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WEB PAPER

Extracurricular participation in research and audit by medical students: Opportunities, obstacles, motivation and outcomes

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Abstract

Background: Medical students should learn to critically evaluate research to inform future evidence-based practice. Participation in research and audit at medical school can help develop these skills whilst prompting interest in academic pursuits.

Aims: We investigate medical student attitudes and participation in extracurricular research and audit focusing on their opportunities, obstacles, motivation and outcomes.

Method: A 60-item questionnaire was distributed to final-year medical students graduating from the University of Nottingham Medical School in the United Kingdom.

Results: A total of 238 questionnaires were returned (response rate 75%). Of these, 86% felt research or audit experience was useful for medical students. The main driver for involvement was curriculum vitae (CV) improvement (51%). Male students and those involved in extracurricular research were more likely to agree that this experience should influence selection into training programmes ($p=0.017$, $p=0.0036$). Overall, 91 respondents (38%) had been involved in such activity with a mean number of projects undertaken of two (range one to four). Those interested in a surgical career were most likely to have undertaken projects (58%). Frequently cited obstacles to involvement were time constraints (74%) and a perceived lack of interest from potential supervisors (63%).

Conclusions: Despite significant CV motivation, many are enthusiastic regarding extracurricular research opportunities but frustrated by obstacles faced. Our study suggests there is scope for providing further opportunities to participate in such activities at medical school.

Introduction

History records many important contributions to the understanding and practice of medicine arising from the investigative work of medical students. The discovery and purification of insulin was made by the researcher Frederick Banting and his second-year medical student assistant Charles Best, whilst the discovery of the anticoagulant Heparin was made by Jay Mclean, a medical student working at John Hopkins University. It could be argued that such important discoveries are now beyond current medical students due to the increased knowledge and complexity of medical science; however, this should not detract from the importance and value of medical students' involvement in research.

In the United Kingdom, the General Medical Council guidelines 'Tomorrow's Doctors' state that graduating medical students must be able to 'evaluate and integrate evidence critically' (General Medical Council 2009). Involvement in research can help medical students acquire these essential skills and generate doctors who practice evidence-based medicine within their clinical field (Jacobs & Cross 1995).

Practice points

- Experience of research at medical school has been shown to promote medical student interest in academic medical careers, and increases postgraduate research productivity.
- Several medical schools are developing 'Student Research Offices' in order to facilitate participation in extracurricular research.
- This study highlights an active interest amongst medical students who are keen to participate in extracurricular research, although the motivation for doing so appears to be largely CV driven.
- Numerous barriers to participation exist, including perceived shortage of opportunities, lack of time and a lack of interest on the part of potential supervisors.

The importance of early involvement in research is further amplified when looking at the current state of academic medicine. In the United Kingdom, unlike many other countries, most medical schools do not offer research.

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programmes as part of their curriculum. Some medical schools offer an intercalated degree, allowing for a year of research to be undertaken while the traditional medical course is temporarily deferred; however, only a third of students in the United Kingdom will intercalate (McManus et al. 1999). This potentially leaves two thirds of final-year medical students with no formal, supervised experience in undertaking a research project as part of their medical school curriculum. Furthermore, since the year 2000 the United Kingdom has seen a steady decline of postgraduate interest in research as the number of doctors undertaking higher degrees such as a MD or a PhD has reduced from 3500 to 3000 in 2007 (Medical Schools Council 2008). This comes at a time of rapid cultural shift within the UK medical training landscape following the introduction of the Modernising Medical Careers programme.

In an attempt to address the state of academic medicine, the Walport report laid out a clearer and more flexible academic training pathway (UK Clinical Research Collaboration 2005). More recently, the British Medical Association (2008) produced a review setting out the importance of research, teaching and training for the future of the National Health Service. It has been suggested that experience of medical research while still in medical school could help address this downward trend by increasing medical student interest in a career in academic medicine (Brancati et al. 1992) and also increasing postgraduate research productivity (Segal et al. 1990; Reinders et al. 2005).

Such experience may also improve medical students' career opportunities. Application forms for UK junior doctors' training posts (the 'Foundation Programme') awards points for demonstrating research experience through presentations or publications. This experience benefits employability throughout a doctors' career with selection for core and specialist training frequently taking account of research productivity to differentiate between candidates.

The current literature investigating medical student research opportunities largely concentrates on the impact of intercalated degree experience on short- and long-term medical career outcomes (McManus et al. 1999; Greenhalgh and Wong 2003; Reinders et al. 2005). This study sets out to assess medical student attitudes and participation in extracurricular research and audit in a single UK medical school.

Methods

Subjects and settings

Final-year medical students from a large UK medical school (University of Nottingham) were invited to participate during June 2008. There were 318 students in the graduating year, comprising 235 standard undergraduate-entry and 83 graduate-entry medical students. The University of Nottingham undergraduate medical course spans 5 years, consisting of four semesters of basic science over a 2-year period followed by a fifth semester in which all students undertake a small research project as part of a Bachelor of Medical Science (BMedSci) degree. The remaining 2.5-year period is devoted to clinical training. This allows all students to get involved with research as an integral part of their medical degree. The majority of

medical schools in the United Kingdom differ, offering an optional 'intercalated' degree in which students take a year out of medical school to undertake a formalised research project on a full-time basis.

The University of Nottingham Graduate Entry Medicine (GEM) course is an intensive 4-year programme open to those already holding a bachelor (honours) degree, or equivalent. This is composed of 18 months of basic medical science, taught and assessed independently from the undergraduate students. This is followed by 2.5 years of clinical training, where the two cohorts of students are combined. The graduate students do not undertake a BMedSci as part of their 4-year course.

All students are asked to undertake an audit (departmental service evaluation project) during their 2-week GP attachment. Other than that, the clinical curriculum does not contain a research component and student involvement with extracurricular research and audit is voluntary.

This study was undertaken by the University of Nottingham Medical School Medical Education Unit as part of our evaluation of medical student experience of teaching attachments and teaching provision. The authors gave due consideration to the ethical dimensions of this anonymous questionnaire survey and no concerns were identified. The questionnaire was optional and completion was taken as consent to participate.

Questionnaire

A questionnaire was devised exploring medical students' attitudes towards research and the opportunities available for participation in extracurricular research. The questionnaire consisted of 60 items allowing free text, multiple choice and 5-point Likert scale responses (Appendix 1). It was initially piloted on 20 medical students, and highlighted ambiguities corrected in the final version. The questionnaire was both distributed manually and made available online for the cohort of final-year medical students to complete. In order to allow follow-up of non-responders the questionnaire was not anonymous; however, answers were confidential and subsequently anonymised.

Analysis of results

Analysis of results was undertaken using the Statistical Package for the Social Sciences, SPSS 15.0 (SPSS Inc. Chicago, Illinois). *p* values were calculated using Chi-square with Yate's correction, as appropriate. Free-text responses were independently categorised into groups for analysis by two of the authors.

Results

A total of 238 questionnaires were returned, giving a response rate of 75%. The makeup of the responding group reflected that of the population sampled. Thus, of the respondents, 149 (63%) were female with a response rate 88% of and 89 (37%) were male with a response rate of 65%. The response rate difference across genders was statistically significant ($p=0.0001$). Overall, 180 replies (76%) were received from

Table 1. Roles played by medical students in extracurricular research projects.

Roles played	Responses (%)
Reviewing patient notes for data collection	27
Analysing data	24
Design of research project protocol	16
Writing of abstracts	11
Conception of research project idea	8
Handing out questionnaires	6
Writing of papers for publication	6
Laboratory work	2

the standard undergraduate course and 58 (19%) came from the graduate-entry medical course. The response rate of final-year medical students from the standard undergraduate course was 76% versus 70% from the graduate-entry course; this was not statistically significant.

Medical student participation in extracurricular research

Of the 238 respondents, 91 (38%) had been involved in extracurricular research. The mean number of projects undertaken by these students was two, with a range from one to four. Of these students, 70 (77%) became involved in the research through a consultant-grade senior clinician. The most frequently cited speciality in which students became involved with research was paediatrics (22%). Other popular specialities were general medicine (21%), general surgery (20%) and obstetrics and gynaecology (12%). Of the students who participated in research, 65 (71%) undertook projects in a teaching hospital, whereas only 12 (13%) undertook these in a district general hospital setting. The roles of students in research projects varied (Table 1). Of the 91 students participating in extracurricular research, 24 (26%) indicated that there was no outcome from their work. Of those who had an outcome the most frequent was an oral presentation (43%) followed by a published abstract (20%). Other outcomes included a published paper (17%), poster presentation (16%) and prizes (4%).

Opinions surrounding extracurricular research

Overall, 204 (86%) respondents felt that research experience was useful for medical students however, only 91 (38%) felt that research experience should influence selection into postgraduate training programmes. When considering those who actively participated in research this proportion rose to 49% and was statistically significant ($p=0.0036$). Of the overall respondents, 164 (69%) agreed that they had been interested in participating in extracurricular research while at medical school. This group was also more likely to believe research experience should influence selection into postgraduate training programmes ($p < 0.0001$).

Although female and male students were in agreement on the usefulness of extracurricular research (84% female compared to 81% of male students), a higher percentage of male students believed it should have a role in selection into

postgraduate training programmes (35% of female, 43% male, $p=0.017$). A total of 72% of male and 69% percent of female students were interested in carrying out extracurricular research, whereas only 47% of female and 61% of male students (mean 53% overall) approached senior clinicians or other staff to seek projects to undertake. Sixty-six respondents (28%) gave free text comments which were categorised (Table 2) and a sample of representative quotes provided in Table 3.

Driving forces for medical student participation in extracurricular research

In response to the question, 'why do you [medical students] wish to become involved with extracurricular research?', 122 (51%) respondents indicated that this was purely to improve their curriculum vitae (CV), whereas only 10 (4%) said this was because they enjoyed research work. A further 72 (30%) of replies indicated that both CV improvement and research enjoyment were joint driving forces behind their interest or involvement in research. There was no statically significant difference between genders regarding expressed driving forces for participation in extracurricular research.

Perceived obstacles to medical student participation in extracurricular research

Of the respondents, 78 (33%) agreed that they had been frustrated by the lack of research opportunities available to medical students. One hundred and nineteen (50%) felt that not asking the right people was the main obstacle faced when trying to become involved in research. One hundred and forty-nine (63%) believed a lack of interest from potential supervisors acted as an obstacle in their involvement in extracurricular research. Coupled with this, 174 (74%) of respondents recognised that time constraints acted as a major obstacle for medical students wishing to become involved in research.

Medical student participation in extracurricular research and career intentions

Of the different career intention subgroups, the highest percentage of medical student involvement in research was those wishing to pursue a surgical career. Overall, 33 (14%) of respondents expressed intentions of pursuing a surgical career; of these 19 (58%) had participated in extracurricular research. However, no statistically significant deviation from the mean existed overall for any of the career intentions. These results are shown in Table 4.

Discussion

Medical students' involvement in research is a longstanding tradition and has been an integral component of medical education for years. Research experience has been recognised to help foster scientific thought and nurture evidence-based practice in clinical settings (Houlden et al. 2004). In Germany, graduating medical students are unable to assume the title 'Doctor' until completing a research thesis (Diez et al. 2000),

Table 2. Summary of free text responses: suggestions on how to increase student involvement in extracurricular research.

Suggestion	Respondents suggested (%)
Supervisors placing advertisements on common webpage or notice board	24 (<i>n</i> = 16)
Increasing awareness among supervisors on usefulness of medical student input	11 (<i>n</i> = 7)
Asking as many potential supervisors as possible	11 (<i>n</i> = 7)
Improved research methodology taught at medical school	8 (<i>n</i> = 5)

Table 3. Representative quotations from free text responses.

'Reduce workload to produce opportunities'
'Be keen'
'Publish a list of possible projects to be involved in, or people who need students to help'
'Just ask around, find a young dynamic doctor and pester them'
'It's very hard because of such commitments to the course itself to find time'
'More extensive research methods course during the clinical years'
'Encourage clinicians to make it accessible for medical students'
'Be proactive!'
'Encourage Audits as part of special study modules. Better teaching for students on how to arrange and conduct audits'
'Ask everybody possible'
'Departments must try to involve students more and allow clinical time for research/writing'
'Local database of research/audits prepared to have medical student input available for all students to apply for'
'More extensive research methods course during the clinical years. Make medical students take part in a journal club as part of the curriculum or for those who are interested in certain specialities'
'Departments must try to involve students more and allow clinical time for research/writing'
'Sorry folks - no interest in research'

Table 4. Medical student involvement in extracurricular research and career intentions.

Career intention	Proportion of respondents (%)	Participated in research (%)	Significance from mean	Mean number of projects	Significance from mean
Medicine	23 (<i>n</i> = 55)	35 (<i>n</i> = 19)	0.840	1.5 (<i>n</i> = 27)	0.854
Surgery	14 (<i>n</i> = 33)	58 (<i>n</i> = 19)	0.251	1.8 (<i>n</i> = 35)	0.760
Paediatrics	10 (<i>n</i> = 24)	25 (<i>n</i> = 6)	0.490	1.6 (<i>n</i> = 10)	0.933
Obstetrics and Gynaecology	8 (<i>n</i> = 19)	32 (<i>n</i> = 6)	0.871	1.3 (<i>n</i> = 8)	0.969
Psychiatry	4 (<i>n</i> = 9)	44 (<i>n</i> = 4)	0.806	1.5 (<i>n</i> = 6)	0.927
Anaesthesia	7 (<i>n</i> = 16)	38 (<i>n</i> = 6)	0.969	1.6 (<i>n</i> = 10)	0.933
General Practice	17 (<i>n</i> = 40)	40 (<i>n</i> = 16)	0.888	1.6 (<i>n</i> = 26)	0.955
Other	17 (<i>n</i> = 10)	50 (<i>n</i> = 5)	0.853	1.6 (<i>n</i> = 8)	0.994
Unsure	4 (<i>n</i> = 40)	33 (<i>n</i> = 13)	0.757	1.6 (<i>n</i> = 21)	0.971

whereas in the United Kingdom, the General Medical Council guidelines 'Tomorrow's Doctors' recognise the importance of critical evaluation of information as an essential skill all doctors should possess (General Medical Council 2009). Despite this, there has been a worrying decline in the numbers of clinical academics in the United Kingdom over recent years (Aldridge and Fitzpatrick 2008); a trend that is being met by strong attempts to reverse it (UK Clinical Research Collaboration 2005). These changes concentrate on improving postgraduate academic career pathways and although they promote the importance of intercalation by medical students they do not address the two thirds of UK students who do not undertake an intercalated degree (McManus et al. 1999; The British Medical Association Medical Students' Committee 2004). A number of studies have shown that students who become involved with research while still in medical school have superior postgraduate research productivity and are more

likely to be interested in pursuing an academic career (Segal et al. 1990; Brancati et al. 1992; Reinders et al. 2005; Dorrance et al. 2008). As such, more should be done to help foster research methodology skills and research experience among all medical students.

This study demonstrates medical students' appreciation of the usefulness of research experience with over 85% recognising this. However, of the respondents only 53% approached a supervisor with regards to undertaking a project and only 38% of respondents had indicated participation in extracurricular research. This deterioration in percentages shows a mismatch between medical students' ideals, initiative and the research opportunities available to them. This lack of opportunity may explain why only 38% of respondents felt that current job application forms should award credit for evidence of research experience, given that many had not attained this. However, this percentage only rose to 49% among those

students who had participated in a research project. This shows that of the students with a citable CV advantage gained through research experience, over half still held the belief that this should not be used to their benefit with regards to job allocations. Our study also highlighted a difference of opinion between genders on whether extracurricular research should play a role in selection for training programmes. Female students were significantly less keen for this to occur. The reasons for this are unclear, perhaps being an acknowledgement that many of their peers will not have had such opportunities at this early stage in their careers and hence will not be competing on a level playing field. Alternatively, they may not believe that such research skills are the primary attribute for the practicing clinician, and hence should not form part of selection.

Alongside this, our study helped highlight that the main driving force behind medical students' involvement in research is CV improvement, with over half of the respondents stating that they would undertake research purely to improve this. As such, many students clearly perceive a 'hoop jumping' mentality with regards to future career advancement.

Challenges and solutions to medical student research

Tagal has previously addressed some of the challenges facing medical students' involvement in research; our study supports many of these (Tagal 2007). Difficulty with supervisors was highlighted as a major obstacle; 45% felt that not asking the right person was a major barrier, linked to a perceived lack of interest in involving student in research projects. This may show a lack of appreciation by supervisors of the benefits medical students' participation in research may bring to a department; Cursiefen et al. showed that medical students can help increase the publication output of their academic institution (Cursiefen and Altnbas 1998). Furthermore, 27% of respondents recognised that time constraints also acted as a barrier to their involvement in research. A possible way to address this problem is by setting time aside as part of the medical degree purely for research or creating opportunities for students outside term time such as summer elective programmes (Kemph et al. 1984). Other suggestions have included starting research interest groups within medical schools as a way to coordinate student and supervisor involvement (Zier et al. 2006). Such interest groups may also relieve some of the time pressure by encouraging medical students to share the workload amongst them and increase efficiency as a consequence. Such a body could even be set up by students with support from academics to help increase medical students' awareness and participation in research. In the United States, several medical schools have now established more formal University administered offices to provide such support (Drexel University College Of Medicine 2009; Mount Sinai Medical Center 2009; The School of Medicine at University of North Carolina 2009; University of Maryland School of Medicine 2009). The findings of our study support the need for such facilities.

Of the respondents, 38% have been involved with extracurricular research with a mean number of two

projects completed. Consultant grade clinicians were the most likely to involve students in research, which may be due to the fact that senior clinicians are better equipped to identify unanswered clinical problems and ways to tackle research questions. Despite clinical placements in a range of hospitals throughout the region, 71% of students undertaking research did so in a teaching hospital; this was perhaps expected, as clinical academics and research funding tend to be concentrated in larger teaching hospitals.

Students intent on pursuing a career in surgery were shown to be the most involved in research compared to those who did not. Furthermore, surgically orientated students undertaking research had the highest mean number of projects per individual. This may reflect awareness of the competition related to a career in surgery. However, these differences did not reach statistical significance.

Although we have highlighted the benefits and importance of research it has been shown that time spent undertaking research while still at medical school can have a negative impact on medical student clinical performance and knowledge. Dyrbye et al. found that a delay of 3 years or more during medical school for research was associated with lower grades and scores on clinical knowledge tests (Dyrbye et al. 2007). In addition, Tait et al. found that students undertaking an intercalated degree had no consistent short-term academic advantage over those who did not (Tait & Marshall 1995).

Study limitations

The questionnaire-based nature of this research exposes the results to potential responder bias, particularly with statistically significant difference between response rates across genders with a disproportionately higher number of questionnaires returned from the female cohort of students. However, our overall 75% response rate is favourable for this type of study.

Due to the lack of anonymity this may have led to 'social desirability bias' when respondents try to portray themselves in a favourable light. Furthermore, the study was undertaken in one UK-based medical school making the generalizability of the results unclear. Coupled to this, the majority of medical students undertaking this survey had previously completed an intercalated degree as undergraduates, or other degree in the case of the graduate-entry medical student. This previous research experience may impact on the findings of this study. Not all UK medical students have this opportunity, however, we are not aware of any previous studies examining whether intercalation has an effect on subsequent medical student research productivity while still at medical school.

Future studies investigating such attitudes and participation in research would be welcome from other medical schools in both the United Kingdom and abroad. In addition, it would be of interest to assess the effectiveness of potential educational interventions such as establishing a student research group within medical schools to act as a way of coordinating and promoting extracurricular research.

Conclusion

Participating in research is important in producing doctors with an understanding of evidence-based medicine and the ability to critically appraise research in clinical practice. Our study shows an interest among medical students in undertaking research while still at medical school but inevitably CV enhancement remains a key driver for participation. We also highlight the numerous obstacles they face in becoming engaged with this. Initiatives such as those seen in North America with the establishment of medical students' 'research support offices' are justified, and other medical schools should investigate creating their own equivalents to encourage participation in extracurricular research.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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Appendix 1

(1) What speciality do you wish to pursue after graduation? (Choose only your top choice)

Medicine	Surgery	Paediatrics	Obs & Gyne	Psychiatry
Anaesthesia	Academic career	General Practice	Don't know	Other.....

(2) Do you think research/audit experience is useful for medical students?
No

Yes

(3) Do you think research/audit experience should influence selection for training jobs?

Yes

No

(4) What was the outcome of your BMedSci Project? (Please indicate number in brackets)

Published abstract () Poster Presentation () Oral Presentation () Published Paper () None
N/A

(5) If you are a GEM were you involved with research before the start of the graduate course?
N/A

Yes

No

If yes please select and specify the number in brackets:

Published abstract () Poster Presentation () Oral Presentation () Published Paper () None

(6) Have you been interested in carrying out research/audit since you started clinicals?
No

Yes

(7) Have you approached anyone about getting involved with research/audit work?
No

Yes

(8) Why do you want to carry out research/audit work?

You enjoy research/audit

You want your CV to look better

Both

Other.....

(9) Have you been frustrated by lack of opportunities available to carry out research/audit work? ('1' = completely disagree, '5' = completely agree)

1 2 3 4 5

(10) What do you think are the main obstacles in getting involved with research/audit work? (Indicate to what extent you agree with the following statements: '1' = completely disagree, '5' = completely agree)

Lack of motivation on your behalf	1	2	3	4	5
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Not asking the right people	1	2	3	4	5
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Lack of research/audit carried out in the departments that you have undertaken attachments	1	2	3	4	5
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Lack of interest by the supervisors to get medical students involved in research/audit work	1	2	3	4	5
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Lack of time due to other commitments	1	2	3	4	5
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Other.....

Yes

No

(11) Have you been involved in any research/audit work since the start of CP1?
(EXCLUDES all audits part of the medical school curriculum ie: GP attachment audit)

If YES:

(12) How many projects have you been involved with?

(13) What level in training was the individual who got you involved in research/audit work?

F1	F2	ST1-2 / SHO	ST3+ / SpR
Consultant	Research Fellow	Teaching Fellow	Other.....

(14) What speciality or specialities have you undertaken your research/audit work?

Medicine	General Surgery	Paediatrics	Obs & Gyne
Dermatology	Anaesthesia	General Practice	
Other.....			

(15) Where did you carry out the research/audit work?

District General Hospital	Teaching Hospital	Other.....
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(16) What part did you play in the research/audit work? (You can choose more than one)

- ☐ Conception of the idea
- ☐ Design of the research/audit project
- ☐ Going through patient notes and collecting data
- ☐ Handing out questionnaires
- ☐ Lab work
- ☐ Analysing data
- ☐ Writing of abstracts
 - Designing posters for presentation (Local National International) Please circle type of meeting
 - Delivering Oral presentation (Local National International) Please circle type of meeting
- ☐ Writing of papers for publication

(17) What has been the outcome of your research/audit work? (Please specify numbers in brackets)

Abstract ()	Poster Presentation ()	Oral Presentation ()
Published Paper ()	Prize ()	None

(18) If presented/published where were you on the list of authors?

First author	Co-author	None
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(19) Do you have any recommendations for increasing medical student opportunities for involvement in research/audit?

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(20) Any other comments:

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