Journal of Cancer Education (2019) 34:768–774
https://doi.org/10.1007/s13187-018-1370-4

Student Perspectives on the Impact of an Undergraduate Work-Integrated Learning Program on Admission and Transition to Medical School

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Published online: 5 May 2018

Abstract
Work-integrated learning (WIL) is a form of education that integrates academic and workplace study. Such programs provide students the opportunity to concurrently develop cognitive and non-cognitive competencies. The purpose of this study is to explore which experiences and skills learned in a WIL placement are useful in applying to medical school and transitioning into the first year of a Doctor of Medicine program. All individuals who worked in the Rapid Response Radiotherapy Program (RRRP; WIL placement) since 2004 and had completed at least 1 year of medical school were invited to participate. Semi-formal interviews were conducted and transcribed. A thematic analysis was completed to identify recurring concepts, and quotes were selected to represent them. Of 39 eligible individuals, 14 agreed to participate (36%). Students identified the volume of work, achieving a work-life balance, and time management as challenges in first-year medical school. Five themes emerged regarding the impact of the RRRP on applying and transitioning to medical school: time management skills, mentorship opportunities, research experience, clinical experience, and career choice. WIL placements present a unique opportunity for undergraduate students interested in pursuing medicine to acquire skills and experiences that will help them succeed in applying and transitioning to medical school.

Keywords Work-integrated learning · Co-operative education · Medical school · Undergraduate medical education

Introduction

Admission to medical school in Canada is becoming increasingly competitive; in the 2015/2016 application cycle, 19.6% of applicants received offers compared to 26.2% of applicants in 2008/2009 [1, 2]. Though the admissions process is conducted differently among the 17 Canadian medical faculties, it generally includes the assessment of cognitive and non-cognitive competencies. For example, select faculties measure academic competency by assessing metrics such as the undergraduate grade point average (GPA) and Medical School Admissions Test (MCAT) [3]. These metrics have demonstrated in several studies to predict success in academic performance, including knowledge-based assessments and the Medical Council of Canada Examinations (MCCE) [4–7]. Other components, such as reference letters and interviews (panel style, multiple mini interview, or other), are used to evaluate non-cognitive competencies, such as interpersonal skills, empathy, and integrity [8]. These, as well as numerous other non-cognitive skills and related behaviors, has been identified to lead to success in medical school, improved patient care, and increased satisfaction in future practice [9–11]. Nonetheless, there is little consensus on what skills should be acquired prior to medical school and how to best assess these during the admission process [10, 12].

Beyond being admitted to medical school, transitioning into a first-year medical program can come with a multitude of challenges. A systematic review by Dyrbye et al. [13] found several studies that identified volume of information, limited time, assessments, relationships, and feelings of self-doubt as sources of stress for medical students. A qualitative study by Reaume and Ropp [14], who interviewed 36 first- and second-year medical students, reports increased volume of information, time pressure, and more stress as issues when

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transitioning from pre-medical to medical education. Developing non-cognitive skills to cope with these obstacles is thus an important component in assisting students into their first year of medical school.

Though cognitive skills can be taught through academic studies and undergraduate courses, non-cognitive skills are more difficult to acquire in the classroom. Work-integrated learning (WIL) is defined by Co-operative Education and Work-Integrated Learning Canada (CEWIL) as "a model and process of education which formally and intentionally integrates a student's academic studies with learning in a workplace or practice setting" [15]. This method has the potential to concurrently develop essential cognitive and non-cognitive competencies for future professional roles. A study of Australian undergraduate students participating in WIL reported perceived improvement in working effectively with others, communicating effectively, critical thinking, problem solving, self-management, and developing professionalism [16]. A review of the literature on service-learning from 1993 to 2000 reported development of personal efficacy and identity, interpersonal skills including leadership and communication, and academic outcomes such as problem analysis and complexity of understanding [17]. The concept of WIL is also employed in medical education through clerkship and residency training, where clerks and residents are learning crucial skills in the workplace, facilitating their development into independent practitioners.

In 2004, the Rapid Response Radiotherapy Program (RRRP), a palliative radiation oncology clinic situated in the Odette Cancer Centre at the Sunnybrook Health Sciences Centre, began to hire undergraduate co-operative education students from the University of Waterloo, as well as students from other universities during the summer. The goal was to provide these students, who were interested in health sciences, with valuable clinical and research experiences to develop skills pertinent to medicine and related health professions. Student responsibilities included facilitating a daily clinic, accruing and following-up with patients on trial, and completing individual research initiatives as assigned. A review of student involvement in the RRRP from 2004 to 2013 was recently published by our group [18]. The results of this investigation showed that students were highly productive, evidenced by accomplishments such as 214 first-author publications (93 of which can be found on PubMed), 40 book chapters, and 99 awards, including those given by post-secondary institutions, provincial and national organizations, and international conferences. Of the 36 students surveyed, 25 of them were pursuing a post-graduate degree, and 17 of these 25 were attending or had graduated from medical school [18].

The objective of our current study was to explore which experiences and skills gained in the RRRP, a model of WIL, were useful in applying to medical school and in transitioning into the first year of undergraduate medicine.

Methods

A qualitative study design was utilized to allow for the collection of rich data through first-hand experiences. In accordance with the purpose of the study being exploratory, a descriptive methodology was chosen. All individuals who were employed by the RRRP (after 2004) during their undergraduate degree as either part of the co-operative education program or as summer research students, and have completed at least 1 year of medical school, were invited to participate. Study participants were recruited via e-mail invitation sent by a clinical research assistant (RM). The e-mail provided eligible participants with the protocol and informed consent information. Individuals were asked to reply to the e-mail if they were interested in participating in the study.

Individuals who agreed to participate were contacted and a one-on-one interview was arranged, either via Skype or telephone at a mutually convenient date and time for the participant and interviewer (AB). The interviewer (AB) had no previous affiliation or introduction to any of the study participants, nor were they a medical student themselves. Interviews were semi-formal in structure and were facilitated with a question guide. Questions were based on the individual's transition to medical school; the questions pertained to the specifics of the individual's experience in both the RRRP and in the first year of medical school. The purpose of using a semi-formal structure was to allow for flexibility and for follow-up questions as appropriate. Interviews were recorded and then transcribed verbatim (AB, RM, LD) once all interviews were completed.

Two members of the study team (RM and LD) independently conducted thematic analysis on each transcription. Two investigators completed this task in accordance with the concept of investigator triangulation to ensure rigor of the data. Transcriptions were coded, and recurrent codes were explored further until recurrent themes emerged. Each theme was discussed between the two members, and consensus was reached regarding core themes. Quotations were selected and included in the results if they represented a common perspective of participants or if they were a unique or deviant case.

Approval was obtained from the Research Ethics Boards of both the Sunnybrook Health Sciences Centre and the University of Waterloo prior to the initiation of the study (REB no. 144-2016).

Results

Of 39 eligible individuals, 14 (36%) agreed to participate in the study, 50% of whom were still in medical school and 50% of whom were in medical residency programs. Nine students (64%) became involved in the RRRP through the co-operative

education program at the University of Waterloo. Six participants (43%) worked in the RRRP for less than 12 months cumulatively (three of six were co-operative education students), while the remaining participants (57%) worked for at least 12 months cumulatively (six of eight were co-operative education students). There were five recurrent themes identified as being a beneficial component of the RRRP in applying to and transitioning into medical school: time management skills, mentorship opportunities, research experience, clinical experience, and facilitating career choice. Participants also identified the volume of work, obtaining a work-life balance, and time management as being challenges they encountered in first year.

Time Management

Several participants identified the volume of work, time management, and achieving a work-life balance as difficult challenges to overcome in their transition to the first year of medicine. Several students echoed the challenge of an increased volume of work from undergraduate education to medical school. One student described, "I think for me it was, I guess, the volume of stuff to learn in first year was quite overwhelming because there's such a general breadth of knowledge that you have to sort of rapidly learn about every single field." This volume also made challenging the notion of time management and the ability to maintain a work-life balance. One participant stated, "I think personally, the most challenging thing of first year is to keep a balance between your personal life and the relationships and things that you have going on outside of medicine, but especially during the first year because you are just so engulfed in this new program that you've been dreaming about attaining for so many years."

Despite these challenges, participants described experiences in the RRRP that taught them applicable skills to overcome challenges encountered in first year of medical school. Time management skills were found to be particularly useful. One participant described, "I think time spent in the RRRP is demanding in terms of the amount of work that is done. I mean, the amount of productivity you can have if you work hard through it so those skills are definitely helpful when I entered medical school, where there is a large volume of information to learn and reading to do." Another participant noted, "Working with my supervisor, if you become one of the senior students, he'll really, no matter how excellent you might be, he's gonna really try and push you to that next level and that's gonna require an extreme amount of perseverance and dedication and time management and I think a lot of those things/skills that I learned from being a student from him I could easily transfer over when I came to med school and I could be pretty easily take on objectively a lot during the first year of med school."

Mentorship Opportunities

Participants who worked in the RRRP for at least 12 months were more likely to identify the opportunity for networking and mentorship as valuable, compared to those who worked there for a shorter duration. Networking with previous students who were now part of the medical field or other careers was beneficial by providing advice to younger students. According to some students, the facilitation of networking and mentorship by the RRRP allowed them to obtain reference letters required for their medical school application. Students also described the benefit of being mentored both by their supervising physician and others, as well as the benefit of themselves being a mentor to other students. Mentorship in the RRRP was described by one participant as follows, "For my supervisor and his colleagues, they've been really excellent and devoted a lot of time to each of their students so that they succeed. And then you also gain a lot of mentorship from students above you so the very neat thing about the RRRP is that it is a very sustainable system. So, you get your students that are in high school or first year university and they are mentored by some of the older students that are in their third or fourth year of university. My supervisor has a lot of these co-op students from University of Waterloo that have had months and months of direct clinical exposure and research exposure who are able to mentor some of the younger students really well and then when those newer students end up gaining more experience, they become the senior students and they can mentor the newer generation."

Research Experience

All participants spoke about the usefulness of gaining research experience. For some individuals, including both summer and co-operative education students, participation in research was one of the motivating factors for applying to a position in the RRRP. One individual stated, "That was really my goal at the time: to get involved in research, get some publications, and attend some conferences." Several students also discussed the benefit of applying to medicine with previous research involvement, describing how research helped them "standout from other candidates that are also applying and show evidence to medical schools of [their] communication skills ability." A few students also mentioned that the RRRP is unique and beneficial since opportunities in undergraduate research are often difficult to obtain. An appreciation for gaining research experience was also described by some students in the context of medical school. One participant stated, "(…) it sort of makes things easier because as you move on through med school too so much of the things are evidence based and knowing where to find that evidence, knowing the best sources for it, it speeds up that learning process for you."

Clinical Experience

The opportunity to gain experience in a clinical setting was also a motivation for some participants to pursue a position in the RRRP and was identified by some as their first exposure to clinical medicine. Through such clinical experience, many participants described the development of communication and interpersonal skills, which helped during their medical school interviews and first year. This was summarized well by a participant who stated, "I had a lot of interpersonal skills that I think were built a lot in RRRP just because of the nature of the program—always interacting with patients, families, other physicians, other healthcare workers in the hospital. You have to be someone able to communicate, articulate what you want and need, and help other people out as well."

Several participants attributed building confidence and "comfort" interacting with patients to their clinical experience in the RRRP. One participant stated, "When it came to clinical skills and interacting with patients, it was like very natural and easy because we had done that so many times." This was echoed by other participants, one of whom stated, "When I was learning those clinical skills in first year, I felt a lot more comfortable at least with speaking with patients, asking them personal questions, because I have done this in a real setting before as a research assistant so that really helped build some confidence." Comfort developed through this clinical experience appears to extend beyond patients and families to ease in interacting with different healthcare professionals and within the hospital environment. One participant stated, "And you know, shadowing different physicians, being in a hospital environment, it was something more comfortable rather than being nervous and scared about being in that environment since it was already so familiar." Another stated, "It gave me confidence in talking with other people, talking with patients and physicians, and it just built up confidence in what you could do." One participant identified the clinical experience in the RRRP as being particularly relevant to improving comfort in later years when interacting with patients in palliative care became more common.

This notion of comfort identified by many students as being built through clinical encounters in the RRRP was also described as being an underdeveloped trait in their peers who lacked previous clinical exposure. These students were described as being "like a deer in the headlights" when they initiated their clinical rotations. One participant summarized: "The RRRP would help with comfort in a clinical scenario. Because you get a lot of people who, the first time they set foot in the clinic or in the hospital, it's like deer in the headlights. But we've already been there, you know you've seen really sick patients and you have that opportunity with the RRRP to learn how to interact with people in some pretty tough spots in their life. And I think that is the piece that's really helpful."

Career Choice

The majority of participants also spoke to their experience in the RRRP as either inspiring or solidifying their decision to pursue medicine. Participants attributed this to many components of their position in the RRRP, including some previously described opportunities such as clinical experience and mentorship. One participant summarized their experience in the RRRP as giving them the confidence to pursue medicine, stating, "I had always thought about medicine but never thought that I'd be the person who could make it, or would be smart enough, or driven enough to do it. (…) So, I was exploring other health-related fields like physiotherapy but kind of hadn't really decided until I got to the RRRP and that was kind of interesting for me to feel that I am that person who can get into medical school, I am intelligent enough, I am driven enough, if I want it bad enough I can do it. Through that, I was so much more ready to explore medicine as an option." Most participants described gaining a deeper understanding of what it means to be a physician and an improved ability to relate that back to how it aligned with their personal career goals. One participant stated, "I think also just having that experience of being in a clinical setting, you know 'Why do you want to do medicine?' You could say, 'Well I really want to do medicine because I know—I have been in that environment before, and I can see myself doing it.'" Another participant identified the duration of time spent working in the RRRP as being beneficial, "That summer when I was working fulltime with my supervisor, I think it helped me in terms of understanding the medical profession a little bit better. I mean it is one thing to shadow a doctor you know for one day and see how the clinic runs, but it is another thing to be a part of that healthcare team for a period of 3 or 4 months." This understanding of medicine and being a physician was also identified as being a gap in the knowledge of classmates without these experiences: "Students that came into medicine who did not have a good clinical background may have been surprised, overwhelmed, and may have had a whole lot of other emotions when it comes to seeing their first patient, or you know, seeing their first case that doesn't do well, speaking to patients that might be rude to them. So, the skillset is definitely one piece of it, another very, very unique thing that the RRRP brings you is direct exposure into the field that you are going to end up pursuing where you are at a huge, huge advantage compared to your other peers."

Deviant Cases

A few participants described the impact of working in the RRRP as either not contributory at all to their transition into medical school or felt that it was simply one component of many that aided them. For instance, one participant said, "I think the RRRP itself doesn't give you as much of an

advantage innately. You develop a lot by just working around patients, understanding the culture around the hospital, as well as working with different positions in their field." Another said, "Everything you learned throughout your educational career will help you to deal with the challenges you face, it's hard to isolate what the RRRP specifically added."

Discussion

Workplace-integrated learning (WIL) in a clinical setting has been a longstanding element of medical education. The passage from pre-clerkship, to clerkship, to residency necessitates progressive involvement in practice until competency as an independent practitioner is achieved. This model of medical education is supported by Lave and Wegner's [19] concept of legitimate peripheral participation, a method of learning that occurs through active participation in a community of practice. According to this framework, newcomers to a community first assume the role of an observer to learn what the organization does and discover available learning opportunities. As participants continue to engage in the community of practice, they acquire skills and knowledge that propel them towards full participation in said community, eventually becoming a "master practitioner" [19].

The RRRP model follows a similar principle. At first, students adopt basic yet still valuable tasks such as learning the essentials of facilitating the daily clinic and contributing to ongoing research initiatives. As they become more experienced within that context, they move towards fuller participation by acquiring greater responsibilities, including developing their own research initiatives or seeking out clinical experiences of interest. Later, they begin to act as mentors to junior students, passing along the knowledge and skills they have now mastered.

One student eloquently described the mentorship opportunities in the RRRP as reciprocal; that is to say that students are both mentored by their supervisor and are mentors to more novice students. Being a physician mentor has been described previously as someone (the mentor) who provides a mentee, usually a less experienced individual, with guidance on their field of interest and shares with them what it means to be a physician [20]. Mentoring in medical education has been associated with increased interest in research and research productivity, improved medical school performance, and both subjective and objective success in post-graduate careers [21, 22]. Mentors also serve as role models and help develop professionalism in mentees [21]. However, a few studies noted that the short duration of medical school courses makes it challenging for students to form meaningful relationships with potential mentors [21]. Our findings support this, as more students who worked in the RRRP for greater than 12 months duration identified mentorship as a beneficial component compared to students who worked there for shorter periods of time. However, even some students who worked for less than 12 months discussed the value of mentorship, likely because the minimum duration worked was 4 months. WIL placements such as the RRRP are typically a few months in duration and can hire students for subsequent placements, thus providing the time for the formation of a mentor-mentee relationship that may not be possible in future medical school courses. Near-peer mentoring is a type of mentorship where the mentors are slightly older peers of the mentees. This form of mentoring also occurs in the RRRP when senior students have the opportunity to mentor more junior students. Mentees in this form of mentorship may feel that mentors are more relatable due to their closeness in age and having been through similar experiences more recently than more formal mentors [23].

Participants described being involved in all aspects of the research process, including drafting protocols, submitting to research ethics boards, completing data collection and analysis, and drafting manuscripts. Knowledge of these aspects of research is critical because, though only some medical students will become clinician-scientists and produce medical literature, they will all become physicians who will need to be effective consumers of research. It is on this basis that they will be able to practice evidence-based medicine and provide optimal care to their patients. Given this, it is unsurprising that research experience is considered with some importance by medical school admissions committees [8], and sought by undergraduate students hoping to pursue medicine. Medical students also recognize research as being important; one study reported they believe research is necessary to advance and improve professionally and in their career, for job satisfaction, and for all aspects of medical practice [24]. However, this same study demonstrated that students in medical school report lower competence in research-related skills, including study design, sampling, participant recruitment, and computation of biologic statistics [24]. Several Canadian schools incorporate a component of research into their curriculum to address this gap in knowledge and to encourage medical students to consider research careers. For example, Queen's University Faculty of Medicine in Kingston, Ontario has a mandatory Critical Enquiry elective that students complete in their second year of studies [25]. A survey of students following completion of this course reported improved self-confidence in performing a literature search, critically appraising literature, designing a study, completing statistical analysis, and delivering a presentation [25]. Our findings similarly demonstrate the development of knowledge and skills pertaining to conducting research, though they were developed at the undergraduate level. Beginning research during undergraduate studies may better prepare students for courses in medical school and beyond.

Clinical experience was identified by the majority of participants as being helpful in their transition to medical school, particularly during patient encounters. Students felt they had an advantage over their peers who did not have previous patient interactions. This was largely because their experience in the RRRP refined their communication skills and increased both comfort and confidence during patient interactions. A systematic review by Dornan et al. [26] also concluded that early clinical experience helped develop these competencies. Effective communication is paramount to the success of patient-physician relationships and a career as a physician in general, so much so that communication is one of the CanMEDs competencies, from which medical curricula are developed. Developing communication skills at a pre-medical education level may allow students more time to practice and perfect them, as well as focus on integrating their new medical knowledge into these interactions once they begin medical school.

Beyond simply developing communication skills and confidence in patient interactions, students in the RRRP felt that their clinical experience and immersion in the healthcare team gave them a greater understanding of what it means to be a physician. This in turn helped students envision themselves as future physicians, and for many, solidified their decision to pursue medicine as a career. Several other studies reported similar findings [27–29]. Dornan et al. [27] studied medical students in clinical placements and observed that, with greater interactions with physicians and nurses, and more contribution to patient care, students built a sense of professional identity. Transitioning into more senior roles fostered this development even further [27]. A qualitative analysis by Smith et al. [28] demonstrated that active participation and the acquisition of clinical responsibilities helped students imagine themselves as future physicians. Another aspect of legitimate peripheral participation supports these findings. That is the argument by Lave and Wegner that with more time spent in a community of practice, the more the learner can make that practice culture their own and develop a sense of identity within it [19]. The development of professional identity has also been reported in several other studies to increase motivation in studying medicine [26–29]. Therefore, participation in clinical experience, even prior to medical school, is beneficial in developing a professional identity and in motivating students to pursue studies in medicine.

A limitation of the present study is that only 14 of 39 eligible individuals participated, which may be reflective of outdated contact information, lack of time to complete the interview, or bias in which individuals with good experiences in the RRRP were more likely to participate. Despite the possibility of this bias, several individuals still presented deviant cases as described. Additionally, data saturation was reached after interviewing 14 individuals; thus, further interviews likely would not add to the present findings.

Our findings support the inclusion of WIL placements, such as the RRRP, in pre-medical education as an important step towards becoming master practitioners in the field of medicine. The early integration of undergraduate students into the medical community facilitates the introduction to research and clinical experiences which fosters the development of skills, including communication and time management, and a professional identity that will be built upon as students progress towards a career in medicine.

Acknowledgements The authors wish to thank the survey participants and the generous support of Bratty Family Fund, Michael and Karyn Goldstein Cancer Research Fund, Joey and Mary Furfari Cancer Research Fund, Pulenzas Cancer Research Fund, Joseph and Silvana Melara Cancer Research Fund, and Ofelia Cancer Research Fund. The authors would also like to thank Peggy Jarvie, Associate Provost, Co-operative and Experiential Education, for her leadership within the co-operative education program at the University of Waterloo.

Compliance with Ethical Standards

Conflicts of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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