

Formative rather than performative: enduring impact of an alternate pathway (QuARMS) to medicine

Formatif plutôt que performatif : l'impact durable d'une voie alternative (QuARMS) vers la médecine

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Introduction

The Queen's University's Accelerated Route to Medical School (QuARMS) experiment changed the pathway from high school to medical school for 10 Canadian students annually from 2013 until 2024.¹ Applicant selection criteria were similar to those used in Queen's University's medical school admissions; however, only students in their final year of high school were eligible to apply. It was the subsequent trajectory from high school completion to medical school entry that diverged from the usual path to medical school. During two years of undergraduate education, 15 of 20 courses were unspecified with only Biology, Calculus or Statistics and English being compulsory. Students attended an additional weekly three-hour QuARMS 'course' described below. Those who maintained a GPA of 3.5 on a 4.3 scale proceeded directly to medical school with no Medical College Admission Test (MCAT) requirement.

Although its primary aim was to shorten the timeframe and reduce the cost of graduating new physicians, QuARMS also provided an opportunity to reconceptualize medical training. Balancing the urgency to graduate physicians efficiently with the need to cultivate excellence in care, altruism, humility, and an appreciation of patients' lived experiences presents an ongoing challenge. The usual path to medical practice in North America includes eight or more years of university education followed by two to five years

of postgraduate training. This lengthy training can conflict with and constrain life trajectories of young adult students.² Intense competition for medical school admission often leads to successful applicants being lauded and elevated before their first day, creating a sense of exceptionalism that may distance them from their future patients.³ Finding an optimal path to the medical profession requires balancing these competing priorities while ensuring that all CanMEDS roles—including professionalism, advocacy, communication, collaboration, and medical expertise—are fully realized. While medical graduates are academically able, highly knowledgeable, and rigorously trained, the literature suggests a problematic decay in personal characteristics such as communication skills, empathy, altruism, and social awareness.^{4,5} These are traits that demonstrably improve patient satisfaction, and, perhaps, more importantly, patient outcomes.^{6–10}

QuARMS was not intended to be a simple return to the historic model of two years of undergraduate study followed by admission to medical school based solely on exceptional MCAT scores and academic performance. Instead, it represented a reimagining of what those early undergraduate years could be. In QuARMS, the first two years of university were not performative, a race to build the most impressive portfolio of grades, extracurriculars, and test results, but formative. These years were intentionally designed to cultivate core values such as

compassion, empathy, humility, altruism, and social accountability. Such traits are foundational to the practice of medicine and deeply embedded in CanMEDS, yet neglected in conventional pre-medical education.

In this mixed-methods study, we examine graduates' reflections on the QuARMS pathway, including its perceived benefits and limitations.¹¹ We additionally examine how such a pathway influences the realization of CanMEDS roles.¹² If QuARMS were shown to produce well-rounded, socially conscious and highly capable physicians, it could become a model for reshaping medical education while also accelerating graduation.

This study also considers the formation of professional identity, described by others as not merely the acquisition of knowledge, but the transformation of identity from student to physician.¹³ In 2014, Cruess et al. proposed that development of professional identity should be a primary goal of medical education, and that this objective could only be met by revolutionizing educational strategies.¹³ Prior research has shown that identity formation begins well before formal medical education and is shaped by the learning and social environments encountered during this period.¹⁴

We situate the QuARMS model within the broader context of reform in pre-medical education. Emerging literature on alternative and accelerated pathways to medicine highlights efforts to address limitations of traditional pre-medical routes, such as reducing student debt and overall costs, and demonstrates that graduates of these programs are clinically comparable to their peers from conventional pathways upon entering residency.¹⁵ These programs often succeed by fostering a sense of wellbeing and community amongst the cohort that contributes to professional identity development from the first day of medical school. These innovative models, including accelerated and direct-entry programs internationally, seek to promote earlier integration into medical learning communities and encourage reflective, patient-centered approaches from the outset of training. We hypothesized that these outcomes may be fostered through QuARMS' distinctive integration of reimagined admissions processes, early socialization within the medical community, and a values-based, person-centered curriculum. By placing QuARMS within the broader discourse on early-entry medical pathways, the secondary outcomes of this study are to deepen understanding of how such programs may shape professional identity formation and promote the cultivation of humanistic values in future physicians,

particularly within the context of Canadian medical education.

QuARMS pathway

From 2013-2024, Queen's Accelerated Route to Medical School (QuARMS) identified 10 high school graduates, annually, who entered medical school after two years as Arts and Sciences, Computing Sciences, or Health Sciences students. Weekly three-hour small group sessions and independent learning activities during their two pre-meds years emphasized social determinants of health, included hour-long "Fireside Chats" with physician faculty mentors who shared their experiences, and incorporated a longitudinal service-learning volunteer project throughout the second year. QuARMS session content rested on four pillars: communication, critical thinking, scientific foundations, and role of the physician. The educational process was designed to foster a collaborative and pedagogically expansive premedical experience unconstrained by the need to prepare for the standardized MCAT.¹⁶ It was anticipated that by reducing the pressure of conforming to traditional 'pre-medical' studies, QuARMS would encourage intellectual exploration that would augment empathy, altruism and innovation among medical professionals.

From the outset, the QuARMS pathway envisioned an ideal candidate who was academically strong, creative, altruistic, humanistic, and curious, with leadership, communication, and critical-thinking skills, as well as a history of extracurricular and community involvement. This profile represented the admissions standard, or the 'total package' the pathway sought to identify and cultivate.¹⁷

In 2020, Queen's modified QuARMS to increase racial and ethnic equity by limiting eligibility to Indigenous and Black students. In 2024, stating that "the idea of the QuARMS pathway for equity was that one day it wouldn't be needed," the School of Medicine ended QuARMS and revised the medical school admissions process to enhance inclusivity, reduce systemic barriers, and increase student diversity.¹⁸ The rationale provided for the discontinuation of the QuARMS pathway was that the new medical admissions process at Queen's University was to build on the success of QuARMS. While QuARMS aimed to address inequity within ten seats, the new process was designed to expand these efforts more broadly.¹⁸

Although the pathway was discontinued, it represents a rare and innovative model for early medical admissions in Canada. Studying its legacy provides insight into how alternative admissions routes may influence professional identity formation and values-based education. Our aim is

not to critique or defend the administrative decision to end the program, but to understand its impact and lessons for future admissions reform within the Canadian medical education landscape.

Materials and methods

We utilized the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) when reporting our methods and results.¹⁹

Questionnaire

Institutional ethics review board approval (Queen's University Ethics Board TRAQ #6041976) was obtained for this cross-sectional survey. Survey development and its subsequent revisions involved a collaborative effort between both authors, one a QuARMS 'graduate' and the other, the longtime Director of QuARMS. We, the authors, are insiders. Our experiences shaped the response options offered for quantitative questions, and the questions themselves. Nevertheless, we prioritized an open-ended approach in the qualitative component, allowing participants' responses to emerge organically and independently shape the narrative.

The survey questions were developed based on the program's curriculum objectives, insights from prior qualitative work, and relevant literature. The 24-item survey was first tested amongst a small group of students to ensure clarity. We acknowledge that validated measures of the desired outcomes were not used and that no comparison group of students from a traditional pathway was included.

Beyond minimal demographic information, three domains of QuARMS were explored: (1) experiences during the two-year undergraduate period, (2) the Medical School experience, and (3) impact and long-lasting effects of QuARMS. In addition, four qualitative questions were asked (Box 1).

Box 1. Qualitative questions

Qualitative Questions
1. How has QuARMS influenced your career path in medicine?
2. Do you believe QuARMS has had a lasting impact on your approach to medical practice?
3. Please reflect on what you believe is gained or lost with the ending of QuARMS.
4. Please share any memorable experiences or stories from your time in QuARMS.

To ensure anonymity, sex/gender data were not collected as the number of men in the pathway was small. Questions were presented in multiple formats, including multiple choice, select multiple options, and open-text fields. The

complete survey is included in the Supplemental Digital Appendix (Supplemental Digital Appendix A).

Participant selection and recruitment

The inclusion criteria required that members be current QuARMS students or successful graduates of the pathway who are now medical students, residents, or physicians. We excluded current first-year QuARMS students (Class of 2030) from the survey because their limited time in the pathway would restrict their ability to provide meaningful insights. Participants were recruited through direct emails, gathered from the Elenra database of Queen's University's current and past medical students.

Survey administration

The survey was hosted and managed using Qualtrics XM, a secure and encrypted online platform, hosted at Queen's University.^{20,21}

Over a span of six weeks (September 26th to November 7th, 2024), this anonymous online survey was available to be completed. Two reminder emails were sent at two weeks and four weeks from initial contact. There was no compensation for participation, and completion of the survey was voluntary. Participants provided active consent by selecting an option that they consented to participating in the survey, after viewing the Letter of Information included as part of the first question.

Quantitative statistical analysis

Given the nature of the data, descriptive statistics were primarily used to summarize the responses from the survey. Frequencies and percentages were calculated for categorical variables.

Qualitative statistical analysis

Open-ended survey questions were chosen as the mode of qualitative data collection rather than interviews or focus groups. This decision was intentional, as graduates of the program are geographically dispersed and many are now engaged in full-time clinical practice across Canada. This approach also enabled inclusion of a wider range of perspectives than might have been feasible through more time-intensive methods, such as individual interviews.

Both authors independently analyzed participants' responses to the four open-ended questions (Box 1) using Braun and Clarke's reflexive thematic analysis framework.²² This six-phase approach involved familiarization with the data, generation of initial codes, construction of themes, reviewing and refining themes, defining and naming themes, and producing the final narrative. Each author initially coded and categorized the

transcripts separately using Microsoft Excel, employing an inductive approach to ensure themes were grounded in the data rather than preconceived categories. The authors then met to compare coding, discuss areas of divergence, and reach consensus through iterative discussion. Discrepancies were resolved by returning to the raw data to ensure interpretations remained faithful to participants' accounts. To enhance rigor, the authors engaged in reflexive practice by documenting analytic decisions and acknowledging potential biases throughout the process, which are openly acknowledged throughout this paper. No software was used for qualitative analyses.

Results

The survey response rate was 94.8% ($n = 91$ of 96 contactable QuARMS students). Table 1 describes the demographic data collected. Most students (64.0%) completed their two years of undergraduate studies in Arts and Science. An undergraduate Health Sciences program was a popular choice after it became available in 2020. Those selecting "other" had studied Computing Sciences, English or Psychology.

Table 1. Demographics of responding residents

Current Professional Status	$n = 86$
QuARMS Student	10 (12.0 %)
Medical Student	38 (44.0 %)
Resident	31 (36.0 %)
Practicing Physician	7 (8.0 %)
Current Medical Specialty	$n = 38$
Family Medicine	7 (18.4 %)
Obstetrics and Gynecology	5 (13.2 %)
Internal Medicine	4 (10.5 %)
Family Medicine – Emergency Medicine	3 (7.9 %)
Psychiatry	3 (7.9 %)
Emergency Medicine	2 (5.3 %)
Anesthesiology	2 (5.3 %)
Dermatology	1 (2.6 %)
General Surgery	1 (2.6 %)
Medical Genetics and Genomics	1 (2.6 %)
Ophthalmology	1 (2.6 %)
Otolaryngology – Head and Neck Surgery	1 (2.6 %)
Plastic Surgery	1 (2.6 %)
Other	6 (15.9 %)
Undergraduate Faculty	$n = 85$
Arts and Science	54 (64.0 %)
Health Science (available after 2020)	28 (33.0 %)
Other	3 (4.0 %)

QuARMS experience

The key advantages of QuARMS highlighted by respondents (Figure 1) were the freedom arising from not having to write the MCAT (85.0%, $n = 63$), the accelerated route to becoming a physician (73.0%, $n = 54$), and the

academic flexibility in choice of undergraduate courses (55.4%, $n = 41$). Being identified as a member of the QuARMS cohort by peers was identified by 79.7% ($n = 59$) to be either a moderate or significant disadvantage.

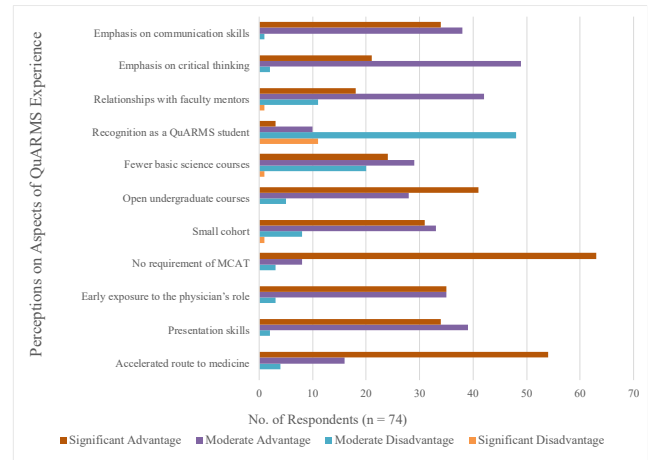


Figure 1. Perceptions of key features of the QuARMS pathway ($n = 74$). Responses were categorized using a 4-point Likert Scale (significant advantage, moderate advantage, moderate disadvantage, significant disadvantage), with the number of respondents displayed for each category.

Respondents' rating of the value of each QuARMS pillar for subsequent medical education and practice are shown in Figure 2. A focus on communication was deemed extremely or moderately useful by 58 participants (80.1%). Critical thinking and role of the physician were found to be useful in 48 respondents per category (66.7%).

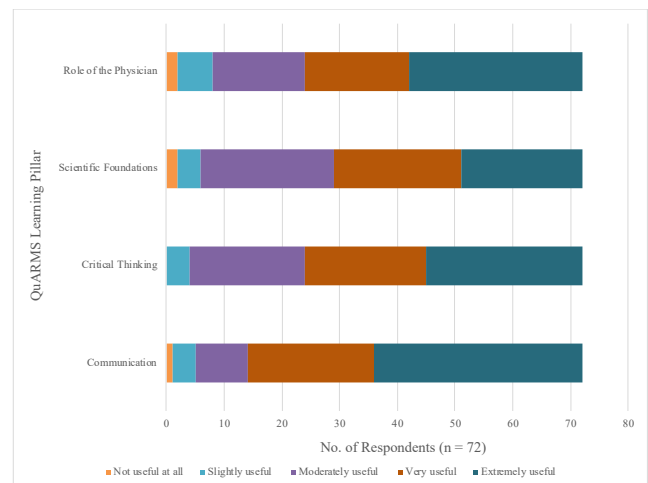


Figure 2. Ratings of subsequent usefulness of QuARMS learning pillars.

A majority of respondents (81.7%, $n = 58$) believed that required courses provided adequate preparation for medical school. When asked which additional courses or content would have been helpful, 53.6% of respondents (n

= 15 of 28 who wrote responses) identified anatomy, while 21.4% ($n = 6$) suggested research and/or statistics skills.

Relationships with faculty and mentors were generally positive (excellent ($n = 31$), good ($n = 35$), poor ($n = 6$)), while formal mentorship groups were of less benefit. A significant component of the QuARMS curriculum was devoted to volunteering and service learning. Participants found this component to be: extremely useful (20.8%, $n = 15$), very useful (22.2%, $n = 16$), moderately useful (29.2%, $n = 21$), slightly useful (18.1%, $n = 13$), not useful (9.7%, $n = 7$).

Medical school experience

For the majority, QuARMS students' transition to medical school was not a challenge, though experiences varied: very easy (15.9%, $n = 10$), easy (34.9%, $n = 22$), while 21 considered it neutral (33.3% $n = 21$) or difficult (15.9%, $n = 10$). Most respondents felt well prepared for medical school with only seven (11.1%) responding that they were either slightly or not at all prepared. Figure 3. illustrates the contribution of various aspects of the QuARMS curriculum to respondents' preparation for medical school. Fireside Chats (informal discussions with practicing physicians) and Social Determinants of Health Sessions were most beneficial.

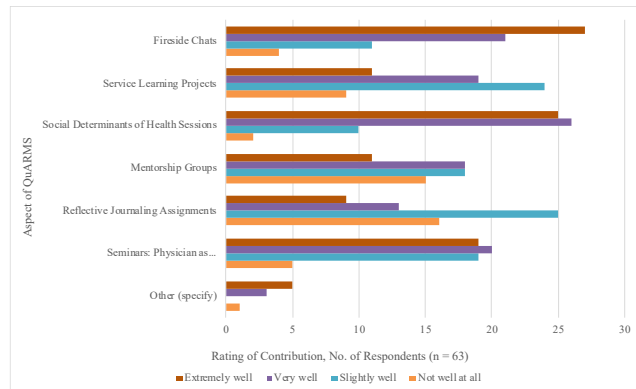


Figure 3. Respondent ratings on the contribution of various QuARMS aspects to medical school preparation, assessed using a 4-point Likert scale ($n = 63$).

We asked respondents: "In your opinion (i.e. – this is not about marks) how was/is your academic and clinical performance compared with your traditional entry colleagues?" Over half of respondents, 56.3% ($n = 36$), perceived their performance to be about the same as their traditional entry colleagues) while 6 (9.4%) chose much better, 17 (26.6%) answered somewhat better, and 5 (7.9%) selected worse or much worse. All felt their ability to relate to and empathize with patients was either much better (23.4%, $n = 15$), somewhat better (39.0%, $n = 25$), or

about the same (37.5%, $n = 24$) as their traditional entry colleagues.

When asked 'What traits do you believe differentiated you and your QuARMS cohort from the rest of your traditional entry colleagues (medical students or other physicians)?' most frequent responses were: adaptability ($n = 34$), compassion ($n = 26$), and drive ($n = 29$). Other responses included: inexperience ($n = 27$), resilience ($n = 23$), managing stress ($n = 21$), maturity ($n = 18$), confidence ($n = 17$), immaturity ($n = 10$).

Career path and professional identity

Of particular importance was to examine whether QuARMS participation had an impact on how graduates engaged with the field of medicine, selected career paths and developed professional and personal identities. Of the 55 respondents who had reached residency or entry into practice, 18 (32.7%) believed that QuARMS influenced their choice of medical specialty, and 37 (67.3%) did not. This was further described in the qualitative responses (see below). Most (72.7%, $n = 40$) did not think they would have been 'better' physicians or medical students had they pursued the traditional route to medical school. Only a few (3.6%, $n = 2$), thought the traditional route would have led to improved outcomes, while 23.6% ($n = 13$) remained neutral on the matter. In response to whether QuARMS has had a lasting impact on their approach to medical practice, 60% ($n = 36$) of participants affirmed that it has. A smaller portion, 18.3% ($n = 11$), reported that QuARMS had no lasting impact, while 21.7% ($n = 13$) could not identify an impact either way.

Qualitative themes and analysis

The following four themes emerged, related to identity formation and professional behaviors: 1) understanding the person, not just the disease, 2) formation of personal and professional identity, 3) the openness, malleability, and uncertainty of youth, and 4) adversity plus support builds resilience.

Theme 1: Understanding the person, not just the disease.

QuARMS students and graduates reflected on the pathway's early emphasis on the social determinants of health, highlighting its lasting influence on their development as compassionate and socially conscious physicians. These teachings enabled most graduates to later cultivate meaningful connections with patients, shaping their professional identity and practice. Many respondents highlighted the importance of the "softer skills" as central elements of their practice. Descriptors such as "communication," "compassion," "understanding,"

“empathy,” and “holistic care” frequently appeared in responses, underscoring the lasting impact of these foundational principles on QuARMS graduates.

QuARMS graduates repeatedly noted that the pathway’s modelled and taught compassionate, person-centered approaches and that this was embedded in their approaches to care before they were introduced to medical knowledge. What was particularly salient was that these students felt the early emphasis on the art and humanistic side of medicine, rather than its science, made them better physicians:

I think one of the coolest things about QuARMS is that it taught us what it meant to practice medicine and how to practice medicine, before we learned what medicine was. We learned about the skills needed to be a great physician, and how to employ these skills, before having any medical knowledge. Once we entered medical school, THEN we could focus on learning the actual medicine on a background of skills like communication, compassion, empathy, etc. I find that in a traditional route to medical school, there is an emphasis on academics and scientific foundations of medicine, and only in medical school do the softer skills start to be developed on the background of medical knowledge. I think that as a result of QuARMS we become physicians who focus on treating the patient rather than physicians who focus on treating the disease. I think this will certainly influence how I and my colleagues approach medical practice.

QuARMS nurtured students’ early identification with patients, emphasizing a patient-centered perspective even before any formal study of scientific and technical aspects of medical care. Another participant reflected:

Undergraduate studies in Global Development provided a unique lens as a future care practitioner and I learned valuable lessons about the global systems that impact our care. My undergraduate studies, paired with a curriculum focused on social determinants of health, has allowed me to approach my patients with empathy, understanding and a passion for advocacy. The elements of community service and inclusivity reflect with the care QuARMS graduates provide.

Advocacy was frequently mentioned in the context of the QuARMS service-learning projects completed in second year. This impact was described by one respondent:

My service learning project...was an eye opening experience - I had the opportunity to listen to stories of...people similar to my age...It helped me to develop

a broader understanding of the intersectionality of SES and gender/age/sexuality, etc., what resources are available in my community, and fostered communication skills. It helped me to develop comfort with a marginalized population, motivated me to address my internal biases and inspired me to provide the best care for my future patients.

Theme 2: Formation of personal and professional identity.

QuARMS curriculum included experiences with diverse populations via service learning and broad undergraduate course options, appeared to contribute to personal growth and an expanded worldview. An emphasis on social determinants of health, coupled with freedom from conforming to the traditional medical school applicant mold, promoted self-reflection, risk-taking and humility, all of which had an impact on both personal and professional identity.

Many respondents noted that their QuARMS colleagues demonstrated greater empathy and a stronger community focus relative to traditionally admitted peers, as further quantified in the descriptive results, an unexpected and positive outcome of the pathway:

I've been pushed to make a true difference! I feel as though I came into Medicine with the understanding that I had a privilege and was selected to be there in a special way...

The QuARMS pathway’s limited mandatory coursework afforded students the freedom to pursue expansive academic and creative interests during their two years of undergraduate study. Many respondents highlighted this flexibility as one of the most valuable aspects of the pathway. They enjoyed exploring passions outside of medicine and often drew on this exploration to broaden their identities as physicians.

I am grateful for the opportunity to explore more non-traditional courses, which I think have shaped my compassion and comprehensiveness as a well-rounded physician. This would be much more difficult to foster in traditional entry, which has stricter criteria for courses and creates a competitive atmosphere where students may choose elective courses based on which will allow them to have the highest GPA, rather than picking courses that will be the most enriching for their education.

Students appreciated the opportunity to delve deeply into their motivations for pursuing medicine—the ‘why’ and the ‘who’—rather than being consumed by the logistical and competitive challenges of admission—the ‘how.’ Instead of selecting extracurricular activities to strengthen a medical

school application, students were pushed to give back to their own and other communities and gained a deeper understanding of the people who would one day be their patients:

If I hadn't been in the QuARMS program I don't think I would have come to discover some things about myself that will make me a better physician.

Theme 3: The openness, malleability, and uncertainty of youth. The structure of QuARMS fostered an environment where risk could be embraced without the fear of failure that can restrict traditional premedical students.²³ Their entry age of 17 or 18 was and is characterized by the excitement of possibility, the vulnerability of inexperience, as well as curiosity, adaptability, and the fluid development of identity.²⁴ QuARMS students described beginning the program with youthful open-mindedness, adaptability and without preconceived notions of medicine that may develop through years of pre-medical education and the medical admissions process:

QuARMS allows us to capture brilliant youth leaders in communities and foster their continued curiosity and drive, while simultaneously preventing 'traditional' premed culture from making these future physicians cookie cutters/jaded.

Many respondents reflected on their young age and how this played a role in the meaningful relationships cultivated throughout medical education. The collaborative spirit within QuARMS cohorts was enhanced by the absence of traditional competitive pressures that often define pre-medical education. With the guarantee of medical school admission, provided the 3.5 GPA requirement was met, a student's focus shifted from competing with peers to challenging oneself to become an excellent physician. The success of the individual was intrinsically tied to success through groupwork and discussion, making teamwork an integral part of the journey. One respondent reflected,

I believe that the QuARMS program fosters collaboration. Working with rather than against your peers to "get into medicine" is one of the largest advantages of the program. I find the need to get 'ahead' or 'beat the system' that some people outside of QuARMS have is very negative." Another added, "I will always be grateful for all my learning and training that stemmed from being in QuARMS. It was a privilege to be able to grow and develop with my cohort.

...we grew up from high school students to adults and supported each other through this huge transitional age. Having a group of trusted friends who understood

exactly what you were going through with no need to be competitive with each other was irreplaceable.

Students appreciated the accelerated nature of their medical training which removed delays and barriers to entry, including greater financial burden and life-course decision deferrals. Many thought they had the option of medical education only because of this accelerated pathway:

...as a QuARMS student I am so fortunate to have time on my side. . . This also alleviates a significant amount of pressure on career selection and allows for career exploration even into residency...I will be able to make a decision for my residency and career path based on passion and interest rather than length of training.

Theme 4: Adversity plus support builds resilience. While QuARMS was designed to offer a supportive and unconventional path to medical school, an unintended consequence was the subtle, and sometimes overt, marginalization and critique from both undergraduate and medical school peers. Though the pathway aimed to avoid conflict, resentment arose among some who perceived QuARMS students' route to medical school as too easy. This resentment, however, fostered growth and enhanced resilience, as QuARMS students navigated the dual pressures of an accelerated academic process and the stigma of being seen as "those 10 students who get a free pass to medical school." The animosity and imposter syndrome experienced during QuARMS may have strengthened students' abilities to prove their worth. The feeling of not fully belonging, of lacking the 'traditional' admission struggles of their peers, often evolved into a source of inner strength and resilience. One participant commented,

I believe that the educational freedom provided by QuARMS provides learners the ability to challenge themselves in ways they would not otherwise. It allows people to take risks. Risk is where opportunity lies.

An overall summative comment was:

...Community is the word that comes to mind when I think of what is lost with the end of QuARMS. Such a special aspect of being in a 10-student program within a much larger program was the idea of having a family to fall back and a community that you know will always be there for support... Even throughout clerkship, I had the opportunity of meeting QuARMS members from multiple years before me, and the simple connection create instant familiarity. There is such a strong sense of community within QuARMS because there is finite number of us who have all gone through the same experience.

Discussion

This study is the most comprehensive assessment of the QuARMS ‘experiment,’ providing a quantitative evaluation of perceived effectiveness of the pathway and a qualitative picture of how it shaped career paths and approaches to the practice of medicine. We acknowledge that our study relies on self-reported outcomes from a pathway that has since been discontinued. We emphasize that our findings are exploratory, intended to generate discussion about optimizing educational pathways and supporting professional development in Canadian medical education. The exceptional response rate (94.8%) in this study serves as a strong indicator of students’ engagement, ownership of, and commitment to QuARMS. Participants’ extensive qualitative responses highlight both their deep investment in and the impact of the pathway on their personal and professional development, and their strong capacity for reflection on the experiences that shaped them as physicians.

A key structural decision in QuARMS was the elimination of the MCAT. This served not only to reduce stress and barriers to entry, but also to liberate students from the pressure to prioritize exam performance. Without the looming weight of the MCAT, students could engage more meaningfully with the humanities, reflective practices, and service-learning experiences. This intentional shift in focus allowed QuARMS students to develop a richer, more holistic understanding that an excellent physician is a healer and an advocate as well as a knowledge expert.

QuARMS students’ professional identity formation appeared to be shaped during their two years of values-based modeling and activities, that is, well before they acquired formal medical knowledge. Importantly, this early shaping was sustained over time, continuing to influence how these graduates practiced medicine throughout residency and into their careers as attending physicians, as referenced by the qualitative responses of those in independent medical practice. Notably, the ambiguity of their position, not yet medical students, but distinct from traditional undergraduates, compelled many to negotiate their place more consciously within the professional hierarchy, prompting early identity reflection and internalization of professional values.

A distinctive aspect of the QuARMS pathway is that students spend two years embedded within the medical school community before beginning formal medical training. According to Sternszus et al., professional identity formation is grounded in the identities learners bring at

entry, shaped by prior experiences and social attachments.¹⁴ By fostering a sense of belonging prior to clinical and formal academic immersion, QuARMS allowed students to begin the process of being and becoming physicians while still in a supportive, preparatory environment. This early integration may help students align their pre-existing personal and professional values with the emerging expectations of the profession, potentially strengthening empathy, reflection, and humanistic identity formation before the pressures of traditional medical school socialization.

While medical education has incorporated training in altruism, patient-centeredness, humility, etc.,²⁵ QuARMS was unique in offering this upon entry to university. Although QuARMS students were selected because they demonstrated such traits, they found their pre-medical experience profoundly strengthened those characteristics and contributed to their growth as future physicians. Our findings suggest that QuARMS students begin forming professional identities not through direct clinical experiences as medical students, but by their undergraduate actions of engaging with the small, close-knit cohort, early experiences with the social determinants of health, and engagement in service-learning projects that brought close contact with diverse populations. This aligns with Wenger’s concept of communities of practice, wherein identity is shaped through social participation and role adoption, even when that participation is initially peripheral.^{11,26} Students described how early interactions with physician-mentors, ethics seminars, and group discussions about professionalism cultivated a sense of legitimacy and belonging. These interactions allowed them to reflect on what it meant to be empathic and resilient: traits they began to internalize as part of their future physician identities. Building on contemporary understandings of Communities of Practice,¹⁴ QuARMS participants engaged in multiple, interconnected communities prior to formal medical training. In particular, a strong sense of closeness with their QuARMS cohort developed, a sense of belonging that persisted well beyond medical school graduation. This enduring connection illustrates that professional identity formation in this context is also about meaningful inclusion within communities that value individuality, shared experiences, and diverse perspectives. By fostering early and lasting bonds, QuARMS exemplifies how longitudinal community membership can support both personal and professional growth, aligning with theoretical perspectives that emphasize the importance of belonging in shaping professional identities.

Despite a largely strong sense of belonging, several participants described navigating tension between how they were perceived ('just a kid') and how they viewed themselves ('already training to be a doctor'). This state of in-betweenness is consistent with the concept of liminality within threshold concepts theory, where identity transformation requires learners to endure discomfort and uncertainty before reaching a new, integrated self-concept as a medical professional.^{27,28} The QuARMS pathway reflects core features of threshold concepts theory: its transformative impact on identity, integration of personal and academic growth, perceived irreversibility, and the troublesomeness of early professional transitions, often marked by imposter syndrome.²⁹ In the context of QuARMS, liminality represents the transitional space students occupy as they move from high school learners to emerging medical professionals, a stage marked by a delayed or incomplete sense of belonging within the medical community. For some, this liminal experience extended beyond their formal entry into medical school, as they navigated feelings of being perceived as outsiders by their traditionally admitted peers. Encountering liminality, students who view abilities as evolving rather than fixed are more likely to stay motivated, navigate uncertainty, and respond positively to feedback and challenge.²⁸ This adaptive mindset mirrors the perseverance shown by many QuARMS students, who continuously demonstrated resilience and initiative.

"Empathy erosion" has been well-documented as a phenomenon that occurs when medical students transition into clerkship, facing intense patient encounters and complex disease management for the first time.^{4,25} The overwhelming nature of these experiences, combined with the pressures of clinical training, can whittle away empathy, as students adapt to the demands of their new role. Our respondents instead found that compassion, altruism, and reflection remained central to patient interactions. As stated in the quantitative results, all QuARMS students felt their ability to relate to and empathize with patients was either much better (23.4%, $n = 15$), somewhat better (39.0%, $n = 25$), or about the same (37.5%, $n = 24$) as their traditional entry colleagues. Additionally, 26 respondents identified compassion as a distinguishing characteristic between themselves and students from the traditional entry pathway. The emphasis on reflective practice and critical thinking within the QuARMS curriculum, and perhaps, the Arts courses many took, played a role in this mindset. Only after these skills were in place did students shift to mastering medical knowledge, a sequence that may prevent compassion

fatigue.³⁰ Furthermore, the resilience and adaptability inherent in younger learners may have contributed to their ability to maintain a strong sense of empathy.^{31,32} Their formative years, marked by ongoing personal and professional growth, likely reinforced their capacity to navigate the emotional demands of medicine without becoming desensitized.

Across North America, there are accelerated medical school programs, although few accelerated routes to medical school.³³ McMaster University and the University of Calgary offer three-year medical programs.³⁴ Data from the College of Physicians and Surgeons of Alberta's Physician Achievement Review program found equivalency of performance for graduates of the University of Calgary three-year program with those from four-year medical schools.³⁵ Studies of similarly structured programs across the United States have also found that students in an accelerated pathway graduate with equivalent medical knowledge and skills compared to their peers, and are ready for residency training.³⁶ Our respondents echoed this academic competency, with 88.9% reporting that they felt sufficiently prepared academically upon entering medical school.

Accelerated medical school programs are known to reduce student debt, enable earlier entry into clinical practice, and allow for structured transitions into medical training for those with relevant experiences.³⁴ Our respondents noted that reduced financial burden and additional years gained for clinical practice were impactful. For individuals from lower socioeconomic backgrounds, the QuARMS pathway allowed students to consider longer residency programs without the similar financial concerns. Women felt fewer reproductive constraints on specialty duration considerations. These benefits align with existing research showing that rising tuition costs and debt can lead prospective physicians to choose specialties based on potential income rather than interest or aptitude.^{36,37}

As we reflect on the lessons learned from QuARMS, a key takeaway is that formative, accelerated pathways that reduce financial and academic pressure can allow students to focus on reflective practice, service-learning, and holistic development while maintaining academic competence. Such a pathway also offers practical benefits and the cultivation of resilience that supports sustained empathy. It also may be concluded that early, values-centered education can have an impact on shaping professional identity throughout a career in medicine. In alignment with Cruess et al.'s framework, which positions identity formation as a central goal of medical education, the

QuARMS pathway illustrates how even pre-clinical experiences can initiate the internalization of the roles, responsibilities, and values associated with becoming a physician.¹³ By emphasizing empathy, humility, and reflection early in training, QuARMS supported young students in beginning the lifelong process of interpreting and reinterpreting themselves as future physicians. Expanding these principles into broader medical education models could help foster a generation of healthcare professionals whose identities are grounded not only in clinical competence, but in the enduring humanistic values.

Future research could include a comparison group to assess whether similar student experiences are observed within the Canadian context, particularly with respect to preparedness for medical school and self-reported empathy. Such studies could also clarify how traditional four-year premedical pathways influence the development of self-reflective personal characteristics. It would further be valuable to examine whether differences emerge in validated assessments of empathy, and how these compare to evaluations made by others, such as faculty instructors and patients.

Limitations

This study has several limitations. First, as the study relies on self-reported reflections, there is an inherent risk of recall bias. The study was also limited by its examination of a single program at a single institution, the absence of a standardized outcome-measure questionnaire, and the lack of a control or comparison group. Third, as with all qualitative analyses, there is the strength of the researchers being inside the arena of study but also the bias that this might introduce, particularly with only two researchers involved. This insider status provided unique advantages, including a deeper understanding of the program's culture, contextual knowledge of its goals and structure, and the ability to interpret participants' reflections with nuance. At the same time, it introduced the potential for bias in several ways: in the framing of survey questions, in the prioritization of codes or themes, and in the interpretation of findings through the lens of our own experiences and values. To address these challenges, we engaged in reflexive practices throughout the analytic process, as detailed in the Methods, and in iterative discussions to challenge each other's interpretations. By explicitly naming our insider perspectives, we aim not only to acknowledge potential limitations but also to highlight the interpretive depth that such positionality can afford.

Finally, we have not separated out responses from the minority of students who entered QuARMS once it became an equity pathway. However, because all other selection criteria and curricula remained the same after this shift, we hypothesize that merging all respondents' perceptions of how the pathway shaped their future as physicians is valid.

Conclusion

This study highlights experiences during, and lasting impact of a shortened route to medical school. The QuARMS pre-medical pathway emphasized empathy, social accountability, critical thinking, communication, and patient-centered care alongside academic excellence. As one respondent aptly stated:

Very grateful for this opportunity. It was truly invaluable, and I hope this model of education expands across the country for others to benefit from. Our healthcare system, patients, and trainees would significantly benefit. It has shaped me personally and professionally, and I'm forever indebted to the program. Thank you sincerely.

Given these findings, there is value in exploring alternative pre-medical education pathways that not only reduce barriers to entry, but also intentionally support the formation of professional identity. Pathways like QuARMS, which integrate early person-centered learning within a nurturing but intellectually rigorous environment, may provide students with the opportunity to form identity and belonging within the medical community both deliberately and spontaneously. Medical institutions can adopt similar approaches to support the development of compassionate, resilient clinicians, an especially urgent goal in an era marked by burnout and the depersonalization of care. Investing in these initiatives could produce a more inclusive and humanistic healthcare system, delivered by physicians whose identities are shaped by both excellence and empathy.

Conflicts of Interest: Dr. Susan Phillips, former Director of the Queen's University Accelerated Route to Medical School (QuARMS) program, and Gina Spencer, former QuARMS student, conducted this research independently after the conclusion of their respective roles in the program.

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