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Research: Why aren't more medical students doing it?

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RESEARCH

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ABSTRACT

Background
Many medical schools in Australia and Internationally struggle to engage medical students along a research pathway.

Aims
The aim of this study was to identify medical student's confidence, attitudes and perceived obstacles to participating in research during medical school.

Methods
A cross-sectional survey was carried out of undergraduate medical students in years 1–5 attending the University of Tasmania.

Results
Of the 237 students who responded to the survey (response rate of 41.9 per cent) the majority (70.3 per cent) agreed that research was a useful experience and expressed a desire to be involved in research (60.1 per cent). Women were generally less confident than men in their ability to conduct research while research experience was significantly associated with an increase in confidence in conducting research. Frequently endorsed reasons by students for not undertaking an Honours year were a desire to not delay graduation by a year for financial (79 per cent) and employment reasons (71 per cent) and social concerns regarding integrating with a different year group (69 per cent). Additional concerns included a lack of time and motivation.

Conclusion
The difficulties inherent for students in undertaking research including low confidence, lack of time, financial constraints and pressure to get out into the workforce should help to inform medical educators in developing solutions to encourage student participation in research.

Key Words
Research, medical students, participation, barriers, self-efficacy, confidence

What this study adds:

1. What is known about this subject?
Previous research has consistently identified similar findings regarding the obstacles that medical students face in undertaking research during medical school.

2. What new information is offered in this study?
Women are less confident than men in their ability to conduct research which might explain in part the underrepresentation of women who pursue a physician-scientist career path.

3. What are the implications for research, policy, or practice?
There is an urgent need to address student concerns and gender biases in confidence around research participation within the MBBS curriculum to ensure the future of the physician-scientist workforce.

Background

In 1959 Victor Johnson[1] published a paper in the British Medical Journal in which he wrote:

"Experience in research warns against the pitfalls of inadequate numbers of observations, faulty controls, inaccurate measurements, the intrusion of chance, the inherent variability of biological material. Engagement in research enhances the physician's judgment of conclusions reached in medical papers he reads, sensitizes him to inadequacies of evidence, increases his wariness of exaggerated claims, tempers his acceptance of enthusiastic predictions." (pg. 332).

Victor Johnson was at the time the Director of the Mayo Foundation for Medical Education and Research at the University of Minnesota and a strong advocate of the benefits of research experience for medical students. Johnson believed research teaches students alertness to the unexpected or inconsequential, teamwork, a respect for persistent routine, and that scientific discovery can be a long and difficult process. Additional benefits identified subsequently include the development of skills in critical appraisal, literature searching, statistics, time management and communication.[2-4] These skills are not only important in the current pursuit of science but have general applicability to patient care.

In the interests of meeting the required standards for accreditation of a medical curriculum in Australia[5] most Universities provide students with research opportunities either as mandatory subjects and/or elective options. In 2012, of the nineteen medical schools in Australia, fourteen offered an additional Bachelor of Medical Science Honours year in conjunction with the medical degree or had shorter optional research project placements. Five had a compulsory research project as part of the degree.[6] In addition to this there has been a recent trend for schools to shift from a standard Bachelor of Medicine/Bachelor of Surgery (MBBS) to a Masters level medical doctorate (MD), thus recognizing the importance of research.

Despite the research opportunities available, many medical schools in Australia and internationally struggle to engage and motivate medical students along a research pathway.[7] The most frequently cited obstacles include time constraints,[8-14] lack of professional supervisors or mentors,[8,11-14] insufficient training in research methodology,[8,11,14] and financial constraints.[7-9]

This has raised concerns about the future of the clinician-scientist and the important role they play in translational research. Contemporary medicine is largely based on the practice of evidence-based medicine, which requires a familiarisation with research competencies and critical appraisal to make decisions about care based on the best available evidence.[15,16]

Currently in the School of Medicine at the University of Tasmania where this study was undertaken a number of research activities have been incorporated into the curriculum as either mandatory or optional subjects. In the first year of the five-year medical degree, students study basic statistical concepts and develop literature retrieval skills. In second year, they are introduced to epidemiological concepts and critical appraisal. In third year, they observe a research team and are required to work in groups to develop a research question and project methodology. After third year and having achieved sufficient grades, students have the option to undertake an intercalated research degree in medical science whereby they defer their medical studies for one year to complete a research project resulting in an honours dissertation. There is no mandatory research component of their study in years 4 and 5; however some students elect to participate in research projects as an additional aspect of their studies.

The aim of this study was to evaluate the current undergraduate research program for medical students at The University of Tasmania by determining students' i) confidence in three key areas of research and examine its associations with prior research experience either in a previous degree or during medical school that was external to the curriculum, and ii) examine the attitudes, motivation and incentives/disincentives to engage in research activities.

Method

A cross-sectional survey was carried out of undergraduate medical students in years 1–5 attending the University of Tasmania in 2012. All students enrolled were invited to participate in the online survey via an email. Participation was voluntary and confidentiality maintained. No identifying information was recorded on the survey. Completion of the questionnaire was taken as consent to participate.

The survey questions were a mixture of new questions developed by the researchers and others adapted from previous work undertaken by Nikkar-Esfahani.[12] Questions included a combination of multiple choice, likert-type responses and free text options. Sixty questions focused on students' research experience, opportunities and attitudes to research and perceptions of their confidence in performing various research related tasks. Responses were loaded into an excel database and each completed questionnaire was assigned an identification number to prevent any duplication in data entry.

Analysis of the results was undertaken using IBM SPSS version 20. Basic descriptive statistics are presented including percentages, means and standard deviations. Group differences were examined using chi-square tests for categorical variables. Qualitative data analysis was undertaken using a thematic approach and constant comparison techniques by authors KO, EM and FH.

Results

A total of 566 students were invited to participate in the study. Of those, 237 (41.9 per cent) responded to the survey either in part or in full. The response rates for year of enrolment were 41 per cent (43/105) from first year students, 47.6 per cent (50/105) from second year, 43.6 per cent (51/117) from third year, 35 per cent (42/123) from fourth year and 37.9 per cent (44/116) from fifth year students. The students who participated in the survey were representative of the overall medical school cohort. In 2012, enrolments included 305 women, 301 men and 101 international students. Overall 30.3 per cent (70/231) of respondents had completed an undergraduate or postgraduate University course prior to enrolling in medicine. Of these students, 22.9 per cent (16/70) had been involved in research activities during their previous course.

Confidence in ability to undertake a literature review, interpret published research and conduct research

Students were asked to rate their confidence as either 'not at all confident', 'confident' or 'very confident' about their perceived ability in undertaking a variety of research related tasks. For the analysis, these categories were collapsed into two categories comparing 'not at all confident' with 'confident to very confident'. The research related tasks fell into three overarching areas of 'conducting a literature review', 'interpreting published results', and 'conducting research.' Overall females were generally less confident (Table 1) on most of the tasks. Significant differences between males and females were found for 'formulating a research question' (X^2=5.24, p=0.022), interpreting the statistical analysis (X^2=6.48, p=0.011), undertaking a quantitative (X^2=6.64, p=0.010) and qualitative data analysis (X^2=4.72, p=0.030), interpreting the results (X^2=3.74, p=0.053), presenting the findings (X^2=8.19, p=0.004) and writing an academic paper (X^2=6.40, p=0.011).

Students research experience/participation other than what they are exposed to in the normal curriculum was determined in the following ways: i) whether they had undertaken or been part of a research group in their prior degree before commencing medicine (n=16), ii) whether they had had involvement as part of a research group in years 1–3 (n=7) or years 4–5 (n=51) of their medical degree, and iii) whether they had interrupted their medical degree and undertaken an honours year at the completion of year three (n=6).

Table 1: Comparison of the proportion of men and women who reported being confident to very confident in undertaking research

	Confidence	
Question: How confident do you feel in your ability to:	**Men (n=85)**	**Women (n=123)**
Conduct a **literature review and:**	(%)	(%)
Formulate a research question	87.1	74
Design a search strategy	74.1	65
Search bibliographic databases	96.5	91.9
Document the search process	76.5	74
Locate and retrieve relevant studies	91.8	87.7
Interpret the published research and:		
Recognize different study designs	87.1	77.9
Critically appraise articles	68.2	63.9
Identify potential sources of bias	78.6	76.5
Identify sources of confounding	75.3	63.6
Interpret the statistical analysis	67.9	50
Evaluate clinical practice	70.6	67.8
Conducting research and:		
Develop a research plan and design	50.6	44.3
Complete an ethics application	23.5	20.5
Write a funding application	14.1	15.6
Create a database to manage data	45.9	33.1
Da a quantitative data analysis	60	41.8
Do a qualitative data analysis	52.9	37.7
Interpret results	70.6	57.4
Write a research report	65.9	52.9
Present the research findings	55.3	35.2
Write an academic paper	49.4	32

These categories were grouped into one category reflecting prior research experience (n=69). Subjects were only counted once if they fell into one or more categories. There were no significant differences in the proportion of men and women who had participated in research (43.5 per cent *vs.* 56.5 per cent respectively).

Confidence in students with previous research was compared to those who had no previous research experience adjusting for sex (Table 2). Overall participation in research was associated with an increase in confidence in

the majority of items relating to research. Significant differences between the groups were found for the following tasks: evaluate clinical practice (X^2=6.88, p=0.009), complete an ethics application (X^2=14.98, p≤0.001), complete a funding application (X^2=4.02, p=0.045), maintain a database (X^2=6.59, p=0.010), do a quantitative data analysis (X^2=4.47, p=0.002), do a qualitative data analysis (X^2=8.87, p=0.003), interpret the results (X^2=8.09, p=0.004), write a research report (X^2=3.69, p=0.009), present the research findings (X^2=15.94, p≤0.001), and write an academic paper (X^2=11.15, p=0.001).

Table 2: Comparison of the proportion of students with research experience to those without who reported being confident to very confident in undertaking research

	Research experience	
Question: How confident do you feel in your ability to:	**Yes (n=62)**	**No (n=145)**
Conduct a **literature review and:**	(%)	(%)
Formulate a research question	82.5	77.9
Design a search strategy	63.5	71
Search bibliographic databases	95.2	93.1
Document the search process	74.6	75.2
Retrieve relevant studies	90.3	89
Interpret the published research and:		
Recognize different study designs	87.1	79.3
Critically appraise articles	71	63.4
Identify potential sources of bias	85.2	73.9
Identify sources of confounding	69.4	68.1
Interpret the statistical analysis	57.4	57.2
Evaluate clinical practice	82	63.4
Conducting research and:		
Develop a research plan & design	56.5	42.8
Complete an ethics application	38.7	14.5
Write a funding application	22.6	11.7
Create and manage a database	51.6	32.6
Da a quantitative data analysis	66.1	42.1
Do a qualitative data analysis	59.7	37.2
Interpret results	77.4	56.6
Write a research report	72.1	52.4
Present the research findings	64.5	34.5
Write an academic paper	56.1	31.7

Attitudes toward extracurricular participation in research during medical school

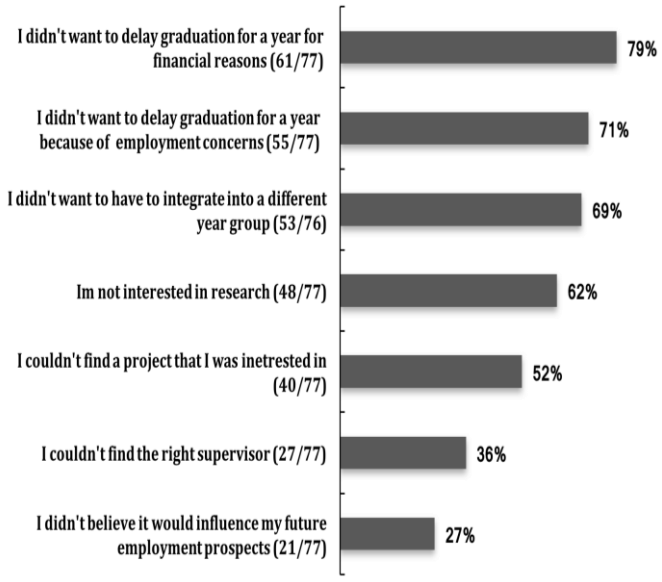
The majority of students (70.3 per cent 161/229) agreed or strongly agreed that research was a useful experience but only half believed it should influence selection for training jobs (48.9 per cent 112/229). Many expressed a desire to want to be involved in research (60.1 per cent 110/183) endorsing its potential benefits for improving their curriculum vitae (CV) (87.4 per cent 188/215) and influencing health at a population level (71.2 per cent 153/215).

Two key themes emerged from the qualitative responses regarding participation in research: students' attitudes and motivation toward research, and support to identify and undertake research. Motivation to become involved in research fell into the two broad categories of career aspiration and learning. Some students saw involvement in research as an opportunity to build career opportunities: research as a career, enhance their clinical career, improve employment opportunities by making contacts, and improve their CV.

Obstacles to participating in research

Fourth and fifth year students' ratings on the obstacles in undertaking a Bachelor of Medical Science (BMedSci (Honours)) during medical school are shown in Figure 1. The most frequently endorsed reasons were a desire to not delay graduation by a year for employment, financial and social concerns, and lack of interest in research.

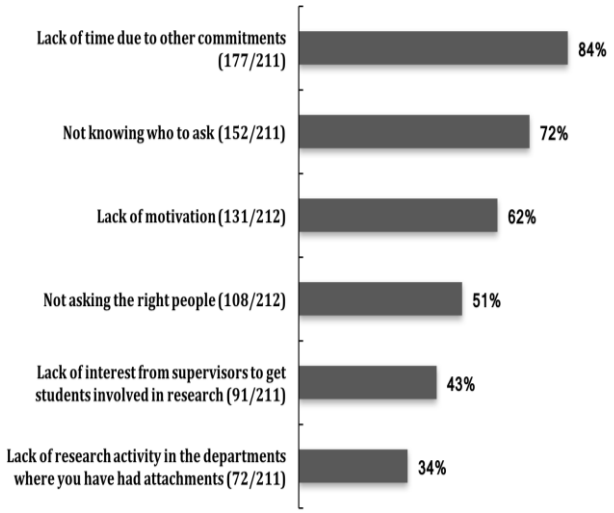
Figure 1: Obstacle to doing Honours



Student's ratings (inclusive of years 1-5) on the obstacles to participating in research more generally during medical

school are shown in Figure 2. The most frequently endorsed reasons for not wanting to participate in research was lack of time, not knowing who to ask and lack of motivation. These responses are consistent with the qualitative thematic analysis. Additional obstacles reported included a sense that research is not important to their future role as doctors and a lack of available topics of interest, particularly clinically relevant rather than laboratory based projects.

Figure 2: Obstacles to involvement in research



There was a reluctance to take an additional research year with concern about how that would impact on students in terms of their developing clinical skills. A small number of students felt that research was not an important skill for a clinician to have, that it was really only important for those interested in a research career. Some students expressed doubt in their ability to undertake research.

Overall, many students see the value of undertaking research in improving career prospects and developing important skills, however there was also a sense that other aspects of the curriculum should take priority and time constraints are prohibitive to involvement in research. There is a clear message that students want more information, earlier in the curriculum about research, and the support of a dedicated academic to initiate contact with researchers and provide support during the process. Students perceived a need for there to be clinically relevant (non-laboratory based) opportunities, and supervisors to be more accessible to students. The current model of an intercalated honours year was a disincentive for many because of the additional year required to complete the MBBS, with some students nominating integration of research across the five years as a preferable model.

Support required to facilitate more interest in research

The need for support to be provided to students to enable their participation in research was strongly enunciated in the qualitative responses. The support required was in assistance in finding projects, increased curricular content support, and providing a mentored and nurturing environment. Many students did not know how to become involved in research, commenting that there should be some forum for researchers to communicate with students about projects, whether that be through an IT platform, or by having researchers invited to speak to students about opportunities.

Suggestions for curricular changes that would better support research engagement included; integrating quarantined time across the five years of the course, to dedicate to research endeavours, or using summer vacation to achieve the same and ensuring that the associated subjects are taught in an engaging manner from the beginning of the course.

A preference for more clinical research projects was consistent with student responses to a survey question asking them to rank the type of honours research project they would be most interested it. Projects areas endorsed as their first choice were clinical research 76.9 per cent (60/78), public health 15.6 per cent (12/77), laboratory-based research 9.2 per cent (7/76), and primary care 1.4 per cent (1/69).

Thoughts around what a supportive and mentored environment would look like included having the opportunity to be part of a team, be engaged by researchers, be involved in ways that suit individual students, and be involved in projects which were clinically relevant.

Discussion

This study examined the perceptions and attitudes of medical students to undertaking research during their medical degree. It also explored their confidence in various areas of conducting research and whether there were differences between men and women or those with research experience versus those without in levels of confidence. Interestingly, while the majority of students believed that undertaking research was a useful experience and expressed a desire to do research, very few reported participating in any research during their degree that was not a part of the medical curriculum. Given the advantages for medical students and the broader community, it is important to examine the reasons why medical students fail to engage in research.

Exposure to research at the undergraduate level has been associated with an increased motivation to pursue a career in research after graduation[2,9,17] and choosing a career in academic medicine.[18] Our study also shows that research experience in medical school improved students' perceived confidence in conducting research and that there was an overall trend for women to be less confident than men in some domains of research activity. Burgoyne and colleagues found very similar results in their study of undergraduate medical student's perspectives on research.[2] Students with a previous degree reported higher competencies in a number of research specific skills including study design, statistics and presenting a paper. There were also significant differences between men and women with women reporting lower perceived confidence than men. Interestingly levels of confidence were similar between men and women in the areas of research that are embedded into the curriculum which include most of the tasks encompassing undertaking a literature review and interpreting the published results.

These gender biases are difficult to explain, as there was no significant difference between the number of women and men who had had research experience in this study. It might relate to a more general finding that despite performing equally as well as their male peers, female medical students consistently report decreased self-confidence and increased anxiety, particularly over issues related to their competence.[19] This is not entirely surprising as the finding that men have higher self-esteem than women is a well-established finding in the self-esteem literature that is not just confined to western samples but can be generalised across cultures.[20] In this study there was no difference between the sexes in participation rates of men and women in research. A similar finding has been reported in a recent meta-analysis.[7] Perhaps a more pressing question is whether this lack of confidence is associated with a disinterest in women pursuing a physician-scientist career pathway and undertaking a PhD. It is at this point that participation rates between men and women start to diverge. There is a clear under-representation of women candidates undertaking combined medicine/PhD programs in Australia and the USA.[21] While lack of confidence likely plays a role in why women are less likely to choose this career path other reasons cited include the challenge of combining a successful career with family life and child rearing and a lack of compelling women role models.[21]

This study has also provided insight into the barriers to participation in research at an undergraduate level of medical education in the Australian context. It found that the major obstacles to pursuing extracurricular research in medical school was lack of time due to other commitments with 84 per cent of the respondents strongly endorsing this, further supported in student comments that the medical curriculum is already a long degree and more intense in terms of contact hours than most other degrees. This is consistent with a number of other studies where between 49 per cent and 74 per cent of students have reported lack of time as a major obstacle.[8,11-14] While an obvious solution to this might be to incorporate more research into the curriculum this is not easily done in an already full curriculum. Students at University of Tasmania are exposed to statistics and epidemiology in first and second year in the course, however this research speaks to the challenges of exploring ways of making these units more engaging in the first instance and applying new innovations in teaching.

The intercalated degree on offer to medical students at the University of Tasmania has not been a popular option, with very few students choosing to undertake a BMedSci (Honours). In 2014 seven students enrolled in the course, which represents 6.3 per cent of the third-year cohort for 2013. Enrolments have remained low with 5 in 2015, 6 in 2016 and 6 in 2017. Low uptake rates for similar degrees have also been reported in New Zealand medical schools (less than two per cent)[22] while higher rates around 54 per cent have been reported in medical schools in the United Kingdom.[23] When students in this study were asked about the reasons why they chose not to do undertake a BMedSci (Honours), the majority had concerns about delaying their graduation for a year due to financial and/or employment reasons. Other issues that were cited were not wanting to have to integrate into a different year group, or not being able to find the right project - with the majority being interested in clinical research. Similar concerns by students were reported in a recent systematic review looking at the impact of an intercalated BSc on medical student performance and careers.[24] Two of the key negative aspects reported by students were the loss of social networks, the additional financial costs and concerns about not being able to pursue their preferred topic.[24] Improving access to supervisors and mentors has also been echoed in a number of other papers published in this area.[8,12-14,25]

It is apparent from this research that the attitudes and obstacles medical students experience in relation to engaging in extracurricular research are consistent with those reported in many other medical schools in developed and developing countries. These are not necessarily obstacles that are easy to solve. In attempting to address the issues Cluver and colleagues[26] have suggested a proactive

and well-organized approach is essential to encouraging more students to participate in research. They developed and trialled an initiative at the Medical University of South Carolina that consisted of four components including the following: identifying a research liaison, creating a short-term summer research scholarship, enhancing the elective research course for medical students, and developing a web-based portal to increase the students access to research opportunities. As a result, there has been a steady increase in the number of students participating in research since the trial began. The research liaison acts as a point of contact for students to assist them in finding a project and mentor or supervisor overcoming a major obstacle for students. The provisions of a summer research fellowship provide some financial support and because the project is undertaken over the summer vacation students are not required to take a year out from their medical degree thereby addressing fears around losing contact with their cohort and extending the time to complete their degree. The research elective provides additional teaching and training while the research portal provides up-to-date information about research opportunities. Other examples of successful strategies designed to engage students in undergraduate research activities include embedding the teaching of research and critical analysis into the core curriculum.[27]

There are a number of limitations to this study that need to be considered. First the results are based on self-report measures and rating from medical students from a single school. While self-report measures are commonly used in this type of study they can be subject to information bias regarding the accuracy of the information being reported which may be over-or-underestimated. Given that students were aware that they could not be identified it is unlikely that they would have been influenced by a desire to present favourable responses, however there is no way of knowing this. Second the overall response rate of 42 per cent, while expected for this type of research, raises the possibility of responder bias. It was not possible to identify non-responders. However, they do appear to be a representative sample of the overall age and gender of the medical cohort enrolled at the school.

Conclusion

In conclusion, this study found that the while the majority of students agreed that participation in research was a useful experience they also highlighted many of the obstacles to achieving this. Many medical students remain unaware of the importance of research to patient care and perhaps more specifically the contributions of clinician-scientists to the field of translational medicine. While some of the universal obstacles for students including financial strains and time pressure to get out into the workforce are not easily solved, medical educators must acknowledge the value of student participation in research and strive to facilitate engagement with the resources available to them. Increasing undergraduate student participation in research will undoubtedly have significant benefits in producing doctors who understand the relationship between research and patient care thereby making better and safer decisions.

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PEER REVIEW

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CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

ETHICS COMMITTEE APPROVAL

Ethical approval for the study was obtained from the University of Tasmania's Human Research Ethics Committee (reference number H0012774).