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ORIGINAL RESEARCH

Publication rates of, and attitudes toward, summer research projects: 10-year experience from a single institution in New Zealand

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Background: Research is increasingly being emphasized from an early stage in medical students' careers. Medical student involvement in research and authorship of peer-reviewed manuscripts have been shown to enhance their academic performance—both in the short term and long term. The aim of this study was to evaluate outcomes and motivations of the summer studentship research program at our institution, using Vroom's expectancy theory as a conceptual framework.

Methods: We utilized a mixed-methods approach to our study. Two databases (PubMed™ and Google Scholar™) were searched for publication data. In addition, students and supervisors of the program at the University of Otago were invited to provide comments on the program. Qualitative data were analyzed using an inductive, pragmatic approach which involved coding responses and grouping codes into common themes.

Results: Between 2007 and 2016, 1,345 projects were completed, of which 326 (24.2%) resulted in a peer-reviewed publication. Students made up 48.1% of the first-authors. Three themes each emerged from the students and the supervisors' survey. Student themes included: motives for undertaking a summer studentship, administrative benefits and barriers, and perceived outcomes of the program. Supervisor themes included: motivations for engaging in the summer studentship program, administrative benefits and barriers, and expectations placed on the student. These themes are consistent with Vroom's expectancy theory where motivation is related to expectancy, instrumentality, and valence.

Conclusion: A dedicated program to foster an interest in research by medical students has great value as judged by an overall publication rate of 24.2%. In addition, it provides opportunities to explore areas of interest in depth, acquire research skills, pilot new avenues of research, and create professional networks. Student research program needs to be well founded and well supported including administrative and statistical support.

Keywords: medical education, medical student, research, career development, publication, training, supervisor

Introduction

An increasing body of literature indicates that medical students (some more than others) are interested in conducting research, and in pursuing a career in academic medicine.[1,2] Multiple research training opportunities are offered by medical schools across the globe. These include research activities that are mandatory (in the form of curricular components or graduation theses/projects) and voluntary (eg, summer research electives or intercalated research degrees).[3–8]

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The impact of undergraduate student participation in undergraduate scholarly activities has recently been scrutinized .[9] For medical students specifically, the cited benefits of early exposure to research include enhanced research knowledge and skills, and increased interest in the future involvement in research/academic careers; it is also associated with improved short- and long-term academic success (eg, higher rates of peer-reviewed publications, grants, and appointment to faculty positions).[1,5,8] Recent studies have demonstrated that medical student scholarly concentrations/research activities can result in publications in peer-reviewed journals,[1,2,6,10] with a reported average publication rate of 30%.[1] Indeed, authorship by medical students has been demonstrated to enhance their satisfaction in research and mitigate future attrition.[11]

The University of Otago offers paid summer studentships at each of its three clinical campuses—Christchurch (UOC), Dunedin (DSM), and Wellington (UOW).[12] This summer research program is an elective 10-week project, available to undergraduate sciences students (including medical students), and supervised by clinical and non-clinical University staff. At the end of the project, each student is expected to present their findings before the research committee and submit a written summary report.[12] Peer-reviewed publication of project findings *per se* is not required by the University, although students are often encouraged to do so.

To date, outcomes (including publication rates and student and supervisor satisfaction) of the 10-week summer studentship at our institution have not been formally assessed. A prior study from the University of Auckland in New Zealand has shown a publication rate of 32% of the similar summer research projects.[6] However, the results of such elective programs in Australasia have not been corroborated to date. In addition, qualitative data to identify factors correlated with program satisfaction, motivation, and research productivity have not been previously reported. Informal feedback indicates that students indeed enjoy and value their projects at our institution. In fact, the summer studentship program has been reported to the most common form of research exposure for New Zealand medical students.[13]

Vroom's expectancy theory[14] was used as a theoretical framework and explains motivation on the basis of expectancy (ie, the extent to which a person believes the effort will be successful), instrumentality (ie, the extent to which there is an association between effort and outcome) and valence (ie, how much the person values success). The aims of this exploratory study, therefore, were threefold: 1) to determine the publication rate as a marker of research output; 2) to assess the students' motivation and satisfaction; and 3) to assess the supervisors' satisfaction with the research program.

Methods

Study setting

Faculty representatives from the University of Otago campuses in UOC, DSM, and UOW were contacted in order to obtain names of medical students and supervisors of summer research projects between 2007 and 2016.

Ethics, consent, and permissions

This study was approved by the Department of Medicine, University of Otago, Christchurch, on behalf of the University of Otago Human Ethics Committee (reference: D17/286). Participants were specifically asked to provide their consent on the digital platform before the electronic survey could be accessed.

Publication search strategy

The information collected was standardized to allow for a systematic search. The last names and first initials of both student and supervisor were combined with the region affiliation of "Otago". PubMed™ and Google Scholar™ databases were then searched for publications relevant to each project on record. The following information was then collected: number of authors, position of student among authors, year of publication, and name of the publishing journal. After all publication data were collected, the number of citations for each publication was obtained from Google Scholar™.

Student and supervisor surveys

Based on previous studies,[15,16] draft questions were developed by the first author, and refined following discussions with the research team. The online survey was designed to collect data on demographics, prior research experience, and attitudes toward the summer studentship project. The latter was obtained utilizing a ranking Likert-type scale to statements. Open-ended questions allowed participants to free-text their responses in an effort to capture the range of perceptions and experiences of study participants.

The surveys were electronically mailed to previous students and supervisors of the UOC campus only who had completed projects between 2010 and 2016. The temporal and spatial restrictions were applied due to anticipated limited means of contacting participants who resided

outside Christchurch or had completed projects prior to 2010.

Data analysis

For quantitative data, descriptive statistics were used to analyze the majority of the data while independent-samples Student *t*-test and regression analysis were utilized for the remainder. Statistical significance was determined if type I error rate was <5%. All analyses were performed using SPSS Statistics® software package (version 22.0.0.0).

Qualitative questionnaire data were analyzed using an inductive, pragmatic approach (ie, the grounded theory process) which involved coding responses and grouping codes into common themes via an iterative process. Data were initially coded by one member of the research team, codes were reviewed and revised by other members of the research team, and finally, two researchers met face-to-face to finalize codes based upon consensus. Codes were grouped into themes by the research team as a whole. Responses to the student survey were considered separately from responses to the supervisor survey. The research team acknowledge their own biases as relative "insiders" with research and publication experience and professional connections to the University of Otago. Diversity of roles and perspectives within the research team (Professor, medical registrar, house officer, medical student), however, ensured high inter-rater reliability, and the number of respondents allowed saturation within the data to be achieved.

Results

Project output

Data were available from 1,345 projects over the 2007–2016 period. Between 2010 and 2016, there was a trend toward fewer projects per year, although this did not reach statistical significance (r=−0.73, p=0.065; see Table 1).

Publication data

Over the study period, there were 326 publications, giving a 24.2% publication rate. Rates of publishing summer studentship projects were highest in UOW (28%), followed by DSM (25.5%) and UOC (19.9%). Although the themes of the summer research projects included clinical studies, laboratory experiments, and community projects, the exact number of each theme and how it related to project *publishability* was not calculated.

The lag-period between project completion and publication was less than 1 year for 52 projects (16%), between 1 and 2 years for 121 projects (37.1%), between 2 and 4 years for 110 projects (33.7%) and more than 5 years for 43 projects (13.2%). Of the publications generated, 22.3% were published in Australasian journals. The median number of article citations was 2, with a range of citations between 0 (26.1% of the published projects) and 196.[17] The median impact factor for journals in which students published was 1.36 (range, 0–13.6).

Student authorship

More female students (58.1%) than male students were published. The mean number of authors per publication was 5.8 (±3.6). This number showed little variation over the years (r=0.08, p=0.13). Across years, students were first authors of a median of 50% of the publications (range, 40–100%); this rate remained relatively steady through the study period (r=2.9; p=0.98).

Student and supervisor survey responses

Between 2010 and 2016, a total of 285 projects were completed at UOC. Accounting of students who completed more than one project over the study period, and those for whom no contact details were available, the total number of students invited to the survey was 245. The number of student respondents was 48, giving a response rate of 19.6%.

A total of 242 UOC supervisors were contacted, of whom 73 responded to the survey. The majority of the supervisors were clinicians (42/71=59.1%), with the rest being non-clinical academics (29/71=40.5); two supervisor respondents did not indicate an academic background. Academic supervisors were significantly more likely to publish their project than clinical supervisors (93.1% vs 71.4%, p=0.01).

Table 1 The number of annual summer projects per school between 2010 and 2016

	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	Total
UOC	53	36	53	45	48	50	285
DSM	128	114	109	92	98	94	635
UOW	38	27	31	37	29	31	193
Total	219	177	193	174	175	175	1,113

Abbreviations: DSM, Dunedin School of Medicine; UOC, University of Otago, Christchurch campus; UOW, University of Otago, Wellington campus.

Overall, students and supervisors reported high level of satisfaction with the program. Table 2 summarizes the responses (out of 5). There was no evidence of bi-modal responses that would have otherwise been concealed by reporting the means.

Qualitative data

Through the analysis, three themes emerged for each of the students and the supervisors' survey. Student themes included: motives for undertaking a summer studentship, administrative benefits and barriers, and perceived outcomes of the program. Supervisor themes included: motivations for engaging in the summer studentship program, administrative benefits and barriers, and expectations placed on the student.

Students

1. **Motives for undertaking a summer studentship**

Student respondents revealed four key motives for undertaking a summer studentship. These included: gaining research experience, working on a topic of personal interest, financial incentive, and career building.

1.1 *Gaining research experience*

Students reported that they undertook a summer studentship to gain research experience, and some acknowledged that such experience can otherwise be difficult to get. For many, the studentship was a first introduction to research that afforded them a taste of research without excessive personal commitment.

> Good opportunity to get research experience and see if it is an area of interest. Student 30

> For someone that is thinking about a career in research but hasn't had any experience in it as it provides a "taster" without having to commit to formal study. Student 47

1.2 *Working on a topic of personal interest*

Some participants commented that they undertook a summer studentship in order to learn more about a topic of personal interest. Some participants remarked that the experience shaped their research and career interests going forward.

> Much better and more rewarding than taking a summer job unrelated to one's area of study. Student 5

> Find an area you think you'll be interested in and it will give a good taste of that area. Student 23

> It shaped some of my interests. Student 49

1.3 *Financial incentive*

Students described remuneration as an important motivator for undertaking a summer studentship. For many, the program offered a unique opportunity to earn a reasonable summer wage while undertaking work that was more rewarding and relevant than alternative summer employment such a retail work.

> Mainly it was an interesting way to earn money in the holidays instead of a boring retail job. Student 29

> Good way to occupy the summer, experience a different side of medicine and get some money doing it. Student 49

1.4 *Career building*

Students noted that the summer studentship had relevance to their career, fulfilled research experience on their C.V.,

Table 2 Student and supervisor satisfaction with the UOC summer studentship program (5-point Likert scale; 1= strongly agree; 5= strongly disagree)

	Student, Mean±SD	Supervisor, Mean±SD
Response rate (%)	48/245 (19.6%)	73/242 (30.2%)
The program is clearly advertised as an option for interested students.	2.4±1.1	2.1±1.1
The summer studentship program is well set-up.	2.0±0.9	2.1±0.9
The allotted duration for research is adequate.	1.9±0.9	2.3±0.9
The support (financial, intellectual/supervision) from the university is adequate.	2.1±1.1	N/A
The summer studentship increased my interest in research.	2.3±1.2	N/A
I would do it again.	2.2±1.3	N/A
I would recommend a colleague to do it.	1.9±1.0	2.1±1.1

Abbreviations: N/A, not applicable; SD, standard deviation; UOC, University of Otago, Christchurch campus.

and allowed them to attain professional connections and mentors—all of which considered significant for career building and professional advancement.

> It helped substantially with job progression and my own studies. Student 6

> I had a fantastic supervisor who is now a mentor and life-long advisor. Student 7

2. **Administrative benefits and barriers**

For some participants, administrative factors impacted their experience. Students noted that the summer studentships did not always seem fairly advertised, and some projects were better organized and prepared than others. Access to administrative support and expert resources (eg, statistical support) influenced both the student's experience and their perceived success of the project. The fixed time-frame of the summer studentship was noted by some to be inadequate. In light of these barriers, students remarked that they would have benefited from having the opportunity to do some preparatory work on the project, including getting ethics approval and commencing initial data collection, before the summer started. Equally, some students felt they would benefit from teaching on research methods, ethics, and statistics so that they can assume more responsibility for the project themselves.

> Perhaps more theory on research methods, scientific approach for clinicians; An introductory course in statistics. Student 12

> Extremely difficult to get projects if you haven't got connections – most projects are offered to students who have some other connection to the supervisor. Student 19

> There was not enough time for meaningful research. Student 20

3. **Outcomes of the summer studentship**

Three key outcomes were identified: skill acquisition, publication, and working in a research team. A fourth, related upshot of the summer studentship was the missed opportunity to have done something else.

3.1 ***Skill acquisition***

Students remarked that the summer studentship provided an opportunity to attain practical skills related to the publication and presentation of research findings. Similarly, they noted that the experience fostered critical thinking, providing transferable skills required to interpret and appraise the research of others.

> A better understanding of how research is performed and how to interpret journal articles. Student 7

> Good research skills, critical appraisal. Student 23

3.2 ***Publication***

Many students commented that publishing was the central outcome of the summer studentship and suggested that this should be an aim for anyone undertaking a studentship project.

> Choose supervisors that publish and work hard to finish projects. Student 18

3.3 ***Working in a research team***

Several student respondents remarked that the opportunity to work in and learn from a research team was invaluable.

> The opportunities to meet others and be mentored by experienced researchers is fantastic. Student 5

3.4 ***A missed opportunity***

Some participants remarked that the remuneration was inadequate given the commitment required of them. If they were to have their time over again, some said they would prefer to use the time to earn more, or to do something else, such as travel.

> I think id [sic] rather use the holidays to work/travel as the rest of our lives are medicine. Student 9

Supervisors

1. **A win–win situation**

Supervisors reported that the summer studentship was mutually beneficial for students and for supervisors, and that both parties gained from the program. For supervisors, this was the promise of being able to pilot new research ideas; for students, it was the potential to gain research skills and experience; and for both, it was the promise of publication.

> Overall it is an excellent initiative which benefits both the supervisor(s) and the student. Supervisor 9

1.1 ***A low-cost pilot***

The explicit aims of the summer studentship for many supervisors was the opportunity to pilot new research ideas in a quick, low-cost and low-risk way.

> It's a great program that does much to raise the profile of UOC and allow low cost piloting of new research ideas with the assistance of really bright and talented students. Supervisor 20

> [The program] represents amazing value for money regarding work that gets done. Supervisor 21

1.2 *Potential for students to gain experience*

Many supervisors held the view that the aim of the summer studentship was for students to gain experience, skills, and exposure to research. In particular, many highlighted the value for students in spending time in the research team. For some, this aim was paramount to other objectives and was seen, in a sense, as a way of inspiring students to embark on a career involving research.

> It is an amazing opportunity and is the first step up the research ladder for many. Supervisor 21

> Great chance to think about something in depth and work closely with an experienced colleague. Supervisor22

1.3 *Promise of publication*

Several supervisors reported that publication is an expectation they have for all students participating in the program, and saw this as a way of setting a high standard for the student's project. There was also, however, an acknowledgment among supervisors that some projects are more amenable to publication, and that it simply was not a feasible goal in some instances.

> Focus on publication, aim high. Supervisor 2

> Some projects are more academic and "publishable" than others. Supervisor 3

> The time period often does not allow a project of the depth that modern high quality journals would publish. Supervisor 63

2. **Expectations**

Supervisors reported that the motivation and background skill of the student bears strongly on the success of the project. Many espoused high expectations for students, which were inconsistently met. They saw that some students lack enthusiasm or motivation to devote adequate time to the project or to engage fully with the research team. They also expressed concern over the students' lack of existing research skills or experience.

> The student is usually the success-limiting factor, therefore encourage good students. Supervisor 15

> Some students lacked sufficient lab-based experience or were technically challenged. Supervisor 20

> One student was not here for the research just for the money – no fun for anybody – poor attendance, study not completed, even took leave on the final day of presentations. Supervisor 53

Other supervisors praised their summer students and reported that it is important to ensure a good fit and a strong working relationship between supervisor and student. Some acknowledged that completion of the project, and publication, in particular, requires the student to invest time beyond the studentship.

> On the whole our students have been outstanding young people. Supervisor 14

> Students accepting that they may need to continue to work on projects despite their allocated research time being finished. Supervisor 65

3 .**Growing the program**

Many supervisors reported the summer studentship program was effective overall, but broadly felt there were key areas that could be improved. These included timing and administrative support from the Research Office.

> It's currently fit for purpose: well set up, flexible enough, research staff are helpful and responsive. Supervisor 36

3.1 *Timing*

Several supervisors expressed frustration with the restrictive time-frame of the summer studentship and noted it to be one of the main reasons that projects were not finished or results not published. This was made worse by the fact that the Christmas holiday period falls in the middle of the students' summer break.

> The main hindrances were that the students became busy with their studies after the summer and didn't have time to write their projects up. Supervisor 9

> Christmas break is distracting and limits outputs. Supervisor 10

3.2 *Support from the Research Office*

Respondents reported that the summer studentship program would benefit from greater access to and communication about funding sources, more administrative support for compliance reporting, improved recruitment strategies, and assistance with practical tasks such as sourcing statistical support for projects, and securing work space and access to clinical spaces for students.

> It would be great if they could take on more of the admin requirements. Supervisor 9

> Poor communication from the Research Office about whether the project was funded or not. Supervisor 45

Discussion

In the present study, we examined the published output of the summer studentship program at our institution between 2006 and 2017. Over the studied period, 326 manuscripts were published from 1,345 research projects (24.2%). Students made up approximately a half of all first-authors (48.1%); more female (58.1%) than male students were published. The mean time from studentship completion to publication in peer-reviewed journals was 21.3 months. Most publications appeared in the literature 1–4 years after research completion—a lag-period that is in keeping with findings from other studies.[6,10]

In a recent large study from New Zealand,[6] Wells et al examined research output resulting from the Faculty of Medical and Health Sciences summer studentship projects at The University of Auckland, and reported an overall publication rate of 32%. This rate is considerably higher than that reported in this study. It should be noted, however, that the study by Wells and colleagues included medical as well as non-medical students completing summer studentships. Furthermore, the lag between the studied period and data analysis was greater in the study by Wells and colleagues (3 years vs 1 year), potentially accounting for more publications appearing in the literature.

The publication rate reported in our study (24.2%) was lower than the average student publication rate reported in the literature (30%).[10] The low publication rate may be partly explained by the fact that publication in peer-reviewed journals is not a requirement of the summer studentship program at the University of Otago. In addition, students have only 10 weeks to complete their studentship project. As noted by students and supervisors of studentship projects, this may be too short of a duration to produce a report of publishable quality. Finally, the short time between the included most recent summer projects (ie, 2016/2017 projects) and data analysis may have resulted in several publications being missed from our study. This latter factor may have also influenced the number of citations of the identified publications, as a sizeable proportion (26.1%) was not cited (compared with 10% in the study by Wells et al).[4]

The student motivations are consistent with Vroom's expectancy theory.[14] We found the students' comments related to skill acquisition and working in a research team are consistent with Vroom's factor of instrumentality whereby a relationship between effort and outcome was noted. The comments related to the value of publication are consistent with Vroom's factors of valance and expectancy. In contrast, those who viewed the activity as a missed opportunity regarded their effort to not be associated with a desired outcome. Other programs ought to factor the identified themes in this study when auditing similar student research programs at their institutions—positives to be fostered, and barriers to be lessened.

There are several limitations to the present study. The response rates to the surveys were low (20–30%); however, this does not substantially deviate from response rates of medical education surveys elsewhere in the literature. It is possible that a few projects were missed due to incomplete data retrieval from the various faculty representatives. Similarly, the reported publication rate may underestimate the true rate due to missed or non-indexed publications, longer lag times or changed author names. Qualitative responses were voluntary (thus, raising the possibility of selection bias) and only sought from a single campus. Whilst limiting responses to the most recent six years may have curtailed some of the recall bias, it cannot be completely eliminated. Additionally, the qualitative data provided insight into the experiences of some, but they do not necessarily represent the experiences of participants from non-UOC campuses. Using questionnaire data to answer descriptive or qualitative questions is suboptimal. The free-text, electronic format may limit the content and quality of responses and forces interpretation of responses without the ability to clarify ambiguity. Indeed, there is no capacity to probe responses to elicit intended meaning or to develop incomplete or unclear ideas. Furthermore, the data are limited by the questions posed, and therefore run the risk of reflecting the authors' biases as developers of the questionnaire.

Finally, while the low response rate limits the generalisability of our findings from the quantitative analysis, saturation was achieved for the qualitative data.

Conclusion

In conclusion, a dedicated program to foster an interest in research by medical students has great value as judged by an overall publication rate of 24.2%. In addition, it provides opportunities to explore areas of interest in depth, acquire research skills, pilot new avenues of research, and create professional networks. Student research program needs to be well founded and well supported including administrative and statistical support.

Abbreviation list

UOC, University of Otago, Christchurch; DSM, University of Otago, Dunedin; UOW, University of Otago, Wellington.

Ethics approval and consent to participate

This study was approved by the Department of Medicine, University of Otago, Christchurch on behalf of the University of Otago Human Ethics Committee (reference: D17/286). All participants provided consent prior to filling the electronic surveys.

Consent for publication

All participants provided consent prior to filling the electronic surveys.

Availability of data and material

Data are available upon reasonable request.

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Author contributions

All authors contributed to data analysis, drafting or revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

Disclosure

Professor Lutz Beckert was the Head of the Department of the Department of Medicine, Christchurch School of Medicine at the time this study was conducted. Professor Tim J Wilkinson reports being a member of the editorial board of Advances in Medical Education and Practice. The authors report no other conflicts of interest in this work.

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