Current Psychology (2024) 43:18576–18591
https://doi.org/10.1007/s12144-024-05653-x

A cross-sectional examination of ontario graduate students' levels of resilience and health related quality of life during the covid-19 pandemic: The CARE study

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Accepted: 11 January 2024 / Published online: 27 January 2024

Abstract
Graduate students balance several responsibilities which, in addition to pandemic-related pressures, might pose challenges to their mental wellbeing and resilience. The purpose of this study was to: (1) examine the self-reported resilience and health-related quality of life (HRQOL) of Ontario graduate students 18 months into the COVID-19 pandemic; and (2) determine whether a relationship existed between graduate students' resilience and HRQOL, in general, and based on gender and degree program. Participants completed an online survey containing demographics, the Connor-Davidson Resilience Scale-10, and the RAND 36-Item Health Survey 1.0. Data analyses involved computing measures of central tendency and dispersion for demographic characteristics and scales. Linear regression was employed. A total of 376 students participated. Participants reported low resilience ($M = 26.04$, $SD = 6.31$) and, with respect to HRQOL, high physical functioning ($M = 91.63$, $SD = 14.28$) and low role limitations due to emotional problems ($M = 37.61$, $SD = 40.52$). Participants who identified as non-binary scored lowest on each scale compared to their cisgender counterparts. Resilience was positively associated with HRQOL. It is concerning that graduate students' resilience was low, as low resilience has been associated with a high prevalence of depression, anxiety, and perceived stress. Further, it is surprising that participants reported high physical functioning when engagement in physical activity – a component of physical functioning – has been associated with increased resilience among university students. Study findings may aid researchers and student affairs personnel in understanding graduate students' levels of resilience and HRQOL during the COVID-19 pandemic.

Keywords Resilience · Health-related quality of life · Graduate students · COVID-19

Introduction

Since March of 2020, the COVID-19 pandemic has disrupted the lives of many. Public health mandates (e.g., physical distancing, intense personal hygiene practices, working from home, etc.) that aimed to slow the spread of the disease have resultantly altered leisure and work practices, including those of graduate (i.e., master's and doctoral) and professional (i.e., those training for a specific profession) students. This is particularly important given the role that graduate students will play in academia and beyond. Additionally, graduate students tend to have a number of other responsibilities including coursework, dissertation/thesis work, instructing, and research and teaching assistantships (Bal et al., 2020). In a pre-pandemic study conducted by Fried and colleagues (2019), who studied graduate students' ($N = 11$) experiences in a peer coaching program, participants described persistent feelings of stress and anxiety as a result of their academic demands (e.g., grant/scholarship deadlines, research and teaching commitments, candidacy examinations). Some participants also noted a lack of social support, while others voiced concerns about unmanageable workloads, leading them to prioritize their academics over their health (Fried et al., 2019). This multitude of tasks, and the added challenge of time management, can overwhelm students and result in mental health challenges (Arnold,

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2014). Given that graduate school is already highlighted as a time of strain (Bal et al., 2020; Fried et al., 2019), it is possible that the addition of the pandemic could heighten this strain to levels not experienced by previous cohorts.

With an interest in understanding the impacts of the pandemic on the mental health of students attending research-focused universities, Chirikov and colleagues (2020) administered a Student Experience in the Research University (SERU) Consortium COVID-19 survey which included data from 15,346 graduate students across nine universities in Canada and the United States (May–July 2020). The authors found that the prevalence of major depressive disorder among graduate students doubled since 2019 (pre-COVID-19) and the prevalence of generalized anxiety disorder was 1.5 times higher in 2020 compared to 2019 (Chirikov et al., 2020). Additionally, Wasil and colleagues (2021) explored the stressors of graduate students during the COVID-19 pandemic and found that the majority of students expressed problems related to COVID-19 (e.g., loss of productivity, emotional problems, economic problems, loss of daily routine and feelings of isolation due to public health restrictions). On the basis of this evidence, it appears that the COVID-19 pandemic has introduced new challenges and negatively influenced the mental health of some university students, and graduate students more specifically (Chirikov et al., 2020; Wasil et al., 2021). Resilience is a concept that might aid in understanding graduate students' response to pandemic-induced stressors and is known to be linked to health-related quality of life (HQROL; Maheri et al., 2019; Simón-Saiz et al., 2018), both of which will be discussed in turn.

Resilience

While difficult to define due to its various interpretations within the literature, resilience can broadly be understood as a dynamic process wherein environmental and psychosocial factors interact to enable an individual to survive, grow, and adapt despite exposure to stress and/or adversity (American Psychological Association, 2022; Prime et al., 2020). This said, resilience exists on a continuum and intensity of its presence depends on the individual and the situation (Southwick et al., 2014). Understanding the extent to which populations are resilient is important as it may aid in identifying targeted supports to create an environment inducive to resilience. While the literature on graduate students' resilience during the COVID-19 pandemic is scarce, Du and colleagues (2020) explored the relationship between resilience and perceived stress and anxiety on the self-reported sleep quality of undergraduate and graduate students ($N = 2{,}254$) across seven countries early in the pandemic (May 2020). The authors found that higher levels of resilience weakened the relationship between perceived stress and anxiety on sleep quality (Du et al., 2020). Further, Eden and colleagues (2020) explored the moderating factors of hope, optimism, and resilience as buffers against the negative outcomes of college students' ($N = 459$) psychological stress during the pandemic (March–April 2020). The authors found that individuals with higher levels of resilience were less negatively affected by the COVID-19 pandemic and experienced greater wellbeing during the pandemic compared to individuals with lower levels of resilience (Eden et al., 2020). Additionally, Amaral-Prado and colleagues (2020) investigated the resilience of Brazilian undergraduate and graduate students before (2018–2019; $n = 893$) and during (June and December 2020; $n = 242$) the COVID-19 pandemic and concluded that graduate students' resilience was lower pre-pandemic compared to during the pandemic (Amaral-Prado et al., 2020). Further, Yalcin and colleagues (2021) explored the relationship between fear of COVID-19 and the resilience of undergraduate and graduate students ($N = 506$) in Turkey during the pandemic (April–May 2020). The authors found that the majority of participants were classified as having high COVID-19 fear and medium to low resilience (Yalcin et al., 2021). The demands of graduate school coupled with the negative impact of the COVID-19 pandemic might place additional strain on graduate students and test their ability to overcome adversity, thus making graduate students a vulnerable population at risk of worse health-related quality of life (HRQOL; Simon-Saiz, 2018).

Health-related quality of life (HRQOL)

HRQOL can be understood as "how well a person functions in their life and [their] perceived wellbeing in physical, mental, and social domains of health" (Hays & Reeve, 2010, p. 195). Given the challenging demands of graduate students during non-pandemic times, it is imperative that their HRQOL be considered, especially in the context of the COVID-19 pandemic. In a study conducted in Brazil, de Barros Silva and colleagues (2020) explored the impact of distance education, implemented as a result of social isolation (i.e., lockdown), on the quality of life (QOL) of undergraduate dentistry students ($N = 230$) early in the pandemic (April 2020). While the authors did not investigate HRQOL specifically, de Barros Silva and colleagues (2020) utilized the World Health Organization Quality of Life (WHOQOL)-BREF questionnaire, which encompasses the domains of physical health, psychological wellbeing, social relationships, and environment (The WHOQOL Group, 1998). The authors found that 44.8% of students demonstrated low to moderate QOL; this was largely due to the negative impact of social isolation during their distance studies (de Barros Silva et al., 2020). Additionally, Cam and colleagues (2022) explored the impact of the COVID-19 pandemic (May 2020) on the HRQOL of university students ($N = 1095$) in

Turkey. The authors concluded that participants, on average, reported poorer mental than physical health during the COVID-19 pandemic (Cam et al., 2022).

The relationship between resilience and HRQOL

While resilience and HRQOL constructs have been researched independently of one another, less is known about their relationship. Notably, HRQOL includes the domain of mental health (also referred to as emotional well-being), which has been underscored as a core concern of graduate students (Fried et al., 2019). In response to this concern, researchers in the field of positive psychology have suggested that personal strengths and virtues can contribute to one's resilience (Compton & Hoffman, 2019) and, in turn, improve their mental health (Simón-Saiz et al., 2018). This conclusion aligns with findings from previous work, as it was found that resilience was a predictor of HRQOL among adolescent populations pre-pandemic (Maheri et al., 2019; Simón-Saiz et al., 2018). Specifically, in a cross-sectional, descriptive study conducted in Spain by Simón-Saiz and colleagues (2018), the authors explored the influences of resilience on various domains of HRQOL in adolescents (aged 15–18 years). Simón-Saiz and colleagues (2018) concluded that resilience was the most important predictor for the domains of psychological wellbeing and mood (Simón-Saiz et al., 2018). Similarly, Maheri and colleagues (2019) explored the role of resilience on the HRQOL of high school students ($N = 1500$) in Iran and found that resilience was a significant predictor of HRQOL in students (Maheri et al., 2019). While the association between resilience and HRQOL in adolescent populations is clear, the relationship between resilience and HRQOL of graduate students during the COVID-19 pandemic remains unknown and is worth exploring.

Rationale for target population

It is worth noting that the target population of the studies described above primarily included both undergraduate *and* graduate students together. Thus, none of the above-noted studies have focused on graduate students only, which is important for several reasons (Arnold, 2014; Fried et al., 2019). Namely, while all students experience mental health challenges, graduate students experience unique stressors in relation to research funding, supervisor relationships, publishing, and completing their theses/dissertations (Arnold, 2014; CFSO, 2018). Further, given that the term 'graduate students' encompasses three broad categories (i.e., master's, doctoral, and professional students) it is equally important to examine the differences in levels of resilience and HRQOL among the groups. Given the diversity in degree requirements and noted stressors by students, exploring the differences in self-reported resilience and HRQOL among master's, doctoral, and professional students in the current study is crucial, specifically in providing tailored supports for each degree program. For the purpose of this study the term degree program will be used to represent the various levels of graduate education (i.e., master's doctoral, professional, and combined program students).

In addition to the above, it is important to distinguish the differences in levels of resilience and HRQOL among genders. Gender can be understood as "the socially constructed roles, behaviours, expressions and identities of girls, women, boys, men, and gender diverse people" (Government of Canada, 2019, para 2). Gender differs from sex as sex refers to "a set of biological attributes in humans" (Government of Canada, 2019, para 1). While gender is typically understood from a binary perspective (i.e., (girl/woman and boy/man), how an individual understands, experiences, and expresses gender can differ among people considerably (Government of Canada, 2019, para 2). It is also worth noting that gender is socially constructed and can influence the health of individuals, via factors such as access to healthcare, help-seeking behaviours, and prevalence of chronic disease (Mauvais-Jarvis et al., 2020). In research with college students ($N = 1400$) in China gender was found to moderate the relationships among resilience, social support, and psychological distress in college students, such that females reported higher levels of psychological distress than males (94.07% versus 89.11%, respectively), resilience was more strongly associated with psychological stress than perceived support in males, whereas resilience was not significantly related to psychological stress among females (Zhang et al., 2018). Further, in a study that examined gender differences in the health behaviours of Canadian university students ($N = 638$), the authors concluded that males and females differed in general health state, such that a higher percentage of males viewed their general health state to be excellent (32.5%) compared to females (22.2%; Dawson et al., 2007 It is important to note that male/female terminology was used when referencing gender in the aforementioned studies, as to remain with the nomenclature used by authors of the original research presented. It is also worth noting that the aforementioned studies did not include individuals who identified as gender diverse. This is not surprising as the literature pertaining to the resilience and HRQOL of gender diverse students is scant. Given the influence that gender can have on university students' resilience and overall health, it is suitable to explore in the current study.

Purpose

The purpose of this study was two-fold: (1) to examine the self-reported resilience and health-related quality of life (HRQOL; i.e., physical functioning, physical and emotional

role functioning, energy/fatigue, emotional wellbeing, social functioning, pain, general health, and health change) of Ontario graduate students 18 months into the COVID-19 pandemic (August 19-September 19, 2021); (2) to determine whether a relationship existed between graduate students' resilience and HRQOL, in general, and based on gender and degree program.

Methods

Study design, sample size, and eligibility

This study was a cross-sectional, survey-based, exploratory, quantitative study that occurred between August 19-September 19, 2021. For the purpose of this study, the term 'graduate student' was defined as an individual who has earned a bachelor's degree and is currently enrolled in a master's, doctoral, and/or professional program (e.g., medicine, law, dentistry; Universities Canada, 2021).

Participants and recruitment

The current study was approved by the host institution's Non-Medical Research Ethics Board (NMREB #119,239). Participants were recruited via the host institution's mass emailer system and social media platforms (i.e., Twitter, Instagram, Facebook, LinkedIn). A total of 31 posts ($n = 14$ on Instagram; $n = 17$ on Twitter) were made across study-dedicated social media accounts. In addition, 48 student-centred Facebook group administrators were contacted and asked to share the study details (resulting in 8 posts), 79 Ontario university Twitter users were contacted and asked to share the study details (resulting in 24 tweets/retweets), and 133 university Instagram users were contacted and with the request to share the study details (resulting in an additional 25 posts). It is important to note that while recruitment via social media platforms was deemed appropriate for the current study, it can also introduce potential biases. Specifically, it is possible that there was sampling bias towards those with an active online social media presence (Leighton et al., 2021). Interested participants were asked to click the link in the study advertisement to access the online survey, which was administered through Qualtrics®. The first page of the survey outlined the letter of information, and participants were asked to confirm eligibility and provide implied consent by clicking "I consent to begin this study". To be eligible for this study, participants had to be enrolled as a full-time graduate student at an Ontario university and be able to read, write, and speak English. A sample size of 398 was deemed sufficient to achieve 95% power to detect a small to medium effect size of $f2 = 0.03$ at a significance level of $\alpha = 0.05$ with one predictor.

Data collection

The online survey consisted of a demographic questionnaire, the Connor-Davidson Resilience Scale-10 (CD-RISC-10; Campbell-Sills & Stein, 2007), and the RAND 36-Item Health Survey 1.0 (RAND-36; Hays et al., 1993). The tools were selected based on their popular use in the same population (Davidson, 2018; Fried et al., 2019), validity, applicability, and brevity in the topic areas.

Measures

Demographics Participants were asked to complete a demographic questionnaire that included 16 items. Demographic data included age, sex, gender, lived experience as a transgender person, ethnicity, geographic location, residence status (i.e., on- vs. off-campus), dependent children, caregiver status, employment status, income, marital status, university, degree, and faculty. Lived experience of a transgender person was asked as a separate question per guidelines by the University of British Columbia regarding equity and inclusion in data collection (The University of British Columbia, n.d.). The inclusion of 'transgender' as a gender identity option was deemed poor survey design as "many trans people primarily identify as men and women and cannot correctly answer a survey question whose design forces them to choose between their gender and their trans lived experience" (The University of British Columbia, n.d., p. 2). As such, a two-step gender question including a trans-specific question is recommended and was included in the current survey. Additionally, male/female terminology is used throughout this paper when referencing gender, as to reflect the response options provided to participants. Response options for the question regarding participants ethnicity was based off what was deemed good practice by Statistics Canada at time of survey creation (Statistics Canada, 2017). When asking participants their geographic location, an open textbox was provided.

Resilience According to the authors of the CD-RISC-10, Campbell-Sills and Stein (2007), resilience refers to one's ability to thrive despite exposure to adversity. The CD-RISC-10 is a 10-item questionnaire designed to measure one's ability to cope with adversity (Campbell-Sills & Stein, 2007) and was previously validated for use with undergraduate students (Cronbach's $\alpha = 0.85$; Campbell-Sills & Stein, 2007). Items are presented on a 5-point Likert scale ranging from 'not at all true' (0) to 'true nearly all of the time' (4; Connor & Davidson, 2003). Higher scores indicate higher levels of resilience, and lower scores indicate lower levels of resilience. Analysis approaches and cut-off scores are detailed below.

Health-related quality of life The RAND 36-Item Health Survey 1.0 (RAND-36; Hays et al., 1993) is adapted from the MOS 36-Item Short-Form Health Survey (SF-36; Ware & Sherbourne, 1992). It includes the same items as those in the SF-36, with a slightly different scoring protocol (RAND Corporation, n.d.). Given the brevity of the scoring protocol, the RAND-36 was used. It is worth noting that because the RAND-36 is adapted from the SF-36, the reliability of the RAND-36 is the same as the SF-36, as both are based off the Medical Outcomes Study (RAND Corporation, n.d.; Ware & Sherbourne, 1992). The RAND-36 provides an assessment of HRQOL, has been previously validated for use with general populations (Cronbach's $\alpha = 0.78$–0.93; Hays et al., 1993; Ware & Sherbourne, 1992), and measures eight domains: (1) physical functioning; (2) role limitations due to physical health problems; (3) role limitations due to emotional problems; (4) energy/fatigue; (5) emotional well-being; (6) social functioning; (7) bodily pain; and (8) general health perceptions. Further, participants' perceived change in health is determined by an additional single item in the RAND-36 (i.e., 'Compared to one year ago, how would you rate your health in general now?'). Across the eight subscales and change of health question there are 36 items; participants were asked to select one option for each question using a yes/no response option or a Likert scale, depending on the question. Scoring yielded individual domain scores, with higher scores indicating better HRQOL (RAND Corporation, n.d.). Analysis approaches and cut-off scores are detailed below.

Data analysis

The CD-RISC-10 and RAND-36 were scored according to the protocols outlined by Davidson (2018) and Hays and colleagues (1993), respectively. To score the CD-RISC-10, all the items were summed with total scores ranging from 0–40. The scores were then interpreted in quartiles, with scores in the lowest quartile ranging from 0–29, scores in the second lowest quartile ranging between 30–32, scores in the third quartile ranging between 33–36, and scores in the highest quartile ranging between 37–40 (Davidson, 2018). High scores (e.g., 33–40) indicate greater resilience (Davidson, 2018). To score the RAND-36, pre-coded numeric values were re-coded based on the scoring key (RAND Corporation, n.d.). Items were then scored on a 0–100 range and averaged together to obtain a score for each individual subscale; higher scores indicate better health status (RAND Corporation, n.d.).

Data analysis involved computing measures of central tendency and dispersion, and presenting the frequencies for demographic characteristics, the CD-RISC-10, and the RAND-36. Trends were explored among the total sample, as well as by gender and degree program. To explore whether a relationship existed between Ontario graduate students' resilience and HRQOL 18 months into the COVID-19 pandemic, nine linear regression analyses were performed–one for each HRQOL subscale (i.e., physical functioning, physical and emotional role functioning, respectively, energy/fatigue, emotional wellbeing, social functioning, pain, general health perceptions, and perceived change in health). To explore whether a relationship existed between Ontario graduate students' resilience and HRQOL based on gender (male vs. female)[1] and degree (master's vs. doctoral)[2] 18 months into the COVID-19 pandemic, nine linear regression analyses were performed for each gender and degree variable.

To correct for multiple comparison bias, alpha was adjusted to be 0.005 (i.e., $\alpha = 0.05/9$) using a Bonferroni correction. Pairwise deletion was used to handle missing data, such that a participant's response was only eliminated when the data needed to test an assumption was missing (Kang, 2013). Where there were missing data elsewhere in the dataset, the existing values were still used for statistical analyses (Kang, 2013). This approach to handling missing data was deemed appropriate as it uses all information preserved, compared to common methods such as listwise deletion, which excludes cases that have any missing data (Kang, 2013). Additionally, pairwise deletion is less biased for data that is missing at random (Kang, 2013), which was the case for the current study. All data analyses were completed in R (version 4.1; R Core Team, 2021).

Results

Demographics

A total of 389 graduate students consented to participate in the study. Upon completing the eligibility screening questions, 13 students were ineligible, yielding a total sample size of 376. The mean age of participants was 27.8 years ($SD = 6.5$). The majority of participants identified their gender as female ($n = 258$; 73.5%), 77 participants identified as male (21.9%), and 10 participants identified as non-binary (2.8%). Nine individuals (2.6%) disclosed having lived experience as a trans person. Most participants were of European origins ($n = 207$;

[1] Given the relatively small number of participants who identified as non-binary ($n = 10$), these individuals were excluded from the analysis as it was not sufficiently powered to draw meaningful conclusions. However, descriptive statistic trends among genders are presented.

[2] Given the relatively small number of participants in a professional ($n = 28$) or combined ($n = 4$) program, these individuals were excluded from the analysis as it was not sufficiently powered to draw meaningful conclusions.

59.0%) and over half of the participants lived in London, Ontario ($n = 180$; 52%) at completion of the survey. Only 9 participants (2.6%) reported living on-campus in residence, while most individuals reported living off-campus ($n = 342$; 97.4%). Some participants reported being responsible for dependent children ($n = 21$; 5.6%) and/or being a primary caregiver for a family member or friend ($n = 49$; 14.0%). Most participants reported being employed ($n = 228$; 65.1%), half of the participants reported an annual household income of $50,000 or less ($n = 176$; 50.6%), and the majority reported their marital status as single ($n = 233$; 67.0%). Most students attended the researchers' host institution ($n = 263$; 76.2%), with 168 (48.3%) enrolled in a master's program, 148 (42.5%) enrolled in a doctoral program, 28 (8.0%) enrolled in a professional program, and 4 (1.1%) enrolled in a combined program. Students reported being in the graduate programs Health Sciences, Public Health, or Kinesiology ($n = 81$; 23.5%), the Faculty of Medicine and Dentistry ($n = 45$; 13.1%), and the Faculty of Science ($n = 35$; 10.2%). See Table 1 for full demographic data.

Key findings

In general, participants reported low resilience and low HRQOL with respect to role limitations due to emotional problems and energy/fatigue. Additionally, findings revealed a positive association between resilience and the following HRQOL domains: role limitations due to emotional problems; energy/fatigue; emotional wellbeing; social functioning; general health perceptions; and perceived change in health, respectively. With regard to gender, individuals who identified as non-binary reported lower resilience, compared to those who identified as male or female, and scored lowest on all HRQOL domains. Additionally, resilience was positively associated with role limitations due to emotional problems; energy/fatigue; emotional wellbeing; social functioning; and general health perceptions for both males and females. Further, resilience was associated with perceived change in health for females only, while resilience was correlated with role limitations due to physical health problems for males only. In terms of degree program, it was concluded that resilience was positively associated with the following HRQOL domains for both master's and doctoral students: role limitations due to emotional problems; emotional wellbeing; and social functioning. Further, a positive relationship was observed between resilience and general health perceptions for master's students only, while resilience was positively correlated with energy/fatigue for doctoral students only. A comprehensive overview of study findings is detailed below.

Self-reported resilience and health-related quality of life among ontario graduate students: Purpose statement 1

The mean resilience score for the total sample using data from the CD-RISC-10 was 26.04 ($SD = 6.31$), which fell in the lowest quartile (0–29; Davidson, 2018). Using a mid-point cut-off of 50, participants reported high levels ($M = 70$–100) of HRQOL on the physical functioning, role limitations due to physical functioning, and pain domains, while also reporting HRQOL scores around the mid-point ($M = 40$–69) on the emotional wellbeing, social functioning, general health perceptions, and perceived change in health domains. Participants reported low ($M = 0$–39) HRQOL on role limitations due to emotional problems and energy/fatigue domains. With regard to gender, participants who identified as non-binary scored lowest on resilience and all HRQOL domains compared to their male and female counterparts. The mean resilience and HRQOL scores by gender (female, male, non-binary) and degree program (masters, doctoral students) can be found in Table 2.

Relationship between health-related quality of life and resilience among ontario graduate students: Purpose statement 2

The overall regression equations for the physical functioning, role limitations due to physical health problems, and pain subscales of HRQOL were not statistically significant. However, the overall regression equations for the role limitations due to emotional problems ($R^2 = 0.16$ [0.09,0.23], $p = < 0.005$), energy/fatigue ($R^2 = 0.13$ [0.08,0.20], $p = < 0.005$), emotional wellbeing ($R^2 = 0.31$ [0.24,0.39], $p = < 0.005$), social functioning ($R^2 = 0.15$ [0.09,0.22], $p = < 0.005$), general health perceptions ($R^2 = 0.12$ [0.07,0.19], $p = < 0.005$), and perceived change in health ($R^2 = 0.041$ [0.01,0.09], $p = < 0.005$) subscales of HRQOL were all statistically significant. As such, resilience was found to be positively associated with the aforementioned subscales (Table 3).

Relationship between health-related quality of life and resilience among ontario graduate students based on gender and degree program: Purpose statement 2

The overall regression equations for the physical functioning, role limitations due to physical health, and pain subscales of HRQOL were not statistically significant in females; however, the overall regression equations for the role limitations due to emotional problems ($R^2 = 0.15$ [0.08,0.23], $p = < 0.005$), energy/fatigue ($R^2 = 0.13$ [0.06,0.21], $p = < 0.005$), emotional wellbeing ($R^2 = 0.30$

Table 1 Demographic Information of Ontario Graduate Students During the COVID-19 Pandemic

Participant Characteristics ($n = 351$)	n	%
Age, *M (SD)*		
Total	27.8 (6.5)	
Master's students	25.9 (5.0)	
Doctoral students	30.8 (7.4)	
Professional program students	24.2 (3.8)	
Combined program students	25.0 (1.6)	
Sex		
Female	268	76.4
Male	77	21.9
I prefer not to answer	5	1.4
Gender		
Female	258	73.5
Male	77	21.9
Non-binary	10	2.8
I prefer not to answer	6	1.7
Lived Experience as Trans Person		
Yes	9	2.6
No	334	95.4
I prefer not to answer	7	2.0
Ethnicity		
North American Aboriginal origins	3	0.9
Other North American origins	22	6.3
European origins	207	59.0
Caribbean origins	5	1.4
Latin, Central, and South American origins	13	3.7
African origins	9	2.6
Asian origins	60	17.1
Mixed origins/Multiracial	20	5.7
Middle Eastern origins	6	1.7
I prefer not to answer	6	1.7
Geographic Location		
London	180	52.0
Toronto	21	6.1
Guelph	18	5.2
Ottawa	17	4.9
Mississauga	9	2.6
Residence		
On campus	9	2.6
Off campus	342	97.4
Living Situation (members in household)		
Parent(s)/guardian(s)	92	24.5
Spouse/partner	136	36.2
Friend(s)/roommate(s)	74	19.7
Child(ren)	22	5.9
Sibling(s)	41	10.9
Relative(s)	4	1.1
Alone	61	16.2
Primary Caregiver (for individual(s) with health condition/disability)		
Yes	49	14.0
No	294	84.0
I prefer not to answer	7	2.0
Marital Status		
Single	233	67.0
Married/common law/engaged	109	31.3
Divorced/separated	2	0.6
I prefer not to answer	4	1.1
University		
Western University	263	76.2
University of Guelph	20	5.8
University of Ottawa	11	3.2
University of Waterloo	9	2.6
University of Toronto	7	2.0
Faculty		
Health Sciences, Public Health, and Kinesiology	81	23.5
Medicine and Dentistry	45	13.1
Science	35	10.2
Education	30	8.7
Social Science and Humanities	28	8.1
Degree		
Master's	168	48.3
Doctoral	148	42.5
Professional	28	8.0
Combined	4	1.1
Employment Status		
Employed	228	65.1
Not employed	118	33.7
I prefer not to answer	4	1.1
Income		
< $25,000	109	31.3
$25,000-$50,000	67	19.3
$50,000-$75,000	40	11.5
$75,000-$110,000	35	10.1
$100,000-$150,000	30	8.6
$150,000-$200,000	15	4.3
> $200,000	13	3.7
I prefer not to answer	39	11.2

The total sample size was 376 participants; not all categories summed to equal the total sample due to missing data. Age was collected as a continuous variable. Only the top five cities/towns participants resided in are presented, along with the top five universities participants attended, and the top five faculties participants were enrolled. Due to the nature of how the question was asked (e.g., select all that apply), it is possible that participants are included in multiple categories under 'Living Situation'

Table 2 Ontario Graduate Students' Resilience and Health-Related Quality of Life 18-Months Into the COVID-19 Pandemic

Scale	Total *N*	Mean (*SD*)	Range
Connor-Davidson Resilience Scale (CD-RISC-10)			
Total	375	26.04 (6.31)	8–40
Females	258	26.31 (5.86)	8–40
Males	76	25.92 (7.59)	9–38
Non-Binary	10	24.60 (6.72)	13–35
Master's	168	25.77 (6.27)	8–40
Doctoral	147	26.41 (5.95)	9–40
RAND 36-Item Health Survey (RAND-36)			
Physical Functioning			
Total	352	91.63 (14.28)	20–100
Females	258	92.27 (13.38)	20–100
Males	77	91.17 (16.40)	25–100
Non-Binary	10	79.00 (13.70)	55–95
Master's	168	91.13 (14.93)	20–100
Doctoral	148	91.18 (14.71)	25–100
Role Limitations due to Physical Health Problems			
Total	349	76.22 (36.21)	0–100
Females	255	78.43 (34.23)	0–100
Males	77	75.00 (37.61)	0–100
Non-Binary	10	27.50 (39.88)	0–100
Master's	166	75.30 (36.82)	0–100
Doctoral	147	74.83 (37.53)	0–100
Role Limitations due to Emotional Problems			
Total	351	37.61 (40.52)	0–100
Females	257	38.00 (39.91)	0–100
Males	77	42.86 (42.87)	0–100
Non-Binary	10	10.00 (31.62)	0–100
Master's	168	34.92 (38.91)	0–100
Doctoral	147	35.83 (40.18)	0–100
Energy/Fatigue			
Total	351	38.86 (20.18)	0–85
Females	257	39.07 (19.25)	0–85
Males	77	41.69 (22.31)	0–85
Non-Binary	10	22.50 (20.98)	0–65
Master's	168	37.50 (19.77)	0–85
Doctoral	147	38.81 (20.16)	0–80
Emotional Wellbeing			
Total	350	55.91 (20.93)	0–100
Females	256	56.61 (20.12)	0–100
Males	77	56.94 (22.51)	12–92
Non-Binary	10	42.80 (25.16)	4–76
Master's	168	54.83 (21.03)	0–100
Doctoral	146	56.03 (20.86)	4–92
Social Functioning			
Total	352	67.51 (26.02)	0–100
Females	258	68.60 (24.49)	0–100
Males	77	68.34 (28.93)	12.50–100
Non-Binary	10	43.75 (32.41)	0–87.50
Master's	168	65.55 (25.17)	0–100
Doctoral	148	69.17 (26.98)	0–100
Pain			
Total	352	76.97 (19.91)	20–100
Females	258	77.24 (20.13)	20–100
Males	77	79.94 (17.06)	35–100
Non-Binary	10	57.25 (18.58)	22.50–80
Master's	168	76.41 (19.61)	22.5–100
Doctoral	148	76.57 (20.54)	20–100
General Health Perceptions			
Total	352	63.75 (22.41)	0–100
Females	258	64.36 (21.91)	0–100
Males	77	64.42 (22.77)	5–100
Non-Binary	10	41.50 (17.96)	15–70
Master's	168	62.53 (23.88)	0–100
Doctoral	148	63.88 (20.44)	5–100
Perceived Change in Health			
Total	352	49.22 (25.27)	0–100
Females	258	50.29 (25.38)	0–100
Males	77	47.73 (24.73)	0–100
Non-Binary	10	32.50 (20.58)	0–75
Master's	168	49.85 (25.74)	0–100
Doctoral	148	48.82 (24.28)	0–100

[0.21,0.38], $p = < 0.005$), social functioning ($R^2 = 0.11$ [0.05,0.19], $p = < 0.005$), general health perceptions ($R^2 = 0.078$ [0.03,0.15], $p = < 0.005$), and perceived change in health ($R^2 = 0.048$ [0.01,0.11], $p = < 0.005$) subscales of HRQOL were all statistically significant (Table 4). With respect to males, the overall regression equations for the physical functioning, pain, and perceived change in health subscales of HRQOL were not statistically significant; however, the overall regression equations for the role limitations due to physical health problems ($R^2 = 0.16$ [0.04,0.32], $p = < 0.005$), role limitations due to emotional problems ($R^2 = 0.18$ [0.06,0.34], $p = < 0.005$), energy/fatigue ($R^2 = 0.17$ [0.05,0.33], $p = < 0.005$), emotional wellbeing ($R^2 = 0.31$ [0.16,0.46], $p = < 0.005$), social functioning ($R^2 = 0.22$ [0.08,0.38], $p = < 0.005$), and general health perceptions ($R^2 = 0.40$ [0.23,0.53], $p = < 0.005$) subscales of HRQOL were all statistically significant (Table 5).

The overall regression equations for the physical functioning, role limitations due to physical health problems, pain, and perceived change in health subscales of HRQOL were not statistically significant in master's students; however, the overall regression equations for the role limitations due to emotional problems ($R^2 = 0.18$ [0.09,0.28], $p = < 0.005$), energy/fatigue ($R^2 = 0.083$ [0.02,0.18], $p = < 0.005$), emotional wellbeing ($R^2 = 0.30$ [0.19,0.41], $p = < 0.005$), social functioning ($R^2 = 0.15$ [0.07,0.26], $p = < 0.005$), and general

Table 3 Relationship Between Health-Related Quality of Life and Resilience Among Ontario Graduate Students 18-Months Into the COVID-19 Pandemic

Predictor	Response	R^2	95% CI	p	b	b_95%_CI	β	β _95%_CI	sr^2	sr^2_95%_CI	r
Resilience	Physical functioning	.017	[.00, .06]	.072	.32	[0.08, 0.56]	.14	[0.04, 0.25]	.02	[.00, .06]	.14
	Role limitations due to physical health problems	.020	[.00, .06]	.041	.87	[0.27, 1.47]	.15	[0.05, 0.26]	.02	[.00, .06]	.15
	Role limitations due to emotional problems*	.16	[.09,.23]	7.54×10^{-14}	2.56	[1.94, 3.18]	.40	[0.30, 0.50]	.16	[.09, .23]	.40
	Energy/fatigue*	.13	[.08,.20]	8.49×10^{-12}	1.18	[0.87, 1.49]	.37	[0.27, 0.47]	.14	[.08, .20]	.37
	Emotional wellbeing*	.31	[.24,.39]	1.80×10^{-15}	1.86	[1.57, 2.15]	.56	[0.47, 0.65]	.32	[.24, .39]	.56
	Social functioning*	.15	[.09,.22]	3.73×10^{-13}	1.60	[1.20, 2.00]	.39	[0.29, 0.49]	.15	[.09, .22]	.39
	Pain	.020	[.00,.06]	.042	.48	[0.15, 0.80]	.15	[0.05, 0.25]	.02	[.00, .06]	.15
	General health perceptions*	.12	[.07,.19]	4.58×10^{-11}	1.27	[0.92, 1.62]	.36	[0.26, 0.46]	.13	[.07, .19]	.36
	Perceived change in health*	.041	[.01,.09]	6.43×10^{-4}	0.84	[0.43, 1.26]	.21	[0.11, 0.31]	.04	[.01, .09]	.21

An asterisk (*) is used to indicate significant variables. R^2 is the adjusted R^2 value. The reported p is the adjusted p-value for each variable using a Bonferroni correction

Table 4 Relationship Between Health-Related Quality of Life and Resilience in Females 18-Months Into the COVID-19 Pandemic

Predictor	Response	R^2	95% CI	p	b	b_95%_CI	β	β _95%_CI	sr^2	sr^2_95%_CI	r
Resilience	Physical functioning	-.0019	[.00,.03]	1.00	0.10	[-0.18, 0.38]	.04	[-0.08, 0.17]	.00	[.00, .03]	.04
	Role limitations due to physical health problems	-.0017	[.00,.03]	1.00	0.28	[-0.45, 1.00]	.05	[-0.08, 0.17]	.00	[.00, .03]	.05
	Role limitations due to emotional problems*	.15	[.08,.23]	1.50×10^{-9}	2.62	[1.84, 3.39]	.38	[0.27, 0.50]	.15	[.08, .23]	.38
	Energy/fatigue*	.13	[.06,.21]	1.74×10^{-8}	1.19	[0.81, 1.57]	.36	[0.25, 0.48]	.13	[.06, .21]	.36
	Emotional wellbeing*	.30	[.21,.38]	1.98×10^{-15}	1.88	[1.53, 2.23]	.55	[0.45, 0.65]	.30	[.21, .38]	.55
	Social functioning*	.11	[.05,.19]	1.80×10^{-7}	1.42	[0.94, 1.91]	.34	[0.22, 0.46]	.12	[.05, .19]	.34
	Pain	.012	[.00,.06]	.46	0.42	[-0.00, 0.84]	.12	[-0.00, 0.24]	.01	[.00, .06]	.12
	General health perceptions*	.078	[.03,.15]	2.57×10^{-5}	1.07	[0.63, 1.51]	.29	[0.17, 0.40]	.08	[.03, .15]	.29
	Perceived change in health*	.048	[.01,.11]	.0020	.99	[0.47, 1.50]	.23	[0.11, 0.35]	.05	[.01, .11]	.23

An asterisk (*) is used to indicate significant variables. R^2 is the adjusted R^2 value. The reported p is the adjusted p-value for each variable using a Bonferroni correction

Table 5 Relationship Between Health-Related Quality of Life and Resilience in Males 18-Months Into the COVID-19 Pandemic

Predictor	Response	R^2	95% CI	p	b	b_95%_CI	β	β _95%_CI	sr^2	sr^2_95%_CI	r
Resilience	Physical functioning	.12	[.02,.27]	0.012	.78	[0.31, 1.25]	.36	[0.14, 0.58]	.13	[.02, .27]	.36
	Role limitations due to physical health problems*	.16	[.04,.32]	0.0015	2.08	[1.04, 3.13]	.42	[0.21, 0.63]	.18	[.04, .32]	.42
	Role limitations due to emotional problems*	.18	[.06,.34]	6.48×10^{-4}	2.50	[1.31, 3.68]	.44	[0.23, 0.65]	.19	[.06, .34]	.44
	Energy/fatigue*	.17	[.05,.33]	0.0011	1.26	[0.64, 1.87]	.43	[0.22, 0.64]	.18	[.05, .33]	.43
	Emotional wellbeing*	.31	[.16,.46]	7.42×10^{-7}	1.70	[1.13, 2.26]	.57	[0.38, 0.76]	.32	[.16, .46]	.57
	Social functioning*	.22	[.08,.38]	8.01×10^{-5}	1.85	[1.08, 2.62]	.49	[0.28, 0.69]	.24	[.08, .38]	.49
	Pain	.055	[.00,.20]	0.21	.59	[0.08, 1.09]	.26	[0.04, 0.48]	.07	[.00, .20]	.26
	General health perceptions*	.40	[.23,.53]	6.15×10^{-9}	1.90	[1.37, 2.44]	.64	[0.46, 0.81]	.40	[.23, .53]	.64
	Perceived change in health	.018	[.00,.14]	1.00	.58	[-0.17, 1.32]	.18	[-0.05, 0.40]	.03	[.00, .14]	.18

An asterisk (*) is used to indicate significant variables. R^2 is the adjusted R^2 value. The reported p is the adjusted p-value for each variable using a Bonferroni correction

health perceptions ($R^2 = 0.11$ [0.04,0.21], $p = < 0.005$) subscales of HRQOL were all statistically significant (Table 6). With respect to doctoral students, the overall regression equations for the physical functioning, role limitations due to physical health problems, pain, general health perceptions, and perceived change in health subscales of HRQOL were not statistically significant; however, the overall regression equations for the role limitations due to emotional problems ($R^2 = 0.11$ [0.04,0.22], $p = < 0.005$), energy/fatigue ($R^2 = 0.18$ [0.08,0.29], $p = < 0.005$), emotional wellbeing ($R^2 = 0.35$ [0.24,0.46], $p = < 0.005$), and social functioning ($R^2 = 0.15$ [0.06,0.26], $p = < 0.005$) subscales of HRQOL were all statistically significant (Table 7).

Discussion

On average, participants' resilience was low across all genders and, as anticipated, there was a positive association between resilience and HRQOL among graduate students, broadly. Resilience was also positively associated with different HRQOL subscales when comparing gender and degree program. Further, individuals who identified as non-binary scored lowest on resilience and all HRQOL domains, compared to their male and female counterparts. The findings of the current study underscore the importance of focusing on the relationship between resilience and HRQOL and these findings will be discussed in turn.

With respect to purpose statement 1, the average score for participants' resilience was in the lowest quartile (Davidson, 2018), indicating that 18 months into the pandemic graduate students were reporting low levels of resilience. This finding was consistent across all genders (i.e., females, males, and non-binary), with non-binary individuals reporting the lowest resilience and females reporting the highest (all within the lowest quartile), as well as degree program (i.e., masters and doctoral students). It is concerning that graduate students' resilience was in the lowest quartile, as low resilience has been associated with a high prevalence of depression, anxiety, and perceived stress (Kermott et al., 2019). Additionally, researchers have found that university students who reported low levels of resilience experienced high psychological distress, and low levels of perceived social support and campus connectedness, compared to students with high levels of resilience (Pidgeon et al., 2014). This is especially troubling for students who identify as non-binary, as gender minority individuals are two times more likely to be diagnosed with depression and anxiety disorders compared to their cisgender counterparts (Lipson et al., 2019). Thus, finding ways to enhance the resilience of university students is imperative. Findings from the current study align with work conducted by Keener and colleagues (2021),

Table 6 Relationship Between Health-Related Quality of Life and Resilience in Master's Students 18-Months Into the COVID-19 Pandemic

Predictor	Response	R^2	95% CI	p	b	b_95%_CI	β	β _95%_CI	sr^2	sr^2_95%_CI	r
Resilience	Physical functioning	.019	[.00,.09]	.36	.38	[0.02, 0.74]	.16	[0.01, 0.31]	.03	[.00, .09]	.16
	Role limitations due to physical health problems	.036	[.00,.12]	.075	1.20	[0.31, 2.08]	.20	[0.05, 0.36]	.04	[.00, .12]	.20
	Role limitations due to emotional problems*	.18	[.09,.28]	8.15×10^{-8}	2.64	[1.78, 3.50]	.43	[0.29, 0.56]	.18	[.09, .28]	.43
	Energy/fatigue*	.083	[.02,.18]	7.73×10^{-4}	.94	[0.48, 1.40]	.30	[0.15, 0.44]	.09	[.02, .18]	.30
	Emotional wellbeing*	.30	[.19,.41]	7.10×10^{-14}	1.85	[1.43, 2.28]	.55	[0.43, 0.68]	.31	[.19, .41]	.55
	Social functioning*	.15	[.07,.26]	7.74×10^{-7}	1.60	[1.04, 2.17]	.40	[0.26, 0.54]	.16	[.07, .26]	.40
	Pain	-.00038	[.00,.05]	1.00	.23	[-0.24, 0.71]	.07	[-0.08, 0.23]	.01	[.00, .05]	.07
	General health perceptions*	.11	[.04,.21]	5.15×10^{-5}	1.30	[0.75, 1.85]	.34	[0.20, 0.49]	.12	[.04, .21]	.34
	Perceived change in health	.023	[.00,.10]	.24	.70	[0.08, 1.32]	.17	[0.02, 0.32]	.03	[.00, .10]	.17

An asterisk (*) is used to indicate significant variables. R^2 is the adjusted R^2 value. The reported p is the adjusted p-value for each variable using a Bonferroni correction

Table 7 Relationship Between Health-Related Quality of Life and Resilience in Doctoral Students 18-Months Into the COVID-19 Pandemic

Predictor	Response	R^2	95% CI	p	b	b_95%_CI	β	β _95%_CI	sr^2	sr^2_95%_CI	r
Resilience	Physical functioning	.0032	[.00,.06]	1.00	.25	[-0.16, 0.65]	.10	[-0.06, 0.26]	.01	[.00, .06]	.10
	Role limitations due to physical health problems	-.0021	[.00,.05]	1.00	.44	[-0.60, 1.48]	.07	[-0.09, 0.23]	.00	[.00, .05]	.07
	Role limitations due to emotional problems*	.11	[.04,.22]	1.55×10^{-4}	2.35	[1.31, 3.40]	.35	[0.19, 0.50]	.12	[.04, .22]	.35
	Energy/fatigue*	.18	[.08,.29]	6.19×10^{-7}	1.45	[0.95, 1.96]	.43	[0.28, 0.58]	.18	[.08, .29]	.43
	Emotional wellbeing*	.35	[.24,.46]	1.80×10^{-14}	2.09	[1.63, 2.56]	.60	[0.47, 0.73]	.36	[.24, .46]	.60
	Social functioning*	.15	[.06,.26]	6.64×10^{-6}	1.79	[1.11, 2.47]	.39	[0.24, 0.55]	.164	[.06, .26]	.39
	Pain	.014	[.00,.09]	.73	.50	[-0.06, 1.06]	.14	[-0.02, 0.31]	.02	[.00, .09]	.14
	General health perceptions	.071	[.01,.17]	.0058	.96	[0.41, 1.50]	.28	[0.12, 0.44]	.08	[.01, .17]	.28
	Perceived change in health	.040	[.00,.13]	.077	.89	[0.23, 1.54]	.22	[0.06, 0.38]	.05	[.00, .13]	.22

An asterisk (*) is used to indicate significant variables. R^2 is the adjusted R^2 value. The reported p is the adjusted p-value for each variable using a Bonferroni correction

who examined the relationship between quality of life and resilience among undergraduate and graduate nursing students ($N = 152$) during the COVID-19 pandemic (April 2020) in rural Appalachia. Utilizing the CD-RISC-10, the authors found that participants had an average score of 27.88, indicating that participants' resilience was also in the lowest quartile (Keener et al., 2021). Similarly, Chen and Lucock (2022) investigated the resilience and quality of life of university students ($N = 1173$) in the United Kingdom during the pandemic (June-July 2020) and concluded that participants had relatively low levels of resilience, which the authors attributed to public health protections resulting in social isolation. Despite the difference in timeframes and location, these findings align with the current study, as all student populations had low levels of resilience during the COVID-19 pandemic. However, these findings differ from Sarmiento and colleagues (2021), as the authors found that graduate and postgraduate students ($N = 253$) in Spain reported high levels of resilience during the pandemic (April–May 2020), with males reporting higher levels of resilience compared to females. Similarly, Peyer and colleagues (2022) concluded that female university students in the United States had lower levels of resilience compared to males during the COVID-19 pandemic (2020). These findings align with a pre-pandemic study conducted by Rahimi and colleagues (2014), who explored gender differences (male vs. female) in the resilience of undergraduate medical students ($N = 155$) at the University of Saskatchewan in Canada. The mean resilience score of participants who identified as female was 28.84 ($SD = 4.44$) and the mean resilience score of participants who identified as male was 31.25 ($SD = 5.23$). This indicates that females scored in the lowest quartile and males scored in the second lowest quartile, suggesting that Canadian undergraduate medical students in Rahimi and colleagues' (2014) study had low levels of resilience, pre-pandemic. Interestingly, findings from the present study differ as females reported higher levels of resilience when compared to males and non-binary individuals. It is worth noting that the total mean score of participants in the current study was slightly lower than that of Rahimi and colleagues (2014); however, it is not possible to know if this is a result of the COVID-19 pandemic, the difference in degree type (i.e., undergraduate vs. graduate students), the time lapse between the two studies (i.e., seven years), or some combination of these and/or other factors. While it appears that the resilience of university students was poor pre-pandemic (e.g., Rahimi et al., 2014), it is possible that the pandemic timeframe has included challenges that have heightened the stress levels of graduate students, beyond what was previously typical (Bal et al., 2020; Liu et al., 2022). These elevated stress levels may help to account for the concerningly low resilience observed in the current study.

The HRQOL pertaining to physical functioning was high among students in the current study. This finding was surprising given that engagement in physical activity–a component of physical functioning–has been associated with increased resilience among university students (Roman-Mata et al., 2020), although the resilience of participants in the current study was low. It is worth noting that it is possible the majority of participants in the current study viewed themselves as physically healthy, thus explaining the high scores. This finding is similar to a pre-pandemic study conducted by Sun and colleagues (2021), who investigated the relationship between resilience and HRQOL of 435 high school students in China and found that students scored a mean of 91.41 on the HRQOL physical functioning subscale, indicating high physical functioning. While there are no cut-off scores, participants in both studies scored relatively high on the role limitations due to physical health problems subscale, indicating few limitations (Sun et al., 2021). It is not surprising that participants experienced few limitations due to physical health problems when their self-reported physical functioning was high. Such findings align with work by Abdullah and colleagues (2021), who measured the quality of life of university students ($N = 316$) in Malaysia during the pandemic (July 2020) and concluded that participants' physical health quality of life scores were comparable to pre-pandemic norms of the general population. Interestingly, Cam and colleagues (2022) conducted a study during the pandemic (May 2020) wherein the findings regarding students' physical functioning differ from those reported in the current study. Specifically, Cam and colleagues (2022) investigated the impact that the COVID-19 pandemic had on university students' ($N = 1095$) HRQOL in Turkey. The authors utilized the HRQOL domains of general health perceptions, physical functioning, role limitations due to physical functioning, and bodily pain to yield a physical component summary score of 67/100. This summary score was lower than the reported individual scores for each domain in the current study, with the exception of general health perceptions. However, it is worth noting that the physical health summary score reported by Cam and colleagues (2022) was still moderately high when considering the scale ranged from 0–100. Additionally, participants in the current study scored slightly above the mid-point on the social functioning subscale. This finding is noteworthy as social connectedness – a component of social functioning – has been found to contribute positively to university students' mental health during the pandemic (Visser & Law-van Wyk, 2021). Thus, creating opportunities for students to engage socially might be one way to mitigate the stress of university students.

Of concern are participants' mean scores for the emotional wellbeing and role limitations due to emotional problems subscales, as participants scored slightly above the mid-point and low, respectively. Although no statistical comparisons were made to assess differences among genders, participants who identified as non-binary scored lowest on the role limitations due to emotional problems subscale and on the emotional wellbeing subscale. To the authors' knowledge, this is the first study to report on the HRQOL of non-binary graduate students and thus, we are not able to draw comparisons regarding the scores of non-binary individuals to other non-binary individuals. It is advised that researchers place a greater emphasis on this sub-population in future research. In the current study, those who identified as male and female scored slightly higher than non-binary individuals on both the role limitations due to emotional problems and emotional wellbeing subscales. In a study that explored the correlation between resilience and quality of life of adults in Saudi Arabia ($N = 385$) during the COVID-19 pandemic (May–August 2021), the authors compared findings between males and females (Aldhahi et al., 2021). While the authors used a different scale to measure quality of life than the current study, the mean psychological health score was significantly higher in males than females (Aldhahi et al., 2021). This aligns with the current study as males scored highest on the role limitations due to emotional problems subscale. When considering the HRQOL domain scores between master's and doctoral students, interestingly, there did not appear to be large differences in scores. This may be due to the small sample size and as such, it is advised that researchers in the future conduct a larger study to assess these groups in greater detail.

With respect to purpose statement 2, resilience was found to be statistically significantly positively associated with participants' role limitations due to emotional problems, energy/fatigue, emotional wellbeing, social functioning, general health perceptions, and perceived change in health during the COVID-19 pandemic. The findings of the current study are comparable to those of other studies conducted during the pandemic, wherein researchers found that resilience was positively associated with quality of life among nursing students (Berdida & Grande, 2023; Keener et al., 2021). Similarly, in a pre-pandemic study, Bottolfs and colleagues (2020) explored whether resilience predicted HRQOL in early adolescents ($N = 611$; $M_{age} = 13.2$ years) and concluded that resilience was a statistically significant predictor of physical wellbeing and psychological wellbeing. Further, Simon-Saiz and colleagues (2018) found that resilience was a statistically significant predictor of all HRQOL domains among a sample of adolescents ($N = 844$), with resilience being the strongest predictor of the mental health and social relationship-related domains. While the populations differ, the findings align with the current study, as resilience was most strongly associated with role limitations due to emotional problems, emotional wellbeing, and social functioning in graduate students. Further, Bastaminia and colleagues (2016) investigated the relationship between resilience and quality of life in 338 university students in Iran and found that there was a correlation between resilience and quality of life on all four quality of life domains (i.e., physical health, mental health, social relationships, and environmental health domains). Similarly, Noreen and colleagues (2021) investigated the associations between psychological distress and resilience, and their effects on the quality of life of medical ($n = 150$) and non-medical ($n = 150$) university students in Pakistan. The authors concluded that resilience was a positive predictor of quality of life (Noreen et al., 2021), which aligns with the findings of the current study.

When exploring the relationship between resilience and HRQOL between genders, interestingly, resilience was associated with change in health status (for better or for worse) in females, but not in males. This might be because Canadian male university students tend to perceive their health status to be favourable, compared to females (Dawson et al., 2007). On the opposite spectrum, resilience was found to be associated with role limitations due to physical health problems in males, but not in females. This might be explained, in part, by the fact that male university students, on average, engage in more physical activity and physically strenuous tasks compared to females (e.g., Irwin, 2004). Further, Aldhahi and colleagues (2021) found that gender was a significant predictor for quality of life such that men in their study reported a higher quality of life compared to women during the COVID-19 pandemic (May–August 2021). Interestingly, the authors did not find any significant differences in resilience scores between men and women (Aldhahi et al., 2021). This finding differs from the current study as resilience was found to be associated with various HRQOL domains between men and women.

Study implications

Findings from the current study can be leveraged by educational institutions to support graduate students during and following the COVID-19 pandemic. Given that participants in the current study reported low resilience and that resilience was found to be positively correlated with HRQOL, student affairs personnel might consider developing programs to enhance students' resilience which, in turn, might support their HRQOL. Further, it is recommended that programming be tailored based on gender and degree program. While study findings revealed some commonalities among the constructs, there were also distinct differences that existed among genders and between degree programs. Notably, individuals who identified as non-binary scored lowest on resilience and all HRQOL domains, compared to

their male and female counterparts. Given the small sample size, more research is needed to understand the relationship between resilience and HRQOL among gender-diverse students (e.g., non-binary). To this end, student affairs personnel might consider conducing a needs assessment specific to gender and degree program, in order to provide programming that will meet the needs of underrepresented students.

Limitations and future directions

This study is not without limitations. First, the study design was cross-sectional, which did not allow for trends to be observed over time in the current study and is prone to non-response bias (Sedgwick, 2014). It is recommended that in the future, researchers consider the use of a longitudinal study design to track relationships over time. Second, it is worth noting that the researchers did not obtain a sample size sufficient to detect a small effect. This said, with the sample size achieved the authors were sufficiently powered to detect a medium to large effect size. Further, when running regression, it is crucial to highlight that accurate predictions cannot be guaranteed using cross-sectional data (Hanis & Mansori, 2017) and that conclusions cannot be drawn with regard to causal effects. Thus, it is possible that the findings of the current study are specific to the study cohort and not representative of the broader population. As such, it is advised that when running regression cross-sectionally, the research team validate the prediction model in a second sample (Hanis & Mansori, 2017), which the authors of the current study might consider doing. Researchers might also benefit from collecting data post-pandemic and comparing scores to the current study to see if there are any differences. This study also lacks generalizability as the sample was pre-dominantly females of European decent. Thus, the study findings are not representative of the broader student population. As such, recruitment efforts in future studies should target all genders and ethnicities, specifically those who identify as non-binary as well as, Black, Indigenous Peoples, and People of Colour. Additionally, while recruitment via social media platforms was deemed appropriate for the current study, it also introduced the risk of sampling bias towards those with an active online social media presence. This limits the generalizability of study findings, as participants in the current study might have primarily consisted of students with social media accounts; however, this is not reflective of the student population broadly. Further, given that increased social media use can negatively impact students' mental health (Iwamoto & Chun, 2020), it is possible that participants in the current study reported low HRQOL with respect to role limitations due to emotional problems, as a result of their social media use because it has been established that the duration of social media use increased among university students during the pandemic (ParlakSert & Başkale, 2022). Moreover, most participants were pursuing a master's or doctoral degree and were from the host University, given the mass email recruitments were sent from the researchers' host institution. Again, this limits the generalizability of the current study findings as it remains unknown if similar results would be obtained with a more representative student population, inclusive of students pursing degree programs beyond master's and doctoral degrees and attending post-secondary institutions external to the host institution. Future studies should aim to achieve a fuller representation of diverse degree programs and post-secondary institutions, which could be achieved via mass email recruitments at various institutions in addition to using social media recruitment. By obtaining greater representation of gender and degree type, researchers might also consider exploring the relationship between resilience and HRQOL in individuals who identify as non-binary, as well as those in professional or combined programs.

Conclusion

Graduate students have reported heightened stress related to their productivity, physical health, and emotional health as a result of the COVID-19 pandemic (Wasil et al., 2021), which can negatively impact their resilience and HRQOL. Eighteen months into the COVID-19 pandemic, Ontario graduate students self-reported low resilience and poor health states on some HRQOL domains (role limitations due to emotional problems and energy/fatigue). Further, resilience was positively associated with HRQOL in general, and when comparing gender and degree program, which is unsurprising given that researchers of previous studies have found resilience to be a predictor of HRQOL and quality of life more broadly in similar populations (Aldhahi et al., 2021; Bastaminia et al., 2016; Bottolfs et al., 2020; Noreen et al., 2021; Simon-Saiz et al., 2018). The findings of the current study may aid researchers and student affairs personnel in understanding graduate students' levels of resilience and HRQOL during the COVID-19 pandemic, and more specifically among genders and degree programs. Findings from this study will allow student affairs personnel to tailor potential programming to meet the needs of various students. The next phase might include a needs assessment to determine supports for graduate students, specific to gender and degree program, in order to enhance their resilience and in turn, improve their HRQOL during and following the COVID-19 pandemic.

Funding No funding was received.

Data availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval Approval was obtained from the Non-Medical Research Ethics Board of The University of Western Ontario. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

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

Conflict of interest The authors declare that they have no conflict of interest.

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