

Developing Research-Oriented Health Professionals: Understanding Students' Perceptions and Needs for Extracurricular Research Opportunities

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ABSTRACT

BACKGROUND: Undergraduate training in research principles is often mandated by healthcare profession regulators in Ireland to prepare graduates for higher specialist training. Students can be offered the opportunity to participate in extracurricular research activities, in addition to those embedded in the curricula. This cross-sectional study aims to explore student attitudes towards research and to understand their motivations for engaging in research-related activities and any barriers that might prevent them from doing so.

METHODS: Students participating in the Royal College of Surgeons in Ireland Research Summer School (RSS) 2023 completed a questionnaire at the start of the program to assess research experience as well as attitudes and motivations towards research.

RESULTS: Of the 120 participants in the summer research school, only 50 participated in the questionnaire. Of these 50, 42 were medical students. Twenty-nine students were undertaking a supervised research project, while 21 were enrolled in a 4-week taught research skills program. Five students had completed a previous undergraduate or postgraduate degree, and 29 had previously participated in research-related activities. The reasons for participating in the RSS program were to gain experience and skills, followed by having an interest in biomedical research. Twenty-nine students said their motivation was to participate in a more exploratory learning process beyond the syllabus. Thirty students felt the main factor preventing them from gaining research experience was the lack of research opportunities available to them.

CONCLUSION: Undergraduate health professions students recognize the importance of engaging in research-related activities. Gaining research experiences to enhance knowledge and build professional relations is important, but the lack of opportunities is perceived to be a barrier preventing engagement. Given the value undergraduate students place on research experiences, institutions specializing in health professions education should create customized programs to eliminate obstacles and offer undergraduate opportunities that encourage the development of research-focused healthcare professionals.

KEYWORDS: research, medical education, medical student, undergraduate, attitude, perception

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Background

Biomedical and patient-centered research has long underpinned the development of modern healthcare delivery and better patient care. In recent years, the COVID-19 pandemic has demonstrated the need for healthcare professionals to be equipped with the necessary skills to conduct high-quality research that translates into better technologies, new therapeutics, or best practices for the better of human health.¹ This rapid response was due to the involvement of many skilled physician-scientists, including newly graduated doctors.² However, the healthcare community is still challenged with a shrinking pool of graduates who are opting for careers as physician-scientists that have an academic and research-related

component alongside their clinical responsibilities. Concerns have been raised over the possible repercussions of this and the impact on research outputs, the dissemination of important findings, and ultimately, the quality of future healthcare for patients.^{3–7}

A lack of exposure to research experience in undergraduate medical education has been linked to an increased hesitancy in taking medical internships with an academic track, which is a primary pathway to training physician-scientists in Ireland.⁸ Often undergraduate students lack confidence in their research skills and abilities, which is thought to stem from insufficient research experience and a lack of a research culture in undergraduate medical education. However, both



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issues can be addressed by the addition of more research elements into undergraduate curricula and teaching.^{9,10}

Undergraduate health professions students, whether intending to pursue an academic career or not, need to be familiarized with research processes and apply scientific reasoning and the principles of evidence-based practice in their future working lives.¹⁰ Healthcare professional regulators often mandate undergraduate training in research principles be incorporated into curricula to ensure that graduates use an evidence-based approach when managing patients, which in turn ensures quality patient care. This mandate also aims to ensure that graduates can critically evaluate new research and safely integrate it into their daily practice while also fostering a culture of life-long learning that ensures continued advancements in healthcare delivery. This approach should ultimately equip healthcare professionals with the skills for scholarly activities in their career and help them stay up to date with advances in their fields.¹¹ Having a research experience expands knowledge and improves critical thinking, which in turn will encourage undergraduate medical students to understand better and take an evidence-based approach when managing complex clinical scenarios,¹² such as medical emergencies involving a multidisciplinary approach in management, in the future. Providing nursing students with training of research skills that helped them to formulate research questions, create research strategies, identify suitable study designs, and determine study validities and significance was found to significantly improve their abilities to apply their knowledge and skills in practice.¹³ Another study that interviewed allied health professions (audiologists, dieticians, pharmacists, physiotherapists, occupational therapists, etc.) working with healthcare students on research projects highlighted the benefits of research skill attainment through supervised projects. Here it was shown to improve the quality of health services provided, to strengthen clinical practice knowledge and reinforce evidence-based care, contribute to guideline development, and even the foster collaborative relationships between colleagues. In turn, these were found to increase job satisfaction and contribute to safer and better care for patients.¹⁴ It has also been found to result in better student engagement and promote in-depth learning.^{15,16} Exposing undergraduate students to core research is essential to their future career and professional development in a rapidly evolving knowledge-intensive economy.¹⁷

It is not surprising that medical schools, and other third-level institutions focused on health professions education, have recognized the importance of exposing undergraduate students to research skills before graduation.^{18–25} Often, this has involved integrating components of research or the teaching of research skills into the curricula they deliver.^{26–30} Nevertheless, despite the consensus on the need for incorporating research into undergraduate education, academic institutions have differed in their objectives and approaches to implementing research into their undergraduate programs.

Usually, these approaches have largely not been evaluated to ascertain their effectiveness in promoting the acquisition of research skills, such as certain laboratory techniques, statistical analysis skills, and scientific writing skills in future healthcare professionals and to address the current declining trend in academic training.^{28,31}

The Royal College of Surgeons in Ireland (RCSI) University of Medicine and Health Sciences has long recognized the importance of exposing our undergraduate students to research experiences. For example, in the School of Medicine, students will either undertake a 5- or 6-year undergraduate degree program if they enter directly from high school or they can undertake a 4-year graduate entry program if they have a tertiary level degree already. In both degree programs, all students undertake a supervised project as part of their studies. Students studying pharmacy or physiotherapy also have a supervised research component embedded in their respective curricula. Outside of this, some of the students may wish to gain additional experience for career development reasons. For over 12 years, and to complement curriculum-based research activities, RCSI has provided a fully supported 8-week Research Summer School (RSS) to over 100 students every year. As part of this summer school, students can choose from a selection of projects that have been proposed by academics willing to supervise a student over the summer months. Depending on the area of interest and area of expertise of the supervisor, these projects can vary in nature, but the students can select from projects that are lab-based (often involves hands-on experiments, scientific testing, or data collection using laboratory equipment), desk-based (often involves analyzing existing data, reviewing academic literature, conducting systematic reviews, meta-analyses, or working on computational models), or a ward-based research project in one of our affiliated clinical teaching sites (often takes place in a clinical or hospital setting, engaging directly with patients, clinical staff, or medical processes for data collection or observation). Students match to a supervisor that they feel best suits their own research area of interest in a competitive process. More recently, the RSS was expanded to increase capacity, while adapting to the restrictions of on-campus activities during the pandemic, to include an intensive 4-week structured taught program that focuses on equipping students with core research skills in laboratory techniques, simulation in education and its evaluation, and computational biology-related research as well as scientific writing and presentation skills, ethics, clinical and patient-centred research, data management, and statistical analysis. The program also aims to develop transferable skills still important in research, such as time and project management. While this summer program is now well established, we have not assessed student attitudes to research experiences, nor have we truly determined their research needs and motivations for acquiring a research experience before graduation. The primary aim of this study, therefore, is to explore undergraduate students' perceptions

towards engaging in research experiences before graduation by addressing previously unassessed research needs, attitudes toward, and the motivations for seeking-out extracurricular research activities.

Methods

Study design

This observational study was approved by the RCSI Research Ethics Committee (REC1510) and conducted over an 8-week period from the start of June to the end of July in 2023. The reporting of the study conforms to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (see Supplemental Table 1).

Informed consent was obtained from all participants prior to participation in the study. Only students who were registered to participate in the RSS program were asked to consider participating in this study. Due to the lack of standardized surveys on undergraduate health science student research participation, we adapted a questionnaire originally devised and validated by Burgoyne *et al.*³² in their 2010 study, which shared many of our research objectives. All undergraduate students participating in the RCSI RSS program in 2023 were asked to complete it. The adaptations were made to reflect the RCSI student cohort (see Supplemental Material). Participating students completed the survey before engaging with the summer research program. The questionnaires were designed to gather details relating to student perceptions of research and related activities.

In addition, the questionnaire was designed to determine the motivations of undergraduate students for engaging in research programs and to determine what barriers they perceive exist that might hinder their engagement with such opportunities as an undergraduate. Students were also able to provide free-text comments and personal opinions on the significance of research. The questionnaire was designed to take approximately 5 min to complete and aimed to collect student responses under the following topics:

1. Student demographics (age, gender, place of origin, course, year of study, previous research experience, and others)
2. Research experiences and student attitudes towards research
3. Motivators and obstacles for students to do research

Full details of the questionnaires can be found in Supplemental Table 1.

Statistical analysis

Data analysis was performed using Jamovi (2.4.8) software. Data on attitudes towards research and demographics were

Table 1. Participant demographic characteristics ($n = 50$).

PARTICIPANT CHARACTERISTICS	NUMBER OF PARTICIPANTS	PERCENTAGE OF PARTICIPANTS (%)
Gender		
Female	36	72
Male	14	28
Age		
Under 18	1	2
18-22	42	84
23-25	6	12
30-40	1	2
Place of origin		
Asia	20	40
Middle East	9	18
European (Irish)	14 (13)	28 (26)
Americas	6	12
Africa	1	2
Relatives working as healthcare workers		
Yes	28	56
No	22	44
Course of study		
Undergraduate entry medicine	42	84
Graduate entry medicine (GEM)	2	4
Pharmacy	2	4
Physiotherapy	3	6
Advanced therapeutic technologies	1	2
Prospective year of study		
Year 1	3	6
Year 2	10	20
Year 3	26	52
Year 4	9	18
Year 5	2	4
Enrolled RSS program		
4-week taught program	21	42
8-week research program	29	58
Previous degree		
Yes	5	10
No	45	90

analyzed using the χ^2 test of association for nominal variables and correlation matrix (Kendall's Tau-B). Kendall's Tau-B ranges from -1 (100% negative association, or perfect inversion) to $+1$ (100% positive association, or perfect agreement). A value of 0 indicates the absence of association. P -values ≤ 0.05 were considered significant. A word cloud, based on frequencies, was used to highlight reasons for participating in the summer research program.

Results

Student demographics

Of the 120 students registered in the RSS, 50 (42%) responded to the survey. Twenty-nine students (58%) were completing a supervised research project in the 8-week RSS program, while the remaining 21 students (42%) were enrolled in the 4-week taught research skills program.

Of those who responded to the survey, 42/50 students (84%) were between the ages of 18 and 22 years, 36/50 students (72%) were female, and the majority were from Asia (20/50; 40%). The complete demographic details of the respondents are shown in Table 1.

The majority of the respondents were medical students in the 5/6-year undergraduate degree program (42/50; 84%), and the remaining comprised students from the graduate entry medicine (GEM) program (2/50; 4%); undergraduate pharmacy program (2/50; 4%); undergraduate physiotherapy program (3/50; 6%), and the new bachelor of science degree program in advanced therapeutics and technologies (1/50; 2%). Only 5 students (10%) had completed a previous undergraduate or postgraduate degree. Of those participating in the RSS, most students (26/50; 52%) were entering the third year of their studies. Of the participating students, 28/50 (56%) reported having relatives who worked in the healthcare-related profession.

Previous research experiences and student attitudes towards research

Twenty-nine (58%) of the students surveyed indicated that they had not yet been exposed to any form of research-related experience either at the RCSI, as part of their degree program, or at another academic institution, as part of a previous degree program or other experience, before participating in the RSS. Of the remaining participants, 6/50 students (12%) had attended, or were planning to attend, a scientific conference and 10/50 students (20%) had already, or were hoping to have, their previous research findings published. Of the 22 students with previous research experience, approximately half of them had obtained research opportunities through an external research activity ($n=11$) or an extracurricular research elective course ($n=10$). Fewer students had completed a mandatory research curriculum module ($n=8$) or obtained a research-focused academic degree ($n=2$). A majority ($n=16$) pinpointed literature and systematic reviews as well as meta-analyses as the type of research they had been involved in, whereas fewer ($n=4$) were exposed to clinical studies (including audits).

The most frequent reasons provided by the students for applying for the RSS programs included a wish to gain a research "experience" (27/50; 54%) or to gain research "skills" (16/50; 32%). Other reasons included wanting to "learn" more about research (11/50; 22%) or having an "interest" in research (9/50; 18%), and finally, some students wished to participate for "career development" reasons (8/50; 16%). A word cloud of the most frequently occurring terms provided by surveyed students is provided in Figure 1. There were 79 words analyzed, and Figure 1 shows the 12 most frequently occurring reasons for wanting to do research.

Also, 90% of the surveyed students (45/50) reported that they were moderately or highly willing to participate in research activities after graduation but only 44% (22/50) of the students



Figure 1. Word cloud of the most frequently occurring terms provided by surveyed students. Participating students ($n=50$) were asked to provide their reasons for wanting to apply and participate in the RSS program. Respondents were asked to provide keywords for their reasons for applying for the RSS program. Submitted keywords were then screened to remove filler terms such as "that" or "is." An online word cloud generator (<https://www.freewordcloudgenerator.com/>) was used to generate the word cloud. Terms with higher frequencies are presented in larger fonts.

surveyed indicated that they were likely to pursue a future career in academia. Moreover, our analyses found no statistically significant correlation between having more research experiences as an undergraduate and having a greater interest in pursuing a career with an academic component ($P=0.867$). However, those who had managed to contribute to research that resulted in a publication did have a significantly greater interest pursuing a career with an academic component ($P=0.048$) compared to those that have not had a research output arising from a prior experience.

Motivators and obstacles for students to do research

When students were asked about their motivations for pursuing a research experience, it was found that 58% (29/50) were driven by the desire to engage in a learning process that extended beyond the standard curriculum. Table 2 highlights other key motivators for engaging with research opportunities. Of note, 24/50 (48%) of students said a major motivator was the prospect of networking and gaining qualifications for

career advancement while 22/50 (44%) indicated the main motivation was the chance to refine research skills.

Of the surveyed students, 21/50 (42%) said the main driver for gaining research experience was to integrate their research with their clinical practice. Conversely, 60% of students (30/50) found a lack of available research opportunities to be the greatest obstacle preventing them from engaging with research while 54% (27/50) said insufficient mentorship and support was a barrier (Table 2).

Several demographic factors were found to influence a student's motivation for seeking a summer research opportunity and the barriers that might prevent them from engaging with the same. Students who participated in the 8-week RSS program ($n=29$, 58%) were also more likely to be motivated by the financial incentives and prizes linked to these research experiences (χ^2 -value = 4.26, $P=0.039$).

A financial motivation is more prominent in students further along in their studies (Kendall's Tau-B = 0.382, $P=0.004$), while time pressure was the main barrier to engaging in summer research in this same cohort (Kendall's Tau-B = 0.322, $P=0.015$) (Figure 2). Those without prior research experiences ($n=29$) were found to be more attracted to the exploratory learning nature of research (χ^2 -value = 7.24, $P=0.007$). The 4 students who had prior research publications indicated that having a personal interest in the research topic was more important to them than the rest of the surveyed students who had no prior publications ($n=40$; χ^2 -value = 10.4, $P=0.006$).

Discussion

The popularity of both research programs at our institution is evident with 120 students choosing to participate each year during their summer months. Our study revealed that nearly half of the surveyed students had previously engaged in research before attending the RSS program in 2023, which shows student interest was still great in those surveyed even if previous experiences have been gained. We also found that relatively few students in our cohort had managed to achieve a previous research-related output, such as publication in a peer-reviewed journal or a conference presentation, which is similar to a recent study on the research experiences of medical students in an Egyptian university that found only 11.5% of their students ($n=462$) had research publications and 24.5% had presented their research results.³³

The most important factor driving students to engage in research in our study was the opportunity to engage with exploratory learning beyond the syllabus (29/50). In contrast, a previous review of the literature highlighted that gaining a competitive advantage was the main reason medical students engaged with research experiences as undergraduates.³⁴ In addition, a substantial number of students (22/50) also recognized that gaining research experience as an undergraduate is important if they are to refine their research skills. This finding is

Table 2. Motivators and barriers to research for students.

REASON	NUMBER OF STUDENTS (%) ($n=50$)
Motivations	
1. Exploratory learning and exposure beyond the syllabus	29 (58%)
2. Networking and qualification for career progression	24 (48%)
3. Opportunities to hone research skills	22 (44%)
4. Integration with clinical practice	21 (42%)
5. Personal interest in the research topic	16 (32%)
6. Financial incentives and prizes for research	15 (30%)
7. Gratification and satisfaction from research	11 (22%)
Barriers	
1. Lack of access to research opportunities	30 (60%)
2. Lack of mentorship and support	27 (54%)
3. Inadequacy in research skill proficiency	26 (52%)
4. Time conflicts with curriculum and other activities	22 (44%)
5. Lack of interest in research topic	9 (18%)
6. Lack of acknowledgement for contributions	8 (16%)
7. Lack of interaction with patients	2 (4%)

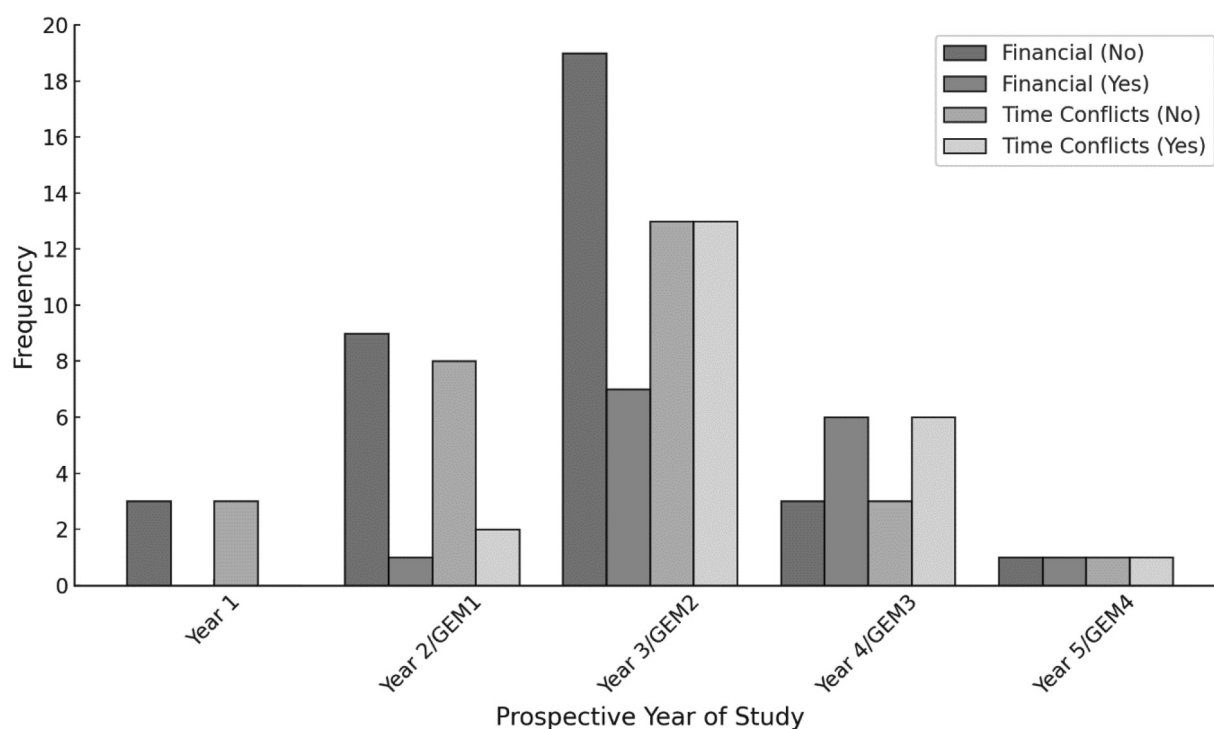


Figure 2. Relationship between perspective year of study, the perceived barriers, and motivations influencing student engagement with undergraduate research. The data illustrates the frequency of responses where students (years 1-5) indicated that financial reasons or time conflicts were either a motivation or a barrier impacting their engagement with undergraduate research.

perhaps not surprising given the majority of those who responded to the survey chose to engage with a taught program of activities that was designed specifically to help develop basic and important research skills. However, nearly half of the surveyed students (24/50) also indicated “networking and career qualification” as one of the top 3 most important reasons for doing undergraduate research. This suggests that career development still remains an important driver for student engagement in research experiences as an undergraduate. Furthermore, our results also showed that clinical research is one of the areas that most of the surveyed students feel they lack exposure to, which highlights the need for a greater focus on promoting student involvement in research at the patient-clinician interface.

Indeed, the lack of access to research opportunities, and the lack of available research mentors and research supports, seemed to be the most significant barriers perceived by our students that hinder their engagement with research as an undergraduate. Students also indicated that their perceived lack of proficiency in basic research skills was an important factor preventing them from engaging with undergraduate medical research opportunities when they arise, which is a finding others have also observed.³³ This again highlights the need to provide undergraduate students with opportunities to develop their research skills in a supportive and confidence-building learning environment. Additionally, having the time to do research was another prominent reason causing students to

avoid engaging with opportunities when they are provided outside of the main curriculum. Given many health professional degree programs are academically dense with teaching activities and assessments, it is not surprising that others have also reported that time restraints can be a barrier. Conflicts with daily commitments, and in particular examination preparation, are some of the main reasons that students do not engage with undergraduate research.^{33,35–37}

When we examined what other factors impact a student’s decision to undertake a research opportunity as an undergraduate at our institution, we found that this decision was influenced by their year of study, the type of research program on offer, and whether prior research experience had been gained previously. The RCSI has a diverse student body from over 100 different countries who will practice in different jurisdictions and will therefore have different career goals as an undergraduate, so it is not surprising to see the differences in requirements, opinions, and motivations when we surveyed the students.

Overall, we found health professions students are generally willing to participate in research activities despite the existing barriers also highlighted here. Various studies have recommended the early introduction of research experiences into the educational journey of students to improve student engagement with research in the long term. Vujaklija *et al.*³⁸ have suggested that the introduction of a compulsory research module into the curriculum can effect positive changes in attitudes towards research for not only those students who have a keen

interest in research but also the wider student population. An additional benefit of having a mandatory research program embedded within health education is that students can develop both valuable research-specific skills and other transferable skills, which are all essential for their future career development as healthcare professionals and physician-scientists.³⁹

Students from another Irish study have also voiced their support for research exposure early in their educational journey, noting that early and structured research electives with a comprehensive program overview and focus on research technique training are essential for their professional development.⁹ Siemens *et al.*⁴⁰ have further linked early research exposure with an increased likelihood of research engagement later during medical school, underscoring the need to address specific concerns faced by students and promote positive research experiences so that students are left with better impressions of a potential academic career. Building on their conclusions, Chang and Ramnanan³⁴ have recommended that educational institutions should recognize the barriers faced by students and address them specifically to enhance their research experiences. Additional extra-curricular programs, like our own summer research program, will only serve to enhance and complement these curriculum-based activities by providing more research experiences that will hopefully instil a culture of life-long learning and an interest in a research-focused career.

Study limitations

While the findings of this study are useful, some limitations need to be acknowledged. Firstly, all respondents to our questionnaire are students undertaking a research elective program at a single institution, which may limit the usefulness of the findings to other educators at institutions where the learning environment is hugely different. The students surveyed were also enrolled in a research-focused program and, therefore, represent a biased population. Also, despite our best efforts to encourage students to participate in the survey, a 42% response rate was all that could be achieved. We also acknowledge the omission of a formal power and sample size calculation in our study. The absence of a formal power analysis could be considered a limitation and while we anticipated a higher response rate, we believe the sample size achieved was appropriate for the study's exploratory goals and the insights we derived. The primary aim of the study was exploratory, focusing on capturing descriptive data and insights rather than testing specific hypotheses. In this context, we prioritized recruiting as many participants as possible to ensure sufficient representation and the collection of meaningful data. However, we also acknowledge that the survey did not collect other potentially informative data, such as the nature of previous degrees obtained by some students, which would have also been helpful when interpreting the findings and drawing conclusions on motivations to engage further with research experiences.

In addition, the reliance on self-reported data may also introduce subjective biases that cannot be ignored. Future research using some additional but more objective metrics, such as student research outputs in the form of publications and/or presentations at conferences, may be useful in further assessing the impact of undergraduate medical research programs on student perceptions and attitudes towards research and whether they engage with opportunities being made available to them. Lastly, the study did not explore the perspectives of faculty members and external scientific and clinical expert speakers who participated in our summer research program. Their understanding and perspectives on the barriers and research needs of undergraduate health profession students would provide additional insights to our study.

Conclusions

Our exploratory study suggests that most undergraduate health professions students recognize the importance of engaging in research-related activities and that accessing these opportunities is necessary to gain experience and skills for their future careers. The main motivations for gaining research experiences appear to be linked to gaining additional knowledge and building professional networks and qualifications for career progression. A lack of research opportunities and a lack of mentorship and prior skills are the main factors preventing students from gaining these experiences. Removing barriers to support undergraduate students to engage with research opportunities within, and outside of, the main curriculum should be a priority for academic institutions involved in health professions education. Strategies designed to address the challenges faced by health professions students will enhance their learning, research experiences, and their professional development while stimulating an interest in advancing healthcare delivery for the benefit of modern medicine and their future patients.

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Author Contributions

P.X. as an undergraduate medical student carried out the research and data acquisition. S.P. and N.T.S. were responsible for the concept of the study and study design. P.X. and F.B. were involved in statistical analyses. P.X., S.P., F.B., and N.T.S. carried out analysis and interpretation of data. P.X., S.P., F.B., and N.T.S. all contributed to the writing and editing of the manuscript. All authors reviewed and approved the manuscript prior to submission.

Availability of Data and Materials

Data are available upon reasonable request from the corresponding author.

Ethics Approval and Consent to Participate

Ethical approval for this study was obtained from the RCSI Research Ethics Committee (REC1510). Informed consent was obtained from all participants prior to their inclusion in the study.

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Supplemental Material

Supplemental material for this paper is available online.

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