

Stimulating the clinical academics of tomorrow: A survey of research opportunities for medical students in New Zealand

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Abstract

Developing the clinical academic workforce of the future is a priority of international relevance. Despite a number of measures implemented to address this challenge, a small proportion of medical students engage in research. Lack of knowledge of available research opportunities, and difficulty finding projects and suitable mentors are key barriers to undergraduate medical research. To date, there is no consolidated source of information on undergraduate research training opportunities and their outcomes available to medical students in New Zealand. Based on a comprehensive review of the published and grey literature and the authors' personal experiences of research training activities as medical students, this article presents an overview of the research training opportunities available to medical students in New Zealand. Challenges facing medical student research involvement are discussed and current knowledge gaps in the literature are highlighted. The article concludes with suggested strategies to help promote research training opportunities and support students through their research experience.

Background

Clinical academics are medical doctors who also undertake research and other academic activities alongside their clinical responsibilities.¹ They typically make substantial contributions to patient care, but also to medical research, undergraduate and postgraduate teaching, and university administration. Furthermore, clinical academics play a pivotal role in bridging the gap between bench and bedside, with their work spanning from basic science to translational, clinical, and population health research.¹ Given their unique combined experiences in research and patient care, clinical academics are well positioned to identify unanswered questions, conduct basic and clinical research, and translate their findings into practical bedside applications.²

Unfortunately, the contribution of this unique group may be dwindling. Recent international trends from the United States,^{1,3} the United Kingdom,⁴ Europe⁵ and Australasia⁶ indicate the proportion of clinical academics is declining relative to the rest of the medical workforce. To reverse this trend, systematic and concerted efforts have been put forth at the undergraduate and postgraduate levels.^{3,7} Studies have shown that early exposure to research increases undergraduate medical students' subsequent interest in academic medicine as a career.^{8,9} For this reason, a number of measures have been implemented to engage medical students

in research across the globe.⁷⁻¹⁴

In addition to the development of interpersonal and research-specific skills,¹⁵ early student participation in scholarly activities is associated with improved short- and long-term academic productivity.⁸ Numerous studies have demonstrated that medical student research activities can regularly result in publications in peer-reviewed medical and scientific journals.^{8,10,11,13-19} Furthermore, early exposure to research enhances medical students' confidence in conducting research and improves their critical thinking and literature appraisal skills,¹³ qualities essential for the practice of evidence-based medicine.

Despite the importance and benefits of undergraduate research, relatively few students participate in scholarly and research activities.^{8,10,15} In New Zealand, only one-quarter of students are involved in research during their time at medical school.¹⁷ International studies exploring perceived barriers to undergraduate research involvement have identified a number of potentially ameliorable factors. As well as time and financial constraints, lack of awareness of available research opportunities and how to get involved in research projects were some of the main barriers cited by medical students.^{8,15,20}

To date, there is no consolidated source of information on undergraduate research training opportunities and their outcomes available to medical students in New Zealand apart from individual university medical school websites.

Aim

The aim of this review was to present an overview of the research training opportunities, formal and informal, offered at New Zealand medical schools. Based on a comprehensive review of the literature, and the authors' personal experiences of research as medical students, challenges facing medical student research involvement are discussed and recommendations are presented in order to promote research opportunities and support students through their research experiences.

Methods

A comprehensive search of the published literature was performed using the MEDLINE database to identify articles relevant to medical student research opportunities in New Zealand. MEDLINE searches were carried out via PubMed in March 2017. The following terms were used alone or in combination: medical student, undergraduate, physician-scientist, academic medicine, intercalated degree, research, publication, New Zealand. The reference lists of identified articles were scanned for additional relevant publications. The websites of the Universities of Auckland and Otago were also searched to identify grey literature sources. Both Universities were contacted to attempt to obtain quantitative data about the uptake of student research opportunities where this was not available from previously published literature.

Available research opportunities

A broad array of research and scholarly activities are available to medical students.^{7,11} These include curricular (i.e. mandatory research modules) and extracurricular (i.e. intercalated research degrees and summer studentships) research training opportunities. A summary is provided in Table 1.

Intercalated research degrees

Undertaking an intercalated degree is the most focused formal research training opportunity offered by medical schools in New Zealand, Australia, the United Kingdom and North America.²¹⁻²⁴ Depending on the combined degree, students are often required to take time away from the medical programme to complete a full-time research-based degree. The aim of research-based intercalated degrees is to "provide an opportunity for medical students to obtain research experience in preparation for an academic or research career"^{1,23}

A variety of intercalated degrees are offered worldwide; these include Honours, Master's and Doctorate degrees. In New Zealand, Honours and Doctorate degrees are the two degrees awarded to intercalating medical undergraduates.¹¹

Currently, two intercalated research programmes are available to interested medical students in New Zealand; the Bachelor of Medical Sciences with Honours (BMedSc(Hons)) and the Doctor of Philosophy (PhD) degrees. Financial support for students undertaking such programmes may be provided by medical schools, local trusts, and other funding bodies in the form of scholarships and awards.

While only offered to students following completion of their third or fifth year at the University of Otago,²⁵ the BMedSc(Hons) degree is available to medical students at any stage after satisfactorily completing the third year of the MBChB programme at the University of Auckland.²⁶

A PhD degree is widely regarded as an essential component in the training of physician-scientists.²⁷ Exceptional undergraduates who have a clear vocational direction and are committed to a career in academic medicine may consider pursuing a dual MBChB/PhD degree.²⁷ The University of Otago offers medical students with an exceptional academic record and research experience a unique opportunity to simultaneously intercalate their medical programme with a PhD degree (MBChB/PhD programme). After completing 3 years of preclinical medicine, students spend 2 years undertaking full-time research then complete 3 years of clinical training while completing their theses to graduate with a joint MBChB/PhD degree.²⁸

There is a paucity of literature investigating New Zealand medical students' attitudes towards, interest and involvement in, and outcomes related to intercalated research degrees. Available research suggests that the uptake of intercalated degrees in New Zealand is low when compared to the United Kingdom and Australia.¹⁰ Reasons for the low interest in intercalated research degrees in New Zealand have not been extensively scrutinized. However, a recent survey of intercalating medical graduates from the University of Auckland reported 80% of students encountered ameliorable difficulties while intercalating, which include heavy workload, poor academic mentorship, financial constraints and prolonged time to graduation.²⁴ Not surprisingly, these challenges are similar to those identified by intercalating students in Australia and the United Kingdom.^{10,23}

Research output is the most commonly reported outcome measure to evaluate the success of undergraduate research programmes.^{8,15} A review of the literature revealed only one study which investigated the outcomes of intercalated research degrees in New Zealand. Al-Busaidi et al. found the number of students enrolled in the intercalated MBChB/BMedSc(Hons) programme at the University of Otago steadily increased from 1995 to 2014.¹¹ Furthermore, research output from BMedSc(Hons) theses was found to be relatively high when compared to international studies, with nearly one-third of theses resulting in at least one peer-reviewed publication.¹¹ However, the outcomes of the intercalated MBChB/PhD programme at the University of Otago have yet to be reported.

Required research experience

One of the methods used by medical schools to engage prospective medical doctors in research is the integration of compulsory research training activities into the medical curriculum. The format and requirements of these research training programmes vary greatly between medical schools. In New Zealand medical schools, students receive teaching on research methods and design in the preclinical years which is reinforced by participation in mandatory research projects during the clinical years of the MBChB programme, often as part of the Public Health module at the University of Otago,²⁹ or required clinical audits during the Paediatrics and Obstetrics & Gynaecology attachments at the University of Auckland (discussed below).

The Trainee Intern Health Care Evaluation module offered at the Dunedin School of Medicine, University of Otago is an example of a curricular research training opportunity.²⁹ Under the supervision of Faculty staff members and over a period of 6 weeks, final year medical students (trainee interns) work in groups to conduct a study, from design to data

Table 1. Summary of currently available research opportunities for medical students in New Zealand

Research Opportunities	Duration	Auckland	Otago	Uptake ^a	Research Outputs
Intercalated Degrees					
- BMedSc(Hons)	1 year	✓	✓	O: 12.6/year ^b	O: Publication rate 33% ¹¹
- PhD	2-3 years	X	✓	O: 1.2/year ^b	NA
Required/compulsory research experience					
- Public Health Module	6 weeks	X	✓	All Trainee Interns	O: Publication rate 8.4%
- Clinical Audit	4-6 weeks	✓	X	All Trainee Interns	NA
Formal Extracurricular Opportunities					
- Summer Research Studentships	10 weeks	✓	✓	O: 120/year ^b A: 87/year ¹⁹	A: Publication rate 32% ¹⁹
- Research Electives	2-3 months	✓	✓	O: 4/year ^b	NA
- Clinical Audits	Variable	✓	✓	NA	NA
Informal Extracurricular Projects					
	Variable	✓	✓	NA	NA

A: Auckland; O: Otago, NA: Not available.^a Average number of students from last 5 years of available data. ^b Data obtained from personal correspondence with university.

interpretation. Student groups are required to present their findings in a forum and submit a written report of the study. Although students are not required to publish their project findings, mandatory medical school research training experiences can result in publications in peer-reviewed journals,¹³ and presentation at local and international conferences (Al-Busaidi & Tarr, unpublished). The tangible research outputs from these curricular training modules attests to their value for students and medical schools in New Zealand, though their effect on long-term engagement in research remains unknown.

Extracurricular research opportunities

Despite perceived lack of time being one of the most commonly reported barriers to undergraduate medical research, students continue to participate in extracurricular scholarly activities. These include taking part in formal (i.e. summer studentships) or informal (i.e. research during spare time) research opportunities.

Formal Opportunities

Summer Research Studentships

Summer studentships are supervised research projects, supported financially by grants/scholarships, available to medical students over a 10-week period during the summer vacation. It is commonly accepted that well-structured and mentored summer projects provide students with the basic research knowledge and skills and spark their interest in a future career in academic medicine while mitigating the barriers associated with intercalating and other long-term research endeavours.³⁰

Summer studentship programmes are the most common form of medical student research involvement in New Zealand.¹⁷ Furthermore, recently published data indicate summer studentships appear to be increasing in popularity among New Zealand medical students as a short-term research activity. Wells et al. identified the number of students undertaking summer studentship projects at the University of Auckland has at least tripled since the early 2000's.¹⁹ Financial incentives, an interest in research, and CV development are reported to be the main motivating factors for medical students to undertake a summer studentship, while most students hope to develop skills in critical thinking, research methods, interpretation of results, and academic writing (Wells, Wallace, Alexander, McLaughlin & Shelling, unpublished). Notably, three-quarters of students stated they were more likely to be involved with research again in the future because of their summer studentship experience.

Long-term follow up of summer research students at the University of Auckland from 2001 to 2013 has shown 32% have published at least one article with their studentship supervisor,¹⁹ a comparable publication rate to students undertaking intercalated BMedSc(Hons) degrees.¹¹

Research Electives

Electives are a potentially valuable opportunity for students to obtain an in-depth experience in medical research.³¹ Similar to summer studentships, research electives provide medical students with a protected period of time to build upon existing research skills, free from curricular assignments and other clinical commitments. Students may acquire new research skills, build valuable connections and improve their research productivity during a period even as short as 4-9 weeks (depending on the student's ability, commitment, and available resources).³² In addition to boosting institutional research performance, electives might represent an opportunity for medical schools where research-oriented students could be identified and directed towards an academic career pathway. A mandatory Canadian undergraduate research elective significantly increased medical students' interest in pursuing a career in medical research.³¹

As part of the final year of the University of Otago and University of Auckland 6-year undergraduate medical curriculum, students are required to complete an elective attachment (usually for 8-12 weeks), in clinical or non-clinical medical-related disciplines (e.g. medical education, journalism

or research) in New Zealand or at an institution abroad. Furthermore, the University of Otago, Christchurch School of Medicine, offers its final year medical students a supervised 4-week selective period where students elect to join a specialty of their choice to pursue further clinical and/or research training, sometimes culminating in peer-reviewed publications.³³ A review of the literature revealed no published data on the uptake and outcomes of research electives by New Zealand medical students, though correspondence with the University of Otago found only 1-2% of students undertake this option during their elective placement.

Clinical Audits

Medical students on clinical attachments may be presented with opportunities to participate in clinical audits or other quality improvement projects, either voluntarily or as part of the required assessment for the attachment. These projects are usually small and based on retrospective chart reviews from a single clinical department. The results of these audits may be published, contribute to larger research projects, or inform quality improvement strategies within the clinical department. While these projects are often limited in scope, they may present a valuable opportunity for medical students to gain initial experiences and skills in research. However, no published data was identified evaluating the outcomes from clinical audits undertaken by medical students in New Zealand.

Informal Opportunities

Extracurricular/independent research

Medical students may also contribute to research projects during their personal time during the academic year, often under the supervision of clinical staff or university faculty members.^{17,18,34} These projects make up a minority of the research experience of New Zealand medical students,¹⁷ but may be more common amongst motivated clinical students who have fewer opportunities to undertake summer studentships due to their shorter vacation periods.¹⁶

Reinders et al. showed that medical students who participate in extracurricular research opportunities have significantly greater research outputs both prior to and following graduation.¹⁸ To date, very little attention has been paid to the study of the prevalence and impact of independent/extracurricular medical student research in New Zealand.¹⁷

Student-led initiatives

1. Medical student journals

Students involved in medical research are often confronted with challenges when attempting to publish their findings in mainstream journals.³⁵ Such challenges at an early stage in undergraduate research involvement can erode students' confidence and discourage them from pursuing future participation in academic medicine.

Medical student journals (MSJs) may play a critical role in promoting medical student research involvement. MSJs provide a friendly medium where students share their research findings, develop research-related skills, and navigate through the peer-review and publication processes. However, no published data was found evaluating the effectiveness of MSJs in stimulating interest in research or promoting academic careers. The New Zealand Medical Student Journal was established in 2004, and has since published over 250 articles. It aims to support medical students as they transition from writing medical school assignments to publishing research in peer-reviewed journals.

However, mainstream medical journals are also common outlets for the dissemination of medical student research. In a recent analysis by Wells et al., the New Zealand Medical Journal (NZMJ) was found to be the most common journal for published studentship research projects.¹⁹ Furthermore, in a recent large review of the NZMJ (1999-2013), medical students were found to have authored or co-authored around 9% of the total articles published and their contributions to the NZMJ have more

than quadrupled since 2000.³⁶

2. Student research conferences

The HealthX Conference at the University of Auckland provides an opportunity for undergraduates and postgraduates from across the Faculty of Medical and Health Sciences to present their research, whereas students at the University of Otago may present their work at the meetings of the Otago Medical School Research Society. Medical students frequently present their work from summer studentships or other research projects at these meetings. However, no data exist assessing the impact of presentations at these meetings on subsequent publication, engagement with research, or development of clinical academics.

3. Academic medicine societies

Student-run academic medicine societies have been established at several overseas universities in response to the declining interest in research careers.^{37,38} These groups have successfully run events such as lectures, student research symposiums, and nationwide student research conferences, and have shown positive impacts on student interest in academic careers.³⁷ To the authors' knowledge, similar student-led academic medicine societies do not currently exist in New Zealand.

4. Student-led collaborations

Student-led collaborative initiatives such as STARSurg have been notably successful in the United Kingdom, publishing multi-centre observational studies with close to 8,000 patients from more than 160 centres.^{39,40} These initiatives are based on a successful surgical trainee collaborative model, and have been adapted for medical students to gain experience in data collection, processing, and research methods.⁴¹ Notably, all students who participate are PubMed-indexed authors on the final manuscript, which is published under the authorship of the collaborative group. No similar collaborative initiatives currently exist in New Zealand.

Challenges and solutions

Perceived barriers to performing research during medical school are well-described in the literature. Lack of knowledge of available research opportunities, difficulty finding projects and suitable mentors, and time and financial constraints may serve as early deterrents for medical students interested in research careers.^{7,13,17}

Various strategies to promote research opportunities and support students through their research experience have been implemented with great success. Recently established programmes to advertise research opportunities and help students identify academic mentors, such as university-administered student research offices have succeeded in increasing interest and involvement in research.¹⁴ Furthermore, a web-based "Medical Student Research Portal" has recently been introduced at the University of Queensland, linking medical students interested in research with clinical and academic supervisors.⁴²

Most studies identified in two recent meta-analyses examining medical student research activities (including experience, perceived barriers and outcomes) emanated from North America and Europe.^{8,15} Comparatively few published studies have examined the state of medical student research in New Zealand.^{11,17,19,21,24,36} Findings from these studies should be used to optimise medical students' research experience and design programmes that provide productive, rewarding research experiences that ultimately inspire and encourage students to pursue medical research following graduation. More research is required to formally assess undergraduate medical research training opportunities currently offered in New Zealand.^{11,19} Furthermore, the state of the clinical academic workforce in New Zealand should be evaluated by future research. Trends in the number of academic positions, research funding, remuneration, and postgraduate research opportunities should be assessed, given these factors are likely to affect long-term engagement in academia.

Review of the pertinent literature identified a number of recommendations to improve New Zealand medical student engagement in research.

Providing students with early positive experiences in research is essential to attract high-achieving students to careers as clinical academics. Creating more compulsory research projects for medical students is unlikely to be successful, given students may not be interested, and the projects are usually brief or limited in scope.⁸ Ideally, research projects should be meaningful and interesting; poor-quality projects are unlikely to motivate students to continue their involvement in research. Supervisors of undergraduate medical students should aim to involve and support students in all aspects of the research process from study design to publication.

Mentorship of young researchers by established scientists is crucial, and has been shown to predict future scholarly productivity.⁴³ Academic staff and clinical teachers should be encouraged to supervise projects by undergraduate medical students, and be equipped with information about the availability of medical student research training activities. The establishment of formal academic mentoring programmes for motivated students may facilitate the development of relationships between medical students and clinical academics, and may lead to an increased uptake of available research opportunities.

Medical schools should develop a process by which currently offered undergraduate research training opportunities are regularly evaluated and deficiencies are identified and rectified if possible. Furthermore, universities should work with academic staff to create more opportunities for medical students to engage with research, and promote these to interested students. We recommend establishing a university-based student research office to support student engagement in research, reduce barriers for those interested in pursuing research projects, help students find suitable academic mentors and encourage students to disseminate their findings through peer-reviewed publication or presentation at scientific and medical conferences.¹⁰ Furthermore, students with a particular interest in research and academic medicine should be encouraged to pursue further training in postgraduate research (e.g. enrolling in higher academic degrees including Masters and PhD programmes).

Finally, the establishment of collaborative research networks for trainees and medical students in Australasia may enhance the generation of high quality research, provide medical students with meaningful opportunities to contribute to research, and promote the development of clinical academics in New Zealand.⁴⁴

Conclusion

This report is the first consolidated source of information on undergraduate research training opportunities available to medical students in New Zealand. Medical educators should use this review to familiarise their students with the available research opportunities. At the medical school level, additional measures to facilitate students' involvement in undergraduate research activities should be implemented. The literature evaluating New Zealand medical student research involvement and opportunities, although slowly growing, is generally lacking. Future research should focus primarily on examining the prevalence of, and barriers to medical student research involvement, and evaluating the outcomes of currently offered undergraduate research training activities.

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