



## Exploring the Association between Years of Post-Secondary Education on Medical Students' Self-Perceived Stress

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### ABSTRACT

**Background:** The pressures of medical education have the potential to negatively affect students' academic performance and mental health. We aimed to explore the relationship between years of post-secondary education (PSE) completed prior to medical school and students' self-perceived stress.

**Methods:** This was a cross-sectional study, utilizing an online survey including the Perceived Stress Scale 10 (PSS-10), to determine the self-perceived stress levels of pre-clerkship medical students. Surveys were completed on a voluntary basis. Age, gender, PSE years, current medical school year, alumni status, additional pursuits prior to medical school, and PSS-10 score were captured. Multiple one-way analyses of variance within pairwise comparisons was used to analyze the relationship between PSS-10 with PSE, controlled for all other variables. Student's t-test compared gender, medical school year, alumni status, and additional pursuits before medical school with PSS-10. Analysis of age and PSS-10 was performed using regression analysis.

**Results:** Of the 109 respondents, 50.5% (55/109) were female. The average age of first and second year students were  $23.1 \pm 2.43$  and  $24.5 \pm 2.71$  years, respectively. Controlled for all other variables, PSE contributed significantly to students' perceived stress ( $p < 0.05$ ). PSE 2 year students reported significantly more stress compared to all other PSE years ( $p < 0.05$ ). No differences in PSS-10 scores between PSE 3, 4, and  $>4$  years were found ( $p > 0.05$ ). Higher level of medical training, increased age, and additional pre-medical school experiences were associated with reduced stress scores on the PSS-10 ( $p < 0.05$ ).

**Conclusion:** PSE years may be a significant factor related to medical student stress levels in pre-clerkship. Additional years of medical school and activities prior to medical school may be protective in decreasing perceived stress.

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### Introduction

The demands of medical school can significantly contribute to increased stress, anxiety, and depression amongst students, which may translate into compromised academic performance and patient care [1-3]. Of concern, high stress levels in medical students are correlated with increased dropout rates, burnout, and suicide [4].

The Queen's University Accelerated Route to Medical School (QuARMS) program, introduced in 2013, admits 10 high school graduates into its direct-entry medical program on an annual basis. The program is the first of its kind in North America, requiring students to complete only two years of post-secondary

education (PSE) before integrating into the four year Doctor of Medicine program at Queen's University. An enhanced two-year pre-medical experience is in contrast to students entering from the traditional stream, who are required to have at least three years of PSE with most schools using scores from the Medical College Admission Test (MCAT) as part of the assessment for admission. The goal of the QuARMS learning stream is to minimize the length of overall training and costs associated with medical school, while increasing diversity and encouraging a collegial learning environment [5].

Although stress in medical students has been assessed in the past, literature regarding the relationship between years of PSE and medical student stress

is scarce [6]. As the QuARMS program introduces a new and previously unstudied student demographic, we aimed to investigate the relationship between years of PSE completed prior to medical school and self-perceived stress in medical students. Results from this study may offer insight into the groups at risk for increased stress levels and is foundational for additional research about the reasons for this stress.

## Methods

### Study design

This was a cross-sectional study, with the use of an online survey. The survey captured student demographics and included the 10-Item Perceived Stress Scale (PSS-10). Ethics compliance was received from the Queen's University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (#6017083).

### Participants

A total of 200 medical students from first and second year at Queen's University were invited to complete the online survey on a voluntary basis. Each student was eligible to complete only one online survey. Incomplete surveys were excluded from the analysis.

### Perceived Stress Scale

The PSS-10 is a validated questionnaire used in medical education to measure students' self-perceived stress levels over the past month [7,8]. Questions are answered using a 5-point Likert-type scale. Questions 1, 2, 3, 6, 9, and 10 are negatively stated, while questions 4, 5, 7, and 8 are positively stated with opposite scoring. Higher cumulative scores indicate increased perceived stress, with a score of  $\geq 20$  indicative of high stress levels [7,8].

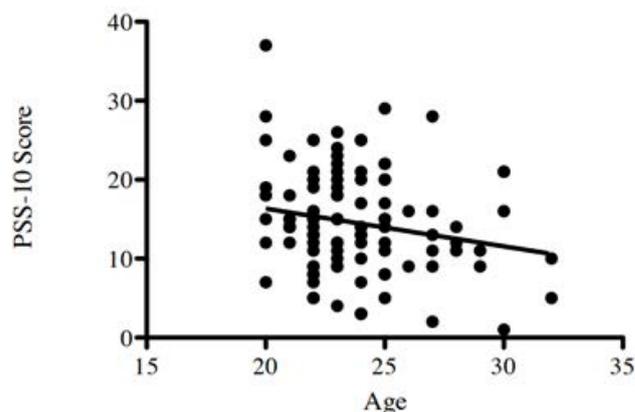
### Outcome measure

The primary outcome measure was students' self-perceived stress level based on the PSS-10 score. The main independent variable was PSE years. Other independent variables included age, gender, alumni status, medical school experience, and additional activities prior to medical school (i.e. full time research, employment, volunteering, etc.).

### Statistical analysis

SPSS (v23.0, IBM Corporation, New York, United States) was used for all analyses, with statistical significance set to  $\alpha=0.05$ . Multiple one-way analyses of variance (ANOVA) within pairwise comparisons analyzed the relationship between PSS-10 and PSE, controlled for all other variables. Student's t-test was used to compare gender, experience in medical school, alumni status, and additional activities before medical school with PSS-10. The correlation between

age and PSS-10 was determined via regression analysis (Figure 1).



**Figure 1.** The correlation between age and PSS-10 was determined via regression analysis

## Results

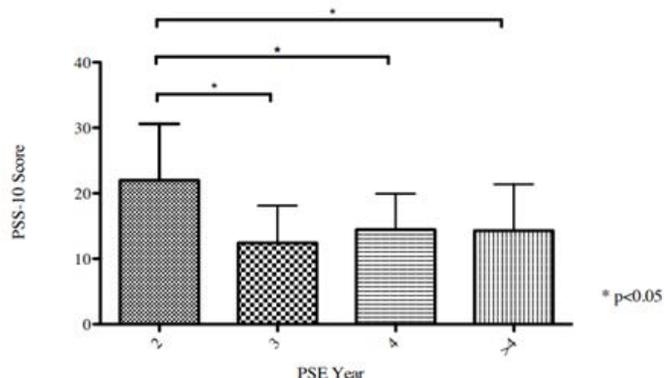
The response rate was 54.5% (109/200), with 50.5% (55/109) female respondents. Average age was  $23.1 \pm 2.43$  years for first year students and  $24.5 \pm 2.71$  for second year students. The average number of PSE years completed prior to medical school admission was  $4.58 \pm 1.97$  and  $4.86 \pm 2.00$  for first and second year students, respectively. Alumni status was noted in 31% (18/59) of first year and 20% (10/50) of second year students. There were 24% (14/59) and 38% (19/50) of students with additional activities prior to medical school in first and second year, respectively. All of the PSE 2 year (QuARMS) students were in first year of medical school, as this was the first cohort of students enrolled in the program. Of the other first year students 19% (11/59) had 3 PSE years, 28% (17/59) had 4 PSE years, and 41% (24/59) had greater than 4 PSE years. Of the second year students, 14% (7/50) had 3 PSE years, 54% (27/50) had 4 PSE years, and 32% (16/50) had >4 PSE years. Complete participant demographics are shown in Table 1.

**Table 1.** Complete participant demographics

Characteristic	1st Year Students	2nd Year Students
Total, n	59	50
Age, mean (range)	23.1 (20-30)	24.5 (22-32)
Females, n (%)	32 (54%)	23 (46%)
PSE years, mean (range)	4.58 (2-11)	4.86 (3-12)
Previous alumni, n (%)	18 (31%)	10 (20%)
Add. activities, n (%)	14 (24%)	19 (38%)

PSE 2 years, n (%)	7 (12%)	0 (0%)
PSE 3 years, n (%)	11 (19%)	7 (14%)
PSE 4 years, n (%)	17 (29%)	27 (54%)
PSE >4 years, n (%)	24 (41%)	16 (32%)

Comparisons of PSS-10 stress scores among different PSE years are illustrated in Figure 2. PSE 3 year students had the lowest stress scores ( $12.33 \pm 5.69$ ) whilst PSE 2 year students had the highest stress scores ( $22.00 \pm 8.60$ ). PSE 4 and >4 year students had intermediate stress scores of  $14.45 \pm 5.48$  and  $14.30 \pm 7.09$ , respectively. When comparing stress between PSE years, PSE 2 had significantly higher PSS-10 stress scores as compared to PSE 3 (mean diff. 9.56, CI [1.94, 17.17],  $p < 0.01$ ), PSE 4 (mean diff. 7.55, CI [0.58, 14.51],  $p < 0.05$ ), and PSE >4 years (mean diff. 7.70, CI [0.69, 14.71],  $p < 0.05$ ). All other comparisons of stress between PSE 3, 4, and >4 years were not statistically different from each other.



**Figure 2.** Comparisons of PSS-10 stress scores among different PSE years.

A significantly inverse correlation was found between age and stress (slope =  $-0.4631x + 25.63$ ,  $r = 0.18$ ,  $p = 0.045$ ). Increased years of medical education (mean diff.  $-3.12$ , 95% CI [ $-5.58$ ,  $-0.66$ ],  $p = 0.013$ ), and presence of additional activities prior to medical school (mean diff.  $-2.96$ , 95% CI [ $-5.65$ ,  $-0.27$ ],  $p = 0.031$ ) also significantly protected against stress. Student gender (mean diff.  $0.69$ , CI [ $0.57$ ,  $0.8$ ],  $p = 0.590$ ) and being an alumni at the surveyed university (mean diff.  $0.98$ , CI [ $-0.91$ ,  $2.87$ ],  $p = 0.501$ ) were not found to significantly affect stress levels.

## Discussion

To our knowledge, this study is the first to investigate the relationship between PSE years and student stress. It provided several novel findings, the first of

which was that PSE 2 year (QuARMS) students had the highest level of perceived stress, with all other factors controlled. With increasing age and life experiences, psychological, social, and physiological maturity are developed [9]. Being the first cohort of students in the QuARMS program may have contributed to the higher stress levels seen. While there was support from faculty and upper year medical students explicitly arranged, PSE 2 year student may have lacked guidance from peer mentors with similar experiences of entering the medical profession through an enhanced program out of high school, resulting in a younger age than most of their peers at medical school entry. Mentorship has been shown to be a key element in the active coping mechanisms of stress and can lead to stress reduction [10,11]. Another contributor to the higher stress levels in PSE 2 year (QuARMS) students may be the added expectations to succeed. Having been enrolled into a highly competitive program, QuARMS students may have felt additional pressures both externally and intrinsically to excel upon their entrance to medical school. Additionally, age was inversely correlated with stress level. As the QuARMS program provides support to successfully enter medical school, PSE 2 year (QuARMS) students, as a group, were the youngest of all participants. Therefore, younger age in combination with decreased PSE years may have contributed to the increased stress scores in PSE 2 year students.

The second important finding was that PSE 3 year students had the lowest levels of stress when controlled for all other variables. It has been postulated that continuous pressures during undergraduate studies to maintain a high grade point average while achieving competitive MCAT standards selects for resilient students [12]. Therefore, students gaining medical school entry after 3 PSE years may have developed better strategies or be more adept at coping with academic demands resulting in greater ease transitioning into medical school, which subsequently lead to decreased self-perceived stress.

Lastly, PSE 4 and >4 year students had stress levels lower than PSE 2 (QuARMS) but higher than PSE 3 year students. Students in this category likely had additional time for more life-enriching experiences. As seen in our study, additional endeavors prior to medical school were protective against stress. However, PSE 4 and >4 students may also possess other unique vulnerabilities to stress. Inherent differences in learning approaches and having to re-adjust back to a structured system of learning has been noted to increase anxiety and stress [13]. As most PSE 4 and

>4 year students have spent time outside of the traditional classroom in pursuit of jobs or post-graduate programs prior to entering medical school, their stress levels may have been adversely affected in this period of re-adjustment.

Despite novel findings, this study contains some limitations to be aware of. Firstly, there were limited numbers of PSE 2 (QuARMS) students, all of whom were in first year of medical school at the time of the survey. Secondly, workload variations and different examination schedules between first and second year students during the time of the survey may have contributed to the stress levels reported. Moreover, the survey was only administered once during the school year and may not be reflective of the fluctuation in student stress that may come with different courses/rotations. Multiple surveys administered at different times would have had the potential to capture a more encompassing picture of student stress.

Accelerated entry medical programs have potential advantages, both for students, institutions and the public. Based on positive outcomes to date [5], other medical schools may create programs based on the QuARMS experience. However, awareness of the risk of increased stress in those students who apply to programs designed to attract students from high school into medicine is foundational to successful curricular development. Stress management and student wellness strategies throughout pre-medical and medical school programs would be beneficial. However, qualitative studies have the potential to provide insight into the main sources of stress in various PSE years along with the protective factors in those who report less stress which is critical to directing intervention. Long-term follow up of the PSE 2 year students as they continue their medical education will help to determine if they continue to report more stress than their peers and the sources of that stress.

### Conclusion

PSE is potentially associated with medical student stress levels during the pre-clerkship years. PSE 2 year (QuARMS) students had higher perceived stress when compared to the other PSE years. Medical school experience, additional activities prior to medical school, and increasing age were associated with less stress. Awareness by medical schools, including pre-medical programs, about groups at risk for stress is critical in order to better tailor wellness initiatives and advocate for students. Further research will help to define whether the increased stress is negative or positive and thus help to tailor appropriate interventions.

### Acknowledgement

None

### Conflict of Interest

The authors declare no conflicts.

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