for undergraduate research could be a difficult task for medical educators. Nevertheless, incorporating a research component/ module/stream with a specific time frame in the medical curriculum at appropriate phase(s) could promote good quality research at the undergraduate level.

Lack of knowledge regarding the importance of research related to their future profession as a medical practitioner is another factor that could prevent students from actively engaging in research. Encouraging the undergraduate medical students to participate in research conferences and workshops may create an awareness regarding the benefits of research among the students. The research conferences must be planned well in advance considering the academic program of the medical students. In addition, the registration fees for their participation or presentation (if any) should be waived or at least reduced to improve their attendance at the conferences.

Reflective remarks

Early engagement of undergraduate medical students in ethical-based, scientific research would be an asset for them to prepare themselves to perform multiple roles in their future careers as medical practitioners, researchers, and innovators. Involvement in multi-

disciplinary research further benefits undergraduate medical students to become intellectually balanced and makes them capable of approaching scientific inquiries from several angles.

One may argue that undergraduate research may not bring valuable outcomes, as students may not have sufficient knowledge in research methodology, guidance from supervisor or mentor could vary subject to their teaching commitment, enthusiasm and experience, finding funding and resources could be challenging, publication opportunities could be limited, and the period allocated for research by the medical curriculum would not be sufficient to design, conduct, and publish groundbreaking research. Further, undergraduate students could be viewed as unsuitable to conduct certain research, for example, clinical trials, animal studies, studies involving vulnerable population(s), etc. These concerns are debatable on multiple grounds, but many (if not all) would fundamentally agree that the introduction to research culture, knowledge enhancement, and training that students would have by involving research deemed to be an asset for them and placing them in a better position to appreciate, interpret, or involve in-depth research in the future. Further, the findings of the undergraduate research may be of little value now, but they could serve as a trigger to formulate large-scale studies in future.

Conclusion

Integration of research methodology in the undergraduate medical curriculum at its appropriate phase(s) and enabling undergraduate students to navigate through the hypothesis-driven scientific research process, from designing the study to its publication(s) while maintaining a predetermined time frame for both, would contribute to the acquisition of knowledge and skills that are deemed essential for future medical practitioners to provide an evidence-based practice to society. Involvement in the organization of research conferences and performing multiple roles in the scientific journals at the undergraduate level would be an added learning experience for the students, particularly for those inclined to a research-based career. It is indeed the responsibility of the supervisors or mentors, academia, and administrators of the higher educational institutions to encourage and guide the students to carry out meaningful research, appropriate for them, for the betterment of society.

References

1. The Council on Undergraduate Research. https://www.cur.org/about/what-is-undergraduate-research/ (retrieved on 17th January 2025).
2. Youvan DC. Wilhelm von Humboldt's Educational Reforms: Foundations of the Modern Research University (2024). 1-36.
3. Massachusetts Institute of Technology, United States of America. https://news.mit.edu/2000/urop-0202 (retrieved on 2nd March 2025).
4. Undergraduate Research Symposium. Faculty of Medicine, University of Jaffna. https://www.med.jfn.ac.lk/proceedings-of-the-7th-urs/ (retrieved on 6th February 2025).
5. Peradeniya Medical School. Annual Research Conference, Faculty of Medicine, University of Peradeniya (PeMSARC'24). https://pemsarc24.vercel.app/other/Book%20of%20Abstracts%20PeMSARC'24.pdf (retrieved on 6th February 2025).
6. Atukorala KR, Sumanasekara DRN, Wickramasinghe KH, Ratnayake GM, Jayasena GM, Weeratunga PN, Wickramasinghe SI, Jayasinghe S. Medical student research output in a developing country: Where has all the research gone?. Medical teacher. 2012 Nov 1;34(11):998.
7. Curriculum. Medical Degree Programme (volume 1). Medical Education Unit, Faculty of Medicine, University of Jaffna (Revised in 2024). https://www.med.jfn.ac.lk/curriculum-2024-2/ (retrieved on 20th January 2025).
8. MBBS Curriculum (Compilation of Amendments 2019 – 2022), Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka. https://fmas.rjt.ac.lk/wp-content/uploads/2023/07/MBBSCurriculum20192022.pdf (retrieved on 21st January 2025).
9. Standard Operating Procedures, Ethics Review Committee, Faculty of Medicine

University of Jaffna (Version 4). https://www.med.jfn.ac.lk/wp-content/uploads/2022/07/ERC-SOP-V4-Senate-approved.pdf (retrieved on 20th January 2025).

10. Standard Operating Procedures, Ethics Review Committee, Faculty of Medicine, University of Kelaniya. https://medicine.kln.ac.lk/prog/erc/images/OnlineResources/sop/SOP-4-2019-V3.pdf (retrieved on 22nd March 2025).
11. Standard Operating Procedures, Ethics Review Committee, Faculty of Medical Sciences, University of Sri Jayewardenepura. https://medical.sjp.ac.lk/wp-content/uploads/ERC-Standard-Operating-Procedures.pdf (retrieved on 22nd March 2025).
12. Standard Operating Procedures, Ethics Review Committee, Faculty of Health-Care sciences, Eastern University, Sri Lanka. https://fhcs.esn.ac.lk/images/downloads/ERC2019/STANDARD%20OPERATING%20PROCEDURES%20New.pdf (retrieved on 22nd March 2025).
13. Schemes of recruitment/promotion for associate professor/professor (Commission Circular No. 916), University Grants Commission, Sri Lanka. https://www.ugc.ac.lk/attachments/666_Circular916.pdf (retrieved on 24th March 2025).
14. Student Research Fund contributed by 6th batch, Faculty of Medicine, University of Jaffna. https://www.med.jfn.ac.lk/2024/06/21/student-research-fund-contributed-by-6th-batch-faculty-of-medicine-university-of-jaffna-2/ (retrieved on 23rd March 2025).
15. Research Awards. Faculty of Medicine, University of Jaffna. https://www.med.jfn.ac.lk/research-awards/ (retrieved on 21st January 2025).
16. The seventh Undergraduate Research Symposium 2024. Faculty of Medicine, University of Jaffna. https://www.med.jfn.ac.lk/urs-2024/ (retrieved on 20th January 2025).
17. The sixth Undergraduate Research Symposium. Faculty of Medicine and Allied Sciences, Rajarata University of Sri Lanka. https://fmas.rjt.ac.lk/ursfmas-2024/ (retrieved on 22nd January 2025).
18. Medical Undergraduates' Research Symposium (MeUReS'22), Faculty of Medicine, Sabaragamuwa University of Sri Lanka. https://www.sab.ac.lk/med/event/meures-2022 (retrieved on 22nd January 2025).
19. Ketheesan S, Natkunam R, Ketheesan N. The Jaffna Medical Journal as a forum for undergraduate research. Jaffna Medical Journal. 2019;31(1):26-29. DOI: http://doi.org/10.4038/jmj.v31i1.63
20. The Medical Student Research Journal (MSRJ). https://msrj.chm.msu.edu/mission-statement/ (retrieved on 16th March 2025).
21. Australian Medical Student Journal. https://www.amsj.org/about/aims (retrieved on 16th March 2025).
22. BMJ Student. https://www.bmj.com/about-bmj/resources-authors/article-types/student (retrieved on 16th March 2025).
23. The British Student Doctor Journal (BSDJ). https://www.bsdj.org.uk/story (retrieved on 16th March 2025).
24. The Amsterdam Medical Student journal (AMSj). https://www.amsj.nl/our-team/ (retrieved on 16th March 2025).
25. Turkish Medical Student Journal. https://turkmedstudj.com/aims-and-scope (retrieved on 17th March 2025).
26. The Harvard Medical Student Review (HMSR). https://www.hmsreview.org/about/about-hmsr (retrieved on 16th March 2025).
27. The International Journal of Medical Students (IJMS). https://ijms.info/IJMS/about (retrieved on 16th March 2025).
28. Student Medical Journal. Faculty of Medicine, University of Colombo https://med.cmb.ac.lk/SMJ/Main%20page-alt.html (retrieved on 12th March 2025).
29. Colombo Law Journal, Faculty of Law, University of Colombo. https://law.cmb.ac.lk/research/publications/colombo-law-journal/ (retrieved on 13th March 2025).
30. Sri Lanka Journal Online (SLJOL). https://www.sljol.info/site/ (retrieved on 15th March 2025).
31. Ceylon Journal of Medical Science (CJMS). https://cjms.sljol.info/ (retrieved on 15th March 2025).
32. The Pharmaceutical Journal of Sri Lanka. https://pjsl.sljol.info/ (retrieved on 15th March 2025).
33. The Sri Lanka Journal of Dermatology. https://sljd.sljol.info/ (retrieved on 15th March 2025).