IMPORTANCE OF UNDERGRADUATE RESEARCH IN MEDICAL AND DENTAL CURRICULUM

Laxmi Pathak,[1] Rajeshwar Reddy Kasarla,[2] Kripa Ghimire[3]

ABSTRACT

INTRODUCTION

The quality of medical education has attracted considerable interest during the last few years. This interest is especially concerned with the question of how education can be made more relevant to the needs of today's society. Emerging changes in today's society such as rapid advances in technology, changes in demographics, environmental factors and life style may require a revision in the present system of education in such a way that students of health profession are trained to deal with problems in the future, preparing themselves to become active, independent learners and problem-solvers, rather than more or less passive recipients of information. The recent trend in medical and dental education is introduction of undergraduate research in the medical and dental curriculum. The present article reviews and describes the importance of undergraduate research to teach students how to conduct research and to develop necessary skills that can be applied outside the academic environment, to produce competent doctors and enhance patient outcomes.

KEYWORDS

Curriculum, Medical education, Undergraduate research

1. Department of Anaesthesiology & Critical Care Medicine, Universal College of Medical Sciences, Bhairahawa, Nepal
2. Department of Microbiology, Universal College of Medical Sciences, Bhairahawa, Nepal
3. Department of Microbiology, Gandaki Medical College, Pokhara, Nepal

https://doi.org/10.3126/jucms.v12i01.65660

For Correspondence
Dr. Laxmi Pathak
Department of Anaesthesiology &
Critical Care Medicine
Universal College of Medical Sciences
Bhairahawa, Nepal
Email: pathak0laxmi@gmail.com

Over the last two decades there has been a transition in higher education creating powerful educational environments that improve learning. The link between development of strong research skills and the provision of medical care is inextricable. Research makes students better scientists, a core part of being a physician, and better prepares them to lead clinical practice. That's why the research experience is stressed during undergraduate medical and dental education program.[1,2] Several studies have shown that incorporation of research in undergraduate medical and dental curriculum enhances the self-directed learning and better understanding of the medical subjects. Participation in research will enhance attributes of scientific thinking, team working, leadership, communication, management skills, self-confidence, and continued advancement of knowledge. Therefore, undergraduate medical and dental curriculum must be revised to incorporate research as a fundamental component. [3]

Undergraduate research is a scholarly or creative investigation or inquiry conducted by an undergraduate student that contributes to the systematic production of new knowledge, an original intellectual or creative contribution to the discipline. It is a meaningful activity undertaken with the guidance of a faculty member or other research mentor(s) and is used to enrich the College academic curriculum and student experience. The research approach and preparation will differ depending on the disciplinary field and the specific research area. Thus Undergraduate research is defined as a scholarly effort, generally beyond the classroom, aimed at developing a student's skills in inquiry through opportunities to contribute to and/or pursue original intellectual or creative work.[4,5]

Students may work independently or in small teams and are mentored by a faculty member. Working with a faculty mentor enables students to share professional researcher's work, learning how to formulate significant questions, developing investigative procedures, gathering and examining evidence, evaluating results, and sharing conclusions with the scientific community. Research with a faculty mentor establishes a meaningful relationship with faculty members and professional researchers, and offers a powerful learning opportunity that goes beyond the traditional classroom experience, and can impact the future career choices of undergraduate students. Students and faculty share the excitement of discovering something new.[6-8] Students gain first-hand experience of real world research. Research balances student's academic life with their personal life. The results of undergraduate research can be published in research journals. Research publications will be an excellent addition to students' resume.[9,10]

Table 1. Types of research

Discovery research	Finding novel interventions (basic research) and validation in in vivo models
Development research	Developing interventions for screening, diagnosis, prevention, treatment of diseases/conditions or make existing interventions simpler, safer, more efficacious, or more affordable
Delivery research or implementation research	Learning how to overcome barriers in delivering effective interventions to the people who need them
Descriptive research	Understanding the disease or condition including its burden, risk factors and determinants and pathogenesis mechanism

The biggest challenge for students is usually figuring out what kind of research they're interested in. The faculty mentors can help students choose a topic for research in a level appropriate for undergraduate students. The topics for research can be in the fields of medicine, public health, and allied health sciences.[11,12] The research should lead to some contributions in generating effective interventions for preventions, diagnosis, treatment, or rehabilitation of those disease conditions. The research proposals must obtain the ethical clearance from institutional ethical committee, to strengthen the ethics in conduct of research.[13,14]

Table 2. Some of the high priority research areas

Communicable diseases	Antimicrobial resistance, vector-borne diseases, tuberculosis, sexually transmitted infections, respiratory infections, urinary tract infections, Gastrointestinal infections including hepatitis, sepsis, meningitis, encephalitis, one-health approach for infections of epidemic or pandemic potential, etc.
Non-communicable diseases	Cardiovascular disease, cancer, diabetes, chronic respiratory diseases, chronic neurological diseases, chronic renal diseases, common mental health disorders, chronic gastrointestinal/liver diseases, trauma and burns, oral health problems, NCD risk factors (diet, activity, alcohol, tobacco etc.), blood disorders (thalassemia, sickle cell disease, clotting disorders etc.), climate change & its impact on health, eye diseases, ENT diseases, ageing and elderly death, genetic diseases.
Reproductive, maternal and child health, nutrition	Preconception care, antenatal care, intra and peripartum care, postnatal care, preterm birth /low birth weight, neonatal sepsis, early child development, childhood malnutrition, breast feeding and complementary feeding, anemia in women and children, common childhood diseases, polycystic ovary syndrome and other reproductive health problems, adolescent health, contraception and infertility.

Undergraduate research allows students to develop professionally and personally in ways not possible through traditional lecture and laboratory courses. Research experiences give students an opportunity to gain a deeper knowledge of research processes and techniques, explore academic literature, and gain a skill set that encompasses problem solving, communication, academic writing skills, project management, making research proposals. Research allows the students to broaden their statistical analysis, helps enhance the IT skills as it requires the students to use various statistical packages to analyse their results.[2,7,8]

Table 3. Benefits of undergraduate research

- Beneficial for academic success and professional career
- Improves problem solving skills
- Helps to think independently
- Improves critical thinking skills
- Improves the ability to deliver presentation in seminars
- Helps to understand the relation between research and clinical practice
- Helps in new knowledge acquisition
- Strengthens self-confidence
- Helps to apply theoretical knowledge into clinical practice
- Motivates to continue post-graduate program
- Improves internet research skills
- Improves communication skills
- Improves self-directed learning
- Provides experience in laboratory studies and experiments
- Improves the ability to search for literature
- Improves the relationship between students and faculty

Undergraduate research experiences can vary from one student to another and from one discipline to another. Undergraduate research experiences help students understand a particular topic or phenomenon in a field while simultaneously strengthening their comprehension of research and research methods.[15-17] Research with a faculty mentor offers a powerful learning opportunity that goes beyond the class room experience. Students share in professional researcher's work, learning how to formulate significant questions, developing investigative procedures, gathering and examining evidence, evaluating results, and sharing conclusions with the scientific community. Faculty members also benefit from undergraduate research, might become better teachers.[18-20]

CONCLUSION

Undergraduate research must be regarded as a fundamental component in medical and dental education for the academic development of medical and dental students for the benefit of future doctors. Undergraduate students must be encouraged to get involved in research and scientific publishing. The objective of undergraduate research is to teach students how to conduct research and to develop necessary skills that can be applied outside the academic environment, to produce competent doctors and enhance patient outcomes. Critical thinking, creation of hypothesis, experimentation, and team work are all abilities needed in every day clinical practice that can be acquired by undergraduate research. Undergraduate research can benefit students, faculty members and academic institutions.

REFERENCES

1. Eagan MK, Hurtado S, Chang MJ, Garcia GA, Herrera FA, Garibay JC. Making a difference in Science Education: the impact of undergraduate research programs. American Education Research Journal. 2013;50:683-713.

2. John K. Petrella, Alan P. Jung. Undergraduate research: importance, benefits, and challenges. Int J Exerc Sci. 2008;1(3):91-95.

3. Ávila M, Rodríguez-Restrepo A. The importance of research in undergraduate medical education. Medwave. 2014 Nov;14(10):e6032.

4. Sapna S Patil, Ameya A Hasamnis. The role and scope of research in undergraduate medical curriculum. Journal of Clinical and Diagnostic Research. 2018 Oct; 12(10):L101-L202.

5. Deo MG. Undergraduate medical students' research in India. J Postgraduate Med. 2008;54(3):176-79.

6. Russell SH, Hancock MP, McCullough J. The pipeline. Benefits of undergraduate research experiences. Science. 2007;316(5824):548-549.

7. Petrella JK, Jung AP. Undergraduate Research: Importance, Benefits, and Challenges. Int J Exerc Sci. 2008;1(3):91-95.

8. Russell SH, Hancock MP, McCullough J: The pipeline. Benefits of undergraduate research experiences. Science. 2007;316(5824):548–549.

9. Imafuku R, Yasuda S, Hashimoto K, Matsunaga D, Ohashi Y, Yamamoto K, et al. Exploring medical students' and faculty's perspectives on benefits of undergraduate research experience. Med Sci Educ. 2018;28:553-560.

10. Detsky MED, Detsky AS: Encouraging medical students to do research and write papers. CMAJ. 2007; 176(12):1719–1721.

11. Taraban R, Logue E. Academic factors that affect undergraduate research experiences. J Educ Psychol. 2012;104:499–514.

12. Kumar J, Memon A, Kumar A, Kumari R, Kumar B, Fareed S. Barriers experienced by medical students in conducting research at undergraduate level. Cureus. 2019;11(4):e4452.

13. Nalliah RP, Lee MK, Da Silva JD, Allareddy V. Impact of a research requirement in a dental school curriculum. J Dent Educ. 2014;78(10):1364–71.

14. Yusuff Adebayo Adebisia. Undergraduate students' involvement in research: Values, benefits, barriers and recommendations. Annals of Medicine and Surgery. 2022;81:104384.

15. Shrestha A, Shrestha A. The importance of doing research as a medical student. Kathmandu University Medical Journal. 2007;Vol. 5, No. 1, Issue 17:138.

16. El Achi D, Al Hakim L, Makki M, Mokaddem M, Khalil PA, Kaafarani BR, Tamim H. Perception, attitude, practice and barriers towards medical research among undergraduate students. BMC Med Educ. 2020;20(1):195

17. Lee GSJ, Chin YH, Jiang AA, Mg CH, Nistala KRY, Iyer SG, et al. Teaching Medical Research to Medical Students: a Systematic Review. Med Sci Educ. 2021;31(2):945-962.

18. Ommering BWC, Wijnen-Meijer M, Dolmans DHJM, Dekker FW, van Blankenstein FM. Promoting positive perceptions of and motivation for research among undergraduate medical students to stimulate future research involvement: A grounded theory study. BMC Med Educ. 2020:20:204.

19. Oliveira CC, Souza RC, Sassaki Abe EH, Silva Móz LE, de Carvalho LR, Domingues MAC. Undergraduate research in medical education: a descriptive study of students' views. BMC Medical Education. 2013; 14:51.

20. Burgoyne LN, O'Flynn S, Boylan GB. Undergraduate medical research: the student perspective. Med Educ Online. 2010, 15.