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Impact of the COVID-19 pandemic on the experience and mental health of university students studying in Canada and the United Kingdom: a cross-sectional study

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Abstract

Objectives: To explore the impact of the COVID-19 pandemic on the experiences and mental health of university students.

Design: A cross-sectional study consisting of an electronic survey about students' experiences and concerns during the pandemic and the associated impact.

Setting: Queen's university in Canada and the University of Oxford in the UK

Participants: Undergraduate students at Queen's university and first year undergraduate students at the University of Oxford were invited to complete the COVID supplement survey. 3013 Queen's students and 337 Oxford students completed the survey with no missing data on the variables of interest.

Results: Females reported greater adherence to government recommendations to prevent the spread of COVID-19 and were more likely to experience associated lifestyle changes than

males. Students concerns were wide-ranging including those related to their learning experience, finances, and future academic and career prospects. A sizeable proportion of students also reported that the pandemic negatively impacted their plans to continue at university (29.4% of Queen's students, 14.2% of Oxford students), and disrupted activities important to their mental well-being. Younger students were more likely to worry about university attendance, while older students were more likely to report concerns about career prospects.

Conclusions: Overall, findings underscore the importance of addressing areas of student concern and the aspects of student life negatively impacted by the pandemic in order to maintain student well-being and support a successful university experience.

Article Summary: Strengths and limitations of this study

- The first study to compare the impact of the COVID-19 pandemic on university students across different countries.
- Responses were obtained from large, diverse samples of university students.
- Validated measures were used to assess the impact of the pandemic on students.
- A low response rate was obtained from the Queen's University sample.
- Participants were surveyed early in the pandemic, and the impact on students may change over time.

1 Introduction

In late 2019, the novel Coronavirus (COVID-19) was detected in Wuhan, China, causing disease ranging from asymptomatic infection to life-threatening respiratory compromise.[1] The restrictions imposed to limit viral transmission and the direct impact of the virus have profoundly affected daily life and well-being, with heightened anxiety and reduced access to usual coping mechanisms such as exercise, socialisation, and leisure activities.[2]

University students are a subgroup of the population particularly affected by COVID-19. Campus life has dramatically changed with remote teaching and social distancing measures implemented across institutions worldwide.[3] In addition to the changes to daily living experienced by the general population, students have experienced disruption to their learning, assessment and schedules, and the cancellation of enriched learning opportunities such as field trips, laboratory courses, and learning exchanges. Additionally, the pandemic may affect future educational opportunities, job prospects, and financial stability.

The pandemic and its aftermath will likely have lasting effects on both students and universities. Therefore, there is a pressing need for the collection of reliable data to assess the impact of the pandemic on student well-being and academic outcomes. This would improve our understanding of student experiences and concerns, informing institutions' approaches to addressing these.

In this study, we aimed to explore university student experiences and concerns during the COVID-19 pandemic, including worries related to the pandemic and the associated impact on education, daily life, career prospects, and mental health support. We leveraged an ongoing longitudinal survey study of undergraduate students attending Queen's University in Canada and the University of Oxford in the UK.[4-5]

2 Methods

COVID-specific measures were added to the ongoing U-Flourish Student Well-Being and Academic Success survey,[6] which invites first-year university students at Queen's (Canada) and Oxford (UK) to complete electronic surveys at the beginning and end of each academic year. The surveys ask about risk and protective factors for well-being and mental health using validated measures. COVID-related questions were added to the U-Flourish follow-up survey for participating first-year Oxford students (May 2020) and sent out as a supplementary survey to all registered Queen's undergraduate students (July 2020).

2.1 Study Variables

2.1.1 Demographic Characteristics.

Age in years and gender were self-reported and international student status, and program and year of study were obtained from university administrative data.

2.1.2 COVID-19 related measures.

Participants were asked to describe their approach to self-isolation during the pandemic by selecting all options that applied from a list of nine options, grouped into: (1) No change (i.e., "I have lived my life as normal"), (2) Minor change, but not self-isolation (e.g., social distancing, working from home), and (3) Self-isolation (i.e., staying at home and avoiding contact with people outside of your household). Participants rated their knowledge level on COVID-19 from "1 – Very Poor" to "7- Very Good", and whether they have been following government recommendations from "1 – Not at all" to "7 – Very much so".

Anxiety surrounding the pandemic was assessed using the COVID-19 Pandemic Anxiety Scale.[7] A series of nine statements asked, how serious an issue do you think COVID-19 is, and how worried are you about the following: catching COVID-19, friends and family catching COVID-19, leaving the house, infecting others, having enough food and other essential items, missing university, and the impact on your finances and long-term academic and job prospects. Each statement was rated on a five-point scale according to level of agreement, re-categorised into 'Disagree' (1-2), 'Neither disagree or agree' (3), and 'Agree' (4-5).

To gauge the impact of COVID-19 on student life, students were asked about the impact of the pandemic on studies and learning opportunities, future academic/professional prospects, lifestyle, relationships and connectedness, and for those in need, access to mental health support. Participants rated the impact of the pandemic and associated social distancing on a five-point scale from 1= Very negative to 5= Very positive (categorised into 'Negative', 'Neither', or 'Positive'). Participants were asked if any mental health support they receive had been stopped, postponed or negatively affected due to the pandemic.

Finally, participants were asked "Are there any other significant impacts related to the COVID-19 pandemic on your mental health, wellbeing, or education that you would like to comment on?"

2.2 Statistical Analysis

The primary analysis utilised data from the Queen's COVID-19 survey. Responses to the Pandemic Anxiety Scale and questions assessing the impact of the pandemic and associated social distancing were examined in the Oxford sample in an exploratory manner to compare

between institutions and countries. Samples were restricted to participants with complete data on the variables of interest. Analyses were conducted using RStudio.[8] Descriptive statistics were used to describe the sample, and responses to the Pandemic Anxiety Scale and COVID-19 impact items overall and by gender, age group and year of study. Students identifying as other than 'male' or 'female' were not included in the gender-stratified analyses because of small numbers (n= 34/3013). Differences in proportions between strata were examined using chi-square tests. The difference in average knowledge levels of COVID-19 between males and females was examined using a t-test.

Qualitative data from the Queen's and Oxford surveys were extracted from free text responses. Qualitative analysis used a framework technique.[9-10] Participant data were interpreted and summarized. Codes comprised of similar information were merged leading to a framework of specific phenomena that appeared increasingly likely to reflect the participant's experience. The study team met regularly to discuss the findings and refine the emerging framework. To reduce researcher bias, the team analysing the qualitative data were not made aware of the quantitative findings until the framework had been agreed.

The STROBE cross-sectional reporting guidelines were used in the reporting of this study.[11]

2.3 Patient and public involvement

The ongoing UFlourish survey is a student-informed research effort.[6] Peer health educators (PHEs) are included at all stages of the research from design to implementation and we will include the student perspective in the interpretation and dissemination of findings.

3 Results

3.1 Description of the sample

The response rate among Queen's undergraduate students was 13.5% (n= 3,452). In this report, we describe the responses of 3,013 Queen's students with complete data on the variables of interest (Table 1) The Queen's student participant sample was broadly representative of the eligible student population by year and program of study, full versus part-time, and international versus domestic status. However, more students in the sample identified as female (70.1% vs. 57.7%, χ^2 p<.01) and were younger than 19 years old (40.6% vs 35.0%, χ^2 p<.01) compared to the university database. The average age of the study sample was 19.6 (SD= 2.8) years old, and most students were domestic (92.5%). Students were most likely to be preparing to begin their first year (25.4%) or finishing first year (23.9%) at the time of survey completion, and the most common programs of study were Arts, Humanities, and Social Sciences (33.8%), Life and Physical Sciences (27.4%), and Engineering and Applied Science (20.2%). The response rate among the first year Oxford University student cohort was 45.0% (n=356). In this report we describe the responses of 337 students with complete data on the Pandemic Anxiety Scale and the impact of COVID-19 items. The average age of student respondents was 18.4 years old, and the majority identified as female (61.7%). In comparison, Queen's first-year students were an average age of 18.6 (SD=2.4) years and 72.1% identified as female.

3.2 Knowledge about COVID-19 and associated experiences

Overall, Queen's students rated their knowledge level on COVID-19 as good to very good (Mean= 5.0 out of 7, SD=1.1). Most reported following government recommendations (90%

≥5 out of 7), and female students were more likely than males to report following recommendations (91.3% vs 86.7%, p<.01). Most students (61.9%) reported self-isolating, defined in this survey as "staying at home and avoiding contact with people outside of your household" (Table 1). A minority reported having continued to live their life as normal (n= 125 (4.0%)). Female students were more likely to report self-isolating (63.9% vs 57.0%, χ^2 p<0.05), and males were more likely to report no change in behaviour (8.0% vs 2.3%, χ^2 p<0.05).

Table 1. Description of the Queen's (Canadian) summer 2020 survey sample, including student levels of knowledge on COVID-19, following of recommendations, and approaches to self-isolation

	N	(%)
Age		
≤18	1222	(40.6)
19-20	1062	(35.3)
≥21	729	(24.2)
Gender		
Female	2111	(70.1)
Male	868	(28.8)
Other	34	(1.13)
Program of Study		
Arts, Humanities & Social Sciences	1019	(33.8)
Life and Physical Sciences	824	(27.4)
Engineering and Applied Science	607	(20.2)
Business	166	(5.5)
Computing	93	(3.1)
Nursing	92	(3.1)
Health Sciences	64	(2.1)
Law	74	(2.5)
Medicine	74	(2.5)
Year of Study		
Incoming	765	(25.4)
First	721	(23.9)
Second	517	(17.2)
Third	536	(17.8)
Fourth	369	(12.3)
Fifth or Sixth	105	(3.5)
International/Domestic Status		
Domestic	2788	(92.5)
International	225	(7.5)
Knowledge level on COVID-19		
1 (Very poor) to 3	209	(6.9)
4	664	(22.0)
5 to 7 (Very good)	2140	(71.0)
Following COVID-19 recommendations		
1 (Not at all) to 3	91	(3.0)
4	203	(6.7)
5 to 7 (Very much so)	2719	(90.2)
Approach to self-isolation		
No change/ life as usual	125	(4.0)
Minor change but not isolation	1075	(34.2)
Self-isolation	1946	(61.9)

3.3 COVID-19 related worries

Responses to the COVID-19 Pandemic Anxiety Scale (Figure 1) showed that almost all Queen's students agreed that COVID-19 is a serious issue (93.7%). This was consistent across genders and age groups (Supplemental Table 1). Although many students reported concerns about catching COVID-19 (48.1%), a greater proportion were worried about infecting others (64.0%), or friends and family catching it (74.9%). Few students reported being afraid to leave the house (14.7%), and the majority were not worried about access to food and essential items (87.6%). These trends were consistent across gender and age groups and were consistent with responses from Oxford students (Supplemental Figure 1).

Most students reported concerns about missing university (67.8%), with younger students most worried (age 18 or younger= 80.4%, age 19-20= 72.1%, and age 21 or older= 47.7%; χ^2 $p<0.01$). Many students reported worries about their finances (58.4%), and long-term academic and job prospects (78.9%). Both trends were consistent across genders and age groups (Supplemental Table 1). Oxford student responses to the Pandemic Anxiety Scale were largely consistent with Queen's student responses, except for a smaller percentage of Oxford students reporting concerns about finances (26.7%) and long-term academic and job prospects (50.1%, Supplemental Figure 1).

3.4 Impact of COVID-19

3.4.1 Effects on university and studies

Queen's students commonly reported that the pandemic had negatively impacted their studies (69.9%) (Figure 1). While most students reported neither a positive nor negative impact on their plans to continue at university (61.5%), a notable proportion reported a negative impact (29.4%). Both a positive (22.8%) and negative (27.8%) impact on grades was reported. Most students perceived online learning negatively (61.2%), and reported a negative impact of the pandemic on their prospects for internships, exchanges, and other enriched learning experiences (68.0%). These findings were consistent across gender, age group, and year of study (Supplemental Table 2), and largely consistent with the Oxford student responses. However, a smaller proportion of Oxford students reported a negative impact on their plans to continue at university (14.2%), and negative perceptions of online learning (30.9%; Supplemental Figure 1).

3.4.2 Employment and finances

Most students at Queen's (69.3%) and Oxford (72.4%) reported a negative impact on their prospects for summer employment. A third of Queen's students reported a negative impact on their prospects to achieve their career aspirations (37.8%). Additionally, students in later years of study reported a more negative impact on their career aspirations (χ^2 $p<0.05$). Most students reported a negative impact on their finances (51.8%), and few reported a negative impact on their ability to access food and essentials (10.7%).

3.4.3 Exercise, leisure and social life

Queen's students reported both a negative (42.9%) and positive (30.3%) impact on their ability to exercise, but most reported a negative impact on their hobbies and leisure activities (56.4%). These findings were consistent with the Oxford data (Supplemental Figure 1). Most students reported a negative impact on their social life (74.0%). While many students reported neither a positive nor negative impact on their relationships with family members (41.6%), several reported a negative impact (24.9%).

3.4.4 Receipt of Mental Health Support

Among those Queen's students who receive mental health support (n=1,256), most reported this support was unaffected by COVID-19 (66.9%). However, significantly more females reported their support being negatively affected than males (37.4% of females, 18.2% of males, χ^2 $p<0.005$). There was no significant difference in the proportions of students reporting a negative impact according to age or year of study.

3.5 Common Pandemic Impact Themes – Qualitative analysis

Free text responses to an open-ended question asking Queen's (n= 815) and Oxford (n= 60) students to describe other impacts related to COVID-19 were analysed for major themes. See Supplemental Materials Appendix A1 for representative quotes.

3.5.1 Negative impact due to social isolation

Many students (56.0% Queen's, 33.3% Oxford) described social isolation to be associated with feelings of anxiety, loneliness, and restlessness due to loss of in-person contact with peers, friends, and significant others. Many students described their friends as key supports, and that reduced contact worsened their well-being: "Forced separation from part of my support system has had a negative impact on both my academics and mental health". Interestingly, students reported that isolation with roommates or family members, with whom they had already-strained relationships, increased stress and caused feelings of being trapped in a negative home environment which worsened mental health: "Having no break from my fairly stressful home situation has not been great for my mental health". Overall, reduced interaction with support networks and forced confinement with others increased stress.

3.5.2 Challenging academic and institutional changes

Students described challenges in rapidly adapting to new learning methods (32.1% of Queen's students, 23.3% of Oxford students). Online learning was reported as difficult or less effective than in-person instruction due to lack of quiet study spaces, blurred school and home boundaries, and distance from peers: "Getting myself into an exam or essay-writing mindset at home is much harder than I thought it would be". Students reported difficulty coping with high work demands outside their usual surroundings, isolated from peers during a stressful, uncertain time: "I am finding it hard to keep a balanced perspective on work and assignments working at home by myself and not being around friends". Concerns about learning experiences and future preparedness stemmed from the loss of practical course components, cancellation of professional placements, and reduced access to specialized facilities. The cancellation of key milestones (orientation week, student sports and clubs) contributed to worries about personal development and the quality of students' social experience at university. Responses concerning institutional pandemic responses were mixed, including understanding given the circumstances, and frustration with decisions regarding tuition, campus closure, and a perceived lack of support.

3.5.3 Financial Challenges

Some Queen's students (11.4%), but no Oxford students, expressed additional, specific financial concerns. These included frustration and anxiety regarding reduced income due to fewer career opportunities and employment termination, and expenses due to continued student housing and university tuition fees. Reduced income combined with maintained expenses amplified financial stress.

3.5.4 Disruptions to support services and means of coping

A small proportion of students at both universities (5.6% Queen's, 5.0% Oxford) described disrupted access to health and support services, including difficulties accessing prescription medication and obtaining healthcare appointments and in-person counselling. Fear of accessing services in-person due to risk of COVID-19 exposure was reported as impeding usual care: "Too afraid to visit hospital for routine problems". Students described reluctance to use online services, outlining difficulties adapting to or navigating them. Additionally, reduced engagement in leisure or physical group activities usually key to managing stress and protective for mental health was reported as negatively impacting the ability to cope: "It has removed my ability to train for my sport which was a crucial part of my weekly structure 6 days a week, and was critical in my being able to maintain my mental health and work/study productively".

4 Discussion

The COVID-19 pandemic has caused major disruption to university and has had far-reaching impacts on students' daily lives, well-being and perception of their future. Our study explored undergraduate student experiences and worries in the early part of the pandemic, and the associated impact on their education, daily life, career prospects and mental health support. To our knowledge, this is the first study to compare the impact of the pandemic on university students across different countries. We hope that this information can be used to support students during and beyond the pandemic.

Nearly all students across both universities agreed that COVID-19 is a serious issue, but female students at Queen's were more likely than males to report following government recommendations and adapting their lifestyle. This may be partly due to increased anxiety among female students. Screening positive for anxiety and depression has been found to be higher in female university students and in females of similar age in the general population when compared to males.[4,5,12] Moreover, females appear more susceptible to anxiety and depression surrounding COVID-19,[13-15] and are more likely to follow COVID-19-related public health guidelines.[16] However, we found no significant differences between male and female students in terms of worries and concerns around the pandemic using the Pandemic Anxiety Scale.

Younger students were significantly more likely to report concerns about missing university than older students, who were more likely to be worried about the impact on their career prospects. This may reflect different priorities: missing university is a more immediate concern than applying for jobs for younger students who are years away from graduating. In contrast, older students may be more concerned with the prospect of leaving university at a time where workers are being furloughed or made redundant, and employment rates are falling.[17-18] This is supported by a consistent concern about long-term academic and job prospects across age groups, and by our qualitative analysis. Queen's, but not Oxford students discussed concerns surrounding employment, which may reflect the presence of older students in the Queen's sample. In summary, students at different stages of their studies require targeted approaches to address their immediate concerns regarding future academic or career prospects.

While students expressed worries about catching COVID-19, many more were worried about infecting others, or friends and family contracting it. Most university students are relatively young with few co-morbidities and therefore at low-risk for severe COVID-19 disease but

may have family members at higher risk of developing severe disease due to their age and co-morbidities.[19] This is an important consideration for decisions regarding bringing students to campus, as students may worry about returning home, either during holidays or following a rise in infections, and potentially exposing family or friends in high-risk groups to COVID-19. The UK government introduced plans for university students to receive COVID-19 tests before returning home for Christmas, which may have allayed students' worries about exposing family members to COVID-19, but was challenging for students who tested positive and were required to isolate.

Several students at Queen's and Oxford expressed concern about the impact of the pandemic on their finances. We noted that a smaller proportion of Oxford students reported these concerns compared to Queen's students, which may be associated with differences in year of study and concerns about employment after graduation. Our qualitative analysis supported the contribution of mandatory continued payment for university accommodation and tuition with reduced perceived value, and loss of income to financial anxiety.[20] Additionally, many students rely on money from family members, whose jobs and income may have been negatively affected by the pandemic, or their ability to work part-time or seasonally which may have been similarly affected by COVID-19. Previous studies have indicated student concern about finances during COVID-19, particularly those remaining in student residences during lockdown.[21]

Most students indicated that COVID-19 negatively impacted their studies, as may be expected due to shifts to online learning or full course suspension. Unfortunately, negative perceptions of online learning suggest dissatisfaction with alternative teaching methods, which may have been worsened by unchanged tuition fees and how quickly these changes were introduced. However, most Queen's students reported little impact on their grades, suggesting disruption is being accounted for in assessments, that students and/or professors are adapting adequately to maintain grades, and/or it is too early to measure the impact on academic performance. While most students reported no impact on their plans to continue university, nearly 30% of Queen's students and 15% of Oxford students reported a negative impact. This may suggest students are more likely to discontinue their studies as a result of the pandemic, and would have significant repercussions for universities' income. Most students also reported a negative impact on their prospects for summer internships, employment, learning exchanges, and other academic pursuits. Explanations include travel restrictions, workplace closures, reluctance to employ non-essential workers, social distancing restrictions, and student concerns regarding exposure to COVID-19. Students' worries surrounding future academic and career prospects might be related to fewer opportunities compared to their predecessors, and increased competition on graduation with less work or academic experience. Reassuringly, most students reported no impact on their ability to access food and other essentials.

Students reported both positive and negative impacts on exercise. Disruption to routines, closure of gyms or lack of university sports societies cited in our qualitative analysis may account for the negative impact. More time to exercise, availability of online classes, and more space for exercise at home may account for the positive impact. Most students reported a negative impact on their participation in hobbies and leisure activities, and unsurprisingly, on their social life. The combination of these factors suggests a significant impact of COVID-19 on student mental well-being, given the importance of recreation, exercise and social connectedness to the support of mental health.[13,22]

Select populations, that may not be readily identified as requiring tailored support, reported unique challenges. Students with dependents described challenges balancing their studies and caring responsibilities due to reduced childcare services and closure of schools. International students reported inability to travel home to reunite with family and friends, and anxiety associated with remaining in a foreign country during a pandemic. Affordability of remaining away from home, high tuition costs, and lack of financial support were concerns for these students.

Strengths of our study include providing timely, important information on a largely unknown and highly relevant topic: the impact of a global pandemic on the lives and experiences of university students. Responses from large, diverse samples of university students were utilized and allowed comparison between countries and institutions. Our findings build on those of previous studies that have focused specifically on mental health impacts,[15,23-25] or been limited to medical students or much smaller samples.[26-31] We assessed the impact of COVID-19 using a validated Pandemic Anxiety Scale. One of the main study limitations was the low response rate in the Queen's sample, which likely reflects the timing of the survey during summer break without a preceding student engagement campaign. Nonetheless, the student sample appeared broadly representative of the Queen's undergraduate population in terms of demographics and program of study. The Oxford data pertains only to first-year students. However, increased surveying of younger students may be more informative for higher education policies, as these students are more likely to be studying at university when these policies are enacted. In this analysis, students at both universities were surveyed early in the pandemic, and worries and impacts may change over the course of the pandemic. Therefore, we will repeatedly survey students at both universities to better understand student concerns and the impact of the pandemic on student experiences and well-being over time. We hope that this information will be helpful to inform universities as to how best to address student priority learning and well-being needs.

5 Conclusion

The COVID-19 pandemic has had wide-ranging impacts on university student experience and mental health. Our findings support that undergraduate students have concerns regarding disruptions to university studies, the inadequacies of online learning as a substitute for in-person learning, and their finances and future academic and career prospects. A concerning number of students reported the possibility of discontinuing their studies due to the pandemic. Many students reported negative impacts of COVID-19 on protective factors for well-being, including socializing, exercise, hobbies and leisure activities, family relationships, and mental health support. Higher education institutions must prepare to address students' concerns in the short term during the pandemic, and provide ongoing support for students in the aftermath of COVID-19 as the long-term impacts become apparent.

COVID-19 Impact on University Students

Figure legends

Figure 1: Queen's university students' responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

Contributors

AD developed the protocol in collaboration with colleagues including KEAS and students including DR, NK and SC. DR led the student engagement campaign at Queen's and SC and AD the survey launch, while CK supervised by AD and KEAS led the engagement and survey launch at Oxford. JA, NK and AD led the quantitative analysis, whilst KEAS, AB, JB and DR the qualitative analysis. All named authors contributed to the writing and reviewed the final manuscript.

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Competing interests

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Data sharing statement

Deidentified raw data is available upon reasonable request to the corresponding author.

Ethical approval

Ethical approval was obtained from the Central University Research Ethics Committee in Oxford (R60998 – RE001), and the Queens University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (HSREB) in Canada (PSIY-669-19). Participants gave informed consent as part of the survey.

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References

[1]Adhikari, S. P., Meng, S., Wu, Y. J., Mao, Y. P., Ye, R. X., Wang, Q. Z, et al. (2020). Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infectious diseases of poverty*, *9*(1), 29. https://doi.org/10.1186/s40249-020-00646-x

[2]Pfefferbaum, B., & North, C. (2020). Mental health and the Covid-19 pandemic. *New England Journal of Medicine*, 383(6): 510–12. https://doi.org/10.1056/nejmp2013466.

[3]Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Magni, P et al. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*, 3(1). https://doi.org/10.37074/jalt.2020.3.1.7

[4]King, N., Pickett, W., McNevin, S., Bowie, C., Rivera, D., Keown-Stoneman, C., et al. (2020). Mental health need of students at entry to university: Baseline findings from the U-Flourish Student Well-Being and Academic Success Study. *Early Intervention in Psychiatry*, 1–10. https://doi.org/10.1111/eip.12939

[5]Duffy, A., Keown-Stoneman, C., Goodday, S., Horrocks, J., Lowe, M., King, N, et al. (2020). Predictors of mental health and academic outcomes in first-year university students: Identifying prevention and early-intervention targets. *BJPsych open*, *6*(3), e46. https://doi.org/10.1192/bjo.2020.24

[6]Goodday SM, Rivera D, Foran H, et al. (2019). U-Flourish university students well-being and academic success longitudinal study: a study protocol. *BMJ Open,* 9:e029854. doi:10.1136/ bmjopen-2019-029854

[7]McElroy, E., Patalay, P., Moltrecht, B., Shevlin, M., Shum, A., Creswell, C., et al. (2020). Demographic and health factors associated with pandemic anxiety in the context of COVID-19. *British journal of health psychology*, *25*(4), 934–944. https://doi.org/10.1111/bjhp.12470

[8]RStudio Team (2020). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL *http://www.rstudio.com/*.

[9]Ritchie, J. & Spencer, L. 1994. Qualitative data analysis for applied policy research by Jane Ritchie and Liz Spencer in A. Bryman and R. G. Burgess [eds.] 'Analysing qualitative data', (pp.173-194). London: Routledge.

[10]Gale, N. K., Heath, G., Cameron, E., Rashid, S. & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology,* **13**:117. https://doi.org/10.1186/1471-2288-13-117

[11]von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. 2007. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *BMJ, 335* doi: https://doi.org/10.1136/bmj.39335.541782.AD

[12]McManus, S., Bebbington, P. E., Jenkins, R., Morgan, Z., Brown, L., Collinson, D., et al. (2020). Data Resource Profile: Adult Psychiatric Morbidity Survey (APMS). *International journal of epidemiology*, *49*(2), 361–362e. https://doi.org/10.1093/ije/dyz224

[13]Xiong, J., Lipsitz, O., Nasri, F., Lui, L., Gill, H., Phan, L., et al. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *Journal of affective disorders*, *277*, 55–64. https://doi.org/10.1016/j.jad.2020.08.001

[14]Smith, L., Jacob, L., Yakkundi, A., McDermott, D., Armstrong, N. C., Barnett, Y., et al. (2020). Correlates of symptoms of anxiety and depression and mental wellbeing associated with COVID-19: a cross-sectional study of UK-based respondents. *Psychiatry research*, *291*, 113138. https://doi.org/10.1016/j.psychres.2020.113138

[15]Elmer, T., K. Mepham, and C. Stadtfeld. 2020. Students under Lockdown: Comparisons of Students' Social Networks and Mental Health before and during the COVID-19 Crisis in Switzerland. *PloS one*, 15 (7): e0236337. https://doi.org/10.1371/journal.pone.0236337

[16]Guzek, D., Skolmowska, D., & Głąbska, D. (2020). Analysis of Gender-Dependent Personal Protective Behaviors in a National Sample: Polish Adolescents' COVID-19 Experience (PLACE-19) Study. *International journal of environmental research and public health*, *17*(16), 5770. https://doi.org/10.3390/ijerph17165770

[17]Statistics Canada. 2020. Canadian Economic Dashboard and COVID-19 https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2020009-eng.htm [Accessed 31st October 2020]

[18]Office for National Statistics. 2020. Coronavirus (COVID-19) roundup: Economy, business and jobs. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/articles/coronaviruscovid19roundupeconomybusinessandjobs/2020-07-02#youngperson [Accessed 31st October 2020]

[19]Clift, A.K., Coupland, C.A.C., Keogh, R.H., Diaz-Ordaz, K., Williamson, E. (2020). Living risk prediction algorithm (QCOVID) for risk of hospital admission and mortality from coronavirus 19 in adults: national derivation and validation cohort study. *BMJ*, 371, pp. m3731. https://doi.org/10.1136/bmj.m3731

[20]Office for National Statistics. 2020. Labour market overview, UK: October 2020. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/october2020 [Accessed 31st October 2020]

[21]Husky, M., Kovess-Masfety, V., & Swendsen, J. (2020). Stress and anxiety among university students in France during Covid-19 mandatory confinement. *Compr. Psychiatry* **102**, 152-191. doi: 10.1016/j.comppsych.2020.152191

[22]Rastegar Kazerooni, A., Amini, M., Tabari, P., & Moosavi, M. (2020). Peer mentoring for medical students during the COVID-19 pandemic via a social media platform. *Medical education*, *54*(8), 762–763. https://doi.org/10.1111/medu.14206

[23]Copeland, William E., Ellen McGinnis, Yang Bai, Zoe Adams, Hilary Nardone, Vinay Devadanam, Jeffrey Rettew, and Jim J. Hudziak. 2021. Impact of COVID-19 Pandemic on College Student Mental Health and Wellness. *Journal of the American Academy of Child &*

COVID-19 Impact on University Students

Adolescent Psychiatry, 60 (1): 134-141.e2. https://doi.org/https://doi.org/10.1016/j.jaac.2020.08.466.

[24]Essadek, A., and T. Rabeyron. 2020. Mental Health of French Students during the Covid-19 Pandemic. *Journal of affective disorders*, 277 (December): 392–93. https://doi.org/S0165-0327(20)32648-3

[25]Wathelet, M., S. Duhem, G. Vaiva, T. Baubet, E. Habran, E. Veerapa, C. Debien, et al. 2020. Factors Associated With Mental Health Disorders Among University Students in France Confined During the COVID-19 Pandemic. *JAMA network open*, 3 (10): e2025591. https://doi.org/10.1001/jamanetworkopen.2020.25591 [doi].

[26]Alsoufi, A., A. Alsuyihili, A. Msherghi, A. Elhadi, H. Atiyah, A. Ashini, A. Ashwieb, et al. 2020. Impact of the COVID-19 Pandemic on Medical Education: Medical Students' Knowledge, Attitudes, and Practices Regarding Electronic Learning. *PloS one*, 15 (11): e0242905. https://doi.org/10.1371/journal.pone.0242905 [doi].

[27]Byrnes, Y. M., A. M. Civantos, B. C. Go, T. L. McWilliams, and K. Rajasekaran. 2020. Effect of the COVID-19 Pandemic on Medical Student Career Perceptions: A National Survey Study. *Medical education online*, 25 (1): 1798088. https://doi.org/10.1080/10872981.2020.1798088 [doi].

[28]Choi, B., L. Jegatheeswaran, A. Minocha, M. Alhilani, M. Nakhoul, and E. Mutengesa. 2020. The Impact of the COVID-19 Pandemic on Final Year Medical Students in the United Kingdom: A National Survey. *BMC medical education*, 20 (1): 206-020-02117–1. https://doi.org/10.1186/s12909-020-02117-1 [doi].

[29]Kecojevic, A., C. H. Basch, M. Sullivan, and N. K. Davi. 2020. The Impact of the COVID-19 Epidemic on Mental Health of Undergraduate Students in New Jersey, Cross-Sectional Study. *PloS one*, 15 (9): e0239696. https://doi.org/10.1371/journal.pone.0239696 [doi].

[30]Lyons, Z., H. Wilcox, L. Leung, and O. Dearsley. 2020. COVID-19 and the Mental Well-Being of Australian Medical Students: Impact, Concerns and Coping Strategies Used. *Australasian psychiatry : bulletin of Royal Australian and New Zealand College of Psychiatrists*, 28 (6): 649–52. https://doi.org/10.1177/1039856220947945 [doi].

[31]Son, C., S. Hegde, A. Smith, X. Wang, and F. Sasangohar. 2020. Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study. *Journal of medical Internet research,* 22 (9): e21279. https://doi.org/10.2196/21279 [doi].

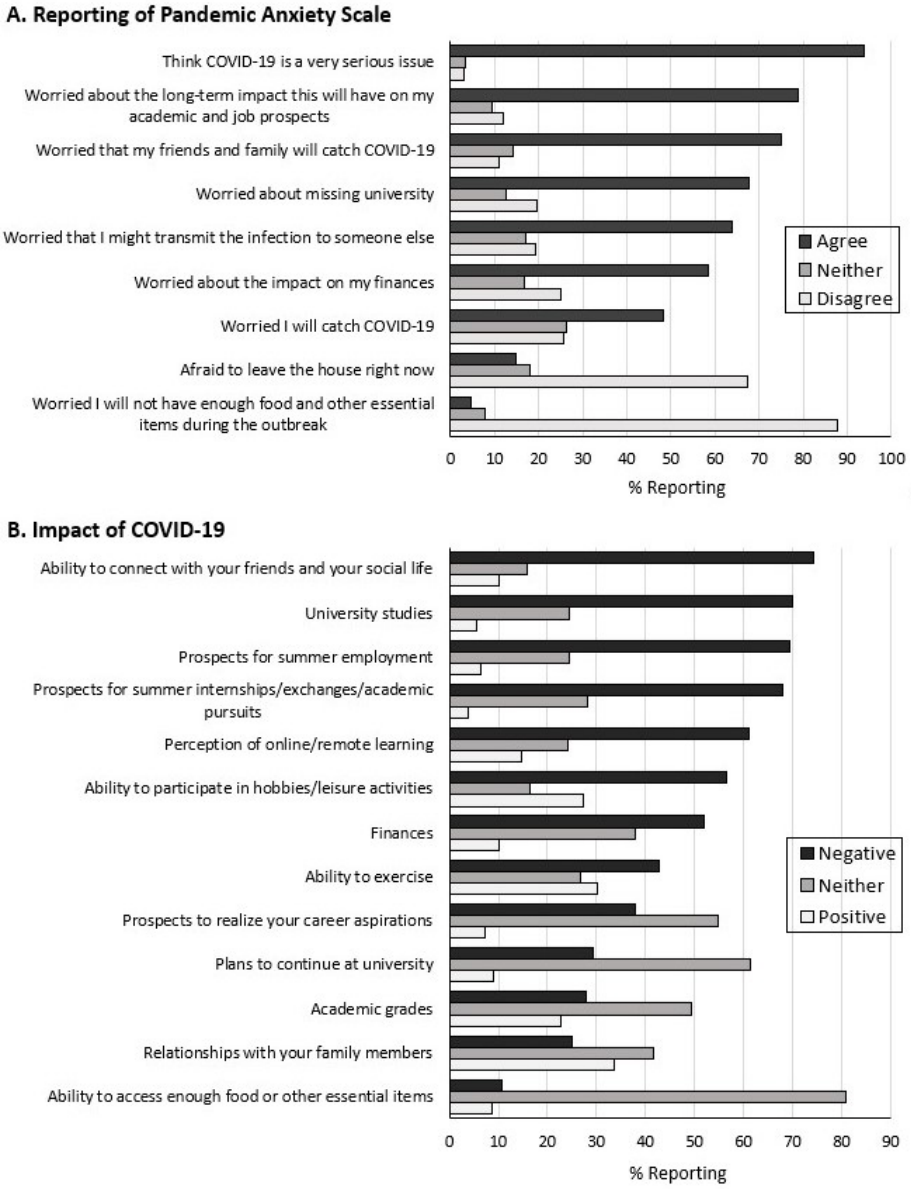


Figure 1: Queen's university students' responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

172x225mm (96 x 96 DPI)

Supplementary Material

Supplemental Table 1. Queen's University percentage ratings on the COVID-19 Pandemic Anxiety Scale items by gender and age

		Gender			Age Group			
	Total (n= 3013)	Male (n= 862)	Female (n= 2100)	p*	≤18 (n= 1166)	19-20 (n= 921)	≥21 (n= 926)	p*
Think COVID-19 is a very serious issue								
Agree	93.7	90.5	94.9	0.46	91.7	94.5	95.4	0.86
Neutral	3.2	4.3	2.8		4.4	2.7	2.3	
Disagree	3.1	5.2	2.3		3.9	2.8	2.4	
Worried that I will catch COVID-19								
Agree	48.1	38.2	52.1	0.10	43.4	50.1	51.9	0.76
Neutral	26.3	28.1	25.6		28.9	23.8	25.4	
Disagree	25.7	33.8	22.3		27.7	26.2	22.7	
Worried friends and family will catch COVID-19								
Agree	74.9	67.5	78.1	0.18	68.3	76.8	81.5	0.28
Neutral	14.1	16.0	13.2		17.2	13.0	11.2	
Disagree	11.0	16.5	8.7		14.6	10.2	7.2	
I am afraid to leave the house right now								
Agree	14.7	9.3	16.6	0.17	12.3	15.1	17.2	0.89
Neutral	18.0	15.1	19.4		17.2	18.8	18.3	
Disagree	67.3	75.6	64.0		70.4	66.1	64.6	
I am worried that I might transmit the infection to someone else								
Agree	64.0	54.2	67.7	0.11	58.5	65.0	69.8	0.57
Neutral	16.9	18.8	16.2		18.7	16.6	14.8	
Disagree	19.2	27.0	16.0		22.8	18.3	15.4	
I am worried I will not have enough food and other essential items during the outbreak								
Agree	4.7	4.6	4.6	0.83	4.1	3.9	6.2	0.92
Neutral	7.7	6.1	8.4		6.9	8.6	8.0	
Disagree	87.6	89.2	87.0		89.0	87.5	85.9	
I am worried about missing university								
Agree	67.8	63.8	69.5	0.60	80.4	72.1	47.7	<.01
Neutral	12.6	12.6	12.6		9.2	12.2	17.4	
Disagree	19.5	23.5	17.9		10.4	15.7	34.9	
I am worried about the impact on my finances								
Agree	58.4	50.0	61.6	0.24	53.5	61.8	61.3	0.71
Neutral	16.6	18.8	15.8		19.9	14.3	14.6	
Disagree	25.0	31.2	22.6		26.6	23.9	24.1	
I am worried about the long-term impact this will have on my academic and job prospects								
Agree	78.9	72.7	81.4	0.27	77.6	80.8	78.6	0.92
Neutral	9.3	10.1	8.9		11.1	8.1	8.2	
Disagree	11.8	17.2	9.7		11.2	11.1	13.2	

Note: *p-value for chi-square test

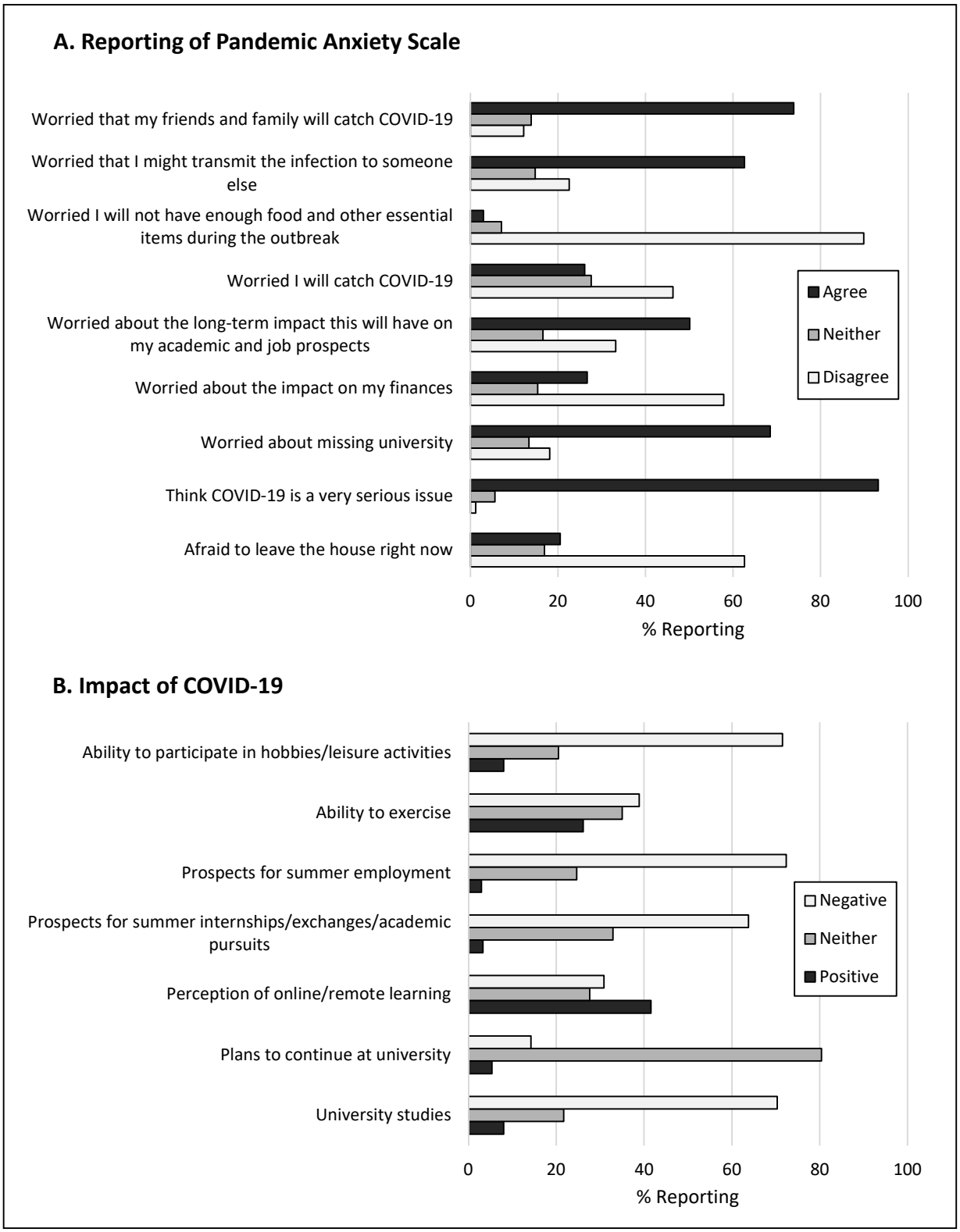
Supplemental Table 2. Queen's University percentage reporting by gender, age group and year of study. Could you describe the impact that the COVID-19 pandemic and associated social distancing have had on:

		Gender			Age Group				Year of Study			
	Total (n=3013)	Male (n= 862)	Female (n=2100)	p*	≤18 (n=1166)	19-20 (n=921)	≥21 (n=926)	p*	Incoming (n= 765)	1st/2nd (n=1238)	≥3rd (n=1010)	p*
Your university studies?												
Negative	69.9	65.2	71.8	0.60	67.2	73.1	70.1	0.72	60.1	74.7	71.3	0.14
Neutral	24.5	28.3	22.9		28.5	20.6	23.2		34.8	20.0	22.2	
Positive	5.7	6.5	5.3		4.4	6.3	6.7		5.1	5.3	6.5	
Your plans to continue at university?												
Negative	29.4	28.5	29.4	0.86	31.1	30.9	25.8	0.74	33.1	28.6	27.7	0.56
Neutral	61.5	60.8	62.2		58.7	59.5	67.2		54.8	62.7	65.2	
Positive	9.0	10.7	8.4		10.2	9.6	7.0		12.2	8.7	7.0	
Your perception of online/remote learning?												
Negative	61.2	61.1	61.3	0.92	62.8	63.5	56.9	0.84	61.0	61.4	61.1	1.00
Neutral	24.1	23.1	24.7		22.0	24.0	26.8		24.1	23.8	24.5	
Positive	14.7	15.8	14.0		15.2	12.5	16.3		14.9	14.8	14.5	
Your academic grades?												
Negative	27.8	29.0	27.2	0.89	26.9	31.2	25.5	0.68	21.7	32.1	27.0	0.46
Neutral	49.4	46.9	50.3		47.0	47.1	54.6		50.6	46.4	52.1	
Positive	22.8	24.1	22.5		26.1	21.7	19.9		27.7	21.4	20.9	
Your prospects for summer internships/exchanges/academic pursuits?												
Negative	68.0	63.9	69.8	0.68	64.0	74.3	66.8	0.43	56.7	74.3	68.8	0.11
Neutral	28.2	32.0	26.8		32.2	21.1	30.3		38.8	22.0	27.9	
Positive	3.8	4.1	3.5		3.8	4.7	2.8		4.4	3.7	3.3	
Your prospects for summer employment?												
Negative	69.3	65.3	71.4	0.64	68.2	71.6	68.5	0.82	62.2	73.7	69.3	0.45
Neutral	24.4	27.1	23.0		23.8	22.5	27.0		28.8	20.6	25.6	
Positive	6.3	7.5	5.7		8.1	6.0	4.5		9.0	5.7	5.0	
Your prospects to realize your career aspirations?												
Negative	37.8	33.8	39.4	0.68	28.8	40.7	46.2	0.15	25.4	38.7	46.1	0.05
Neutral	54.8	57.8	53.9		62.9	51.9	47.6		65.9	54.3	47.1	
Positive	7.4	8.5	6.8		8.3	7.4	6.2		8.8	7.0	6.7	
Your finances?												
Negative	51.8	46.4	54.1	0.53	45.5	55.3	56.4	0.53	40.3	56.5	54.9	0.16
Neutral	38.0	41.6	36.5		43.3	36.0	33.3		47.2	35.1	34.7	
Positive	10.2	11.9	9.3		11.2	8.7	10.4		12.5	8.5	10.5	
Your ability to access enough food or other essential items?												
Negative	10.7	10.2	10.9	0.99	8.6	11.4	12.6	0.88	9.0	10.3	12.4	0.85
Neutral	80.8	81.0	80.6		82.2	79.4	80.2		80.0	81.8	80.0	
Positive	8.6	8.8	8.6		9.2	9.2	7.1		11.0	7.8	7.6	
Your ability to exercise?												
Negative	42.9	46.6	41.1	0.58	40.7	41.0	47.6	0.68	40.4	42.0	45.9	0.88
Neutral	26.8	27.5	26.5		25.7	30.9	24.1		25.9	28.9	25.0	
Positive	30.3	25.9	32.4		33.6	28.0	28.3		33.7	29.1	29.1	

Supplemental Table 2 (Continued)

	Total (n=3013)	Gender: Male (n=862)	Gender: Female (n=2100)	p*	Age Group: ≤18 (n=1166)	Age Group: 19-20 (n=921)	Age Group: ≥21 (n=926)	p*	Year of Study: Incoming (n= 765)	Year of Study: 1st/2nd (n=1238)	Year of Study: ≥3rd (n=1010)	p*
Your ability to participate in hobbies/leisure activities?												
Negative	56.4	57.1	56.3	0.40	54.6	56.9	58.2	0.86	55.7	56.1	57.3	0.99
Neutral	16.3	20.5	14.7		15.2	18.9	15.2		16.3	16.6	16.0	
Positive	27.2	22.4	29.0		30.2	24.2	26.6		28.0	27.3	26.6	
Your ability to connect with your friends and your social life?												
Negative	74.0	72.7	74.6	0.95	71.1	76.1	75.7	0.78	68.8	75.7	76.0	0.67
Neutral	15.9	16.8	15.5		16.3	14.5	16.8		17.9	14.5	16.2	
Positive	10.0	10.4	9.9		12.6	9.3	7.5		13.3	9.9	7.7	
Your relationships with your family members?												
Negative	24.9	20.2	26.6	0.37	25.0	24.2	25.4	0.99	23.1	26.4	24.4	0.97
Neutral	41.6	48.3	39.0		39.9	42.2	43.1		43.0	39.3	43.4	
Positive	33.5	31.6	34.4		35.1	33.6	31.5		33.9	34.3	32.3	

Note: *p-value for chi-square test



Supplemental Figure 1. Oxford university students' (n= 337) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

Supplemental Materials Appendix A1: Quotes from qualitative data analysis of free text responses

Social isolation

"I highly depend on social environments to support my mental health, so not being able to see friends is quite challenging as it makes my depression worse"

"Forced separation from part of my support system has had a negative impact on both my academics and mental health"

"Impacts of the pandemic on family members have reverberating effects to all members of household"

"Being stuck in a house with my parents has negatively impacted my mental health"

"I have to be near my emotionally abusive mother, I self harm a lot more now and I really need access to university student wellness center but I cannot call them while here"

"I've been feeling more lonely and restless with the pandemic going on. There are less outlets to relax due to isolation (ie sports leagues, meeting with friends, etc.)"

"As much as I would sometimes find social interaction difficult and draining, being starved of it is definitely having a negative impact on my mental health."

"Not being able to meet up with friends in person has been somewhat of a blow to mental health"

"Not being able to see my partner has had a significant impact on my mental health."

"Having no break from my fairly stressful home situation has not been great for my mental health"

"I find being stuck inside with my family is very stressful and it leaves me sometimes feeling unable to work which compounds the already existing stress about work and it often becomes a cycle I find difficult to break"

Work adaptation

"Living and working in the same place is a struggle. I am concerned about this going into another year of school with little opportunity for in person learning or access to on campus study spaces.

I am nervous about completing my final year of my undergraduate degree remotely, as my program is very lab-based."

"I am finding it hard to keep a balanced perspective on work and assignments working at home by myself and not being around friends."

"Getting myself into an exam or essay-writing mindset at home is much harder than I thought it would be."

"I am much less motivated to do my university assignments when I am home compared to when I am at university"

Coping skills

"I have found that with the pandemic and social distancing requirements I have had more difficulty than normal maintaining my mental wellness. I have struggled with some anxiety at several points in the past few months as I haven't have school or work to focus on, and small problems are exacerbated as they are taking up more focus."

"It's devastating that we won't get a normal orientation week or first year, but I do understand that Queen's is doing everything they can to try and make it better."

"Severely imparts my ability to spend time outdoors and with my friends, things like rock climbing and hiking and yoga, which are all very important to maintaining my mental health and managing anxiety. It's been a lot harder to deal with in the absence of these things. School was much more stressful online without support of classmates and less connection to professors."

"It has removed my ability to train for my sport which was a crucial part of my weekly structure 6 days a week, and was critical in my being able to maintain my mental health and work/study productively"

Unique populations

"I have been too scared to see my doctor about my physical ~~digestive~~ health issues and they have gotten much worse. I will likely need a lot of treatment when this is all over. I'm too scared to go to a hospital or doctors office because of the virus at the moment as I live with vulnerable individuals"

"Too afraid to visit hospital for routine problems."

"I lost my childcare for two children under 3. Completing online synchronous school while my partner works long hours in the emergency department, and having no help from family because of COVID-19 has left me feeling overwhelmed, un-engaged, frustrated, and easily angered. It has impacted my relationship with my partner and to some extent my self worth as I am being forced to be a stay-at-home mother and student and am unsure if I'll be able to work which gives me a lot of fulfillment, and much needed mental stimulation."

"Trying to juggle dependents alone while in school, as my spouse continues to work"

"Being an international student, I couldn't go back home due to the pandemic. As a result I am all alone. It's lonely and i get restless at times. all this negatively affects by study"

"Not being able to go home as an international student, it was scary to be in this situation in another country"

"Local regulations on flights and exit and entry make international travel difficult, and this also results in the increase in the price of air tickets. An one-way ticket from Canada to China is above 7000 dollars, which is not affordable for me."

"As an international student, I had trouble coming back home, which caused severe stress and started a period of worse mental health for me."

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	#3	State specific objectives, including any prespecified hypotheses	1,2
Methods			
Study design	#4	Present key elements of study design early in the paper	3
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3
Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	3
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is	3-4

		more than one group. Give information separately for for exposed and unexposed groups if applicable.	
Bias	#9	Describe any efforts to address potential sources of bias	3-4
Study size	#10	Explain how the study size was arrived at	4
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	3-4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	3-4
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	3-4
Statistical methods	#12c	Explain how missing data were addressed	3-4
Statistical methods	#12d	If applicable, describe analytical methods taking account of sampling strategy	n/a Not done
Statistical methods	#12e	Describe any sensitivity analyses	n/a Not done
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	4
Participants	#13b	Give reasons for non-participation at each stage	4
Participants	#13c	Consider use of a flow diagram	n/a Described in prose
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	4-5

Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	4
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	5-8
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n/a Descriptive Analysis
Main results	#16b	Report category boundaries when continuous variables were categorized	3,5
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a Not relevant to this study
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	3-5
Discussion			
Key results	#18	Summarise key results with reference to study objectives	5-8
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	10
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	10
Generalisability	#21	Discuss the generalisability (external validity) of the study results	10
Other Information			
Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

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Impact of the COVID-19 pandemic on the experience and mental health of university students studying in Canada and the United Kingdom: a cross-sectional study

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Impact of the COVID-19 pandemic on the experience and mental health of university students studying in Canada and the United Kingdom: a cross-sectional study

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COVID-19 Impact on University Students

Abstract

Objectives: To explore the impact of the COVID-19 pandemic on the experiences and mental health of university students.

Design: A cross-sectional study consisting of an electronic survey about students' experiences and concerns during the pandemic and the associated impact. In addition to the quantitative analysis, free text responses were extracted and analysed using a framework technique

Setting: Queen's university in Canada and the University of Oxford in the UK

Participants: Undergraduate students at Queen's university and first year undergraduate students at the University of Oxford were invited to complete the COVID supplement survey. This study included data from 3013 Queen's students as the primary focus and 339 Oxford students as a secondary comparison.

Results: Females at Queen's reported greater adherence to government recommendations to prevent the spread of COVID-19 (91.3% vs 86.7%, p<.01) and were more likely to self-isolate (63.9% vs 57.0%, p<.01) than males. A similar trend was seen among Oxford students. Students' concerns were wide-ranging including those related to their learning experience, finances, and future academic and career prospects. 78.9% of Queen's students and 50.4% of first-year Oxford students reported worries about the long-term impact on their academic and job prospects. A sizeable proportion of students also reported that the pandemic negatively impacted their plans to continue at university (29.4% of Queen's, 14.2% of Oxford), and disrupted activities important to their mental well-being.. Key themes identified in the qualitative component included the negative impacts of social isolation, challenging academic changes, and disruption to support services and means of coping.

Conclusions: Overall, findings underscore the importance of addressing areas of student concern and the aspects of student life negatively impacted by the pandemic in order to maintain student well-being and support a successful university experience.

Article Summary: Strengths and limitations of this study

- The first study to compare the impact of the COVID-19 pandemic on university students across different countries.
- Responses were obtained from large, diverse samples of university students.
- Validated measures were used to assess the impact of the pandemic on students.
- A low response rate was obtained from the Queen's University sample.
- Participants were surveyed early in the pandemic, and the impact on students may change over time.

1 Introduction

COVID-19 Impact on University Students

In late 2019, the novel Coronavirus (COVID-19) was detected in Wuhan, China, causing disease ranging from asymptomatic infection to life-threatening respiratory compromise.[1] The restrictions imposed to limit viral transmission and the direct impact of the virus have profoundly affected daily life and well-being, with heightened anxiety and reduced access to usual coping mechanisms such as exercise, socialisation, and leisure activities.[2]

University students are a subgroup of the population particularly affected by COVID-19. Remote teaching and social distancing measures implemented across institutions worldwide have dramatically changed campus life.[3] In addition to the changes to daily living experienced by the general population, students have experienced disruption to their learning, assessment and schedules, and the cancellation of enriched learning opportunities such as field trips, laboratory courses, and learning exchanges. Additionally, the pandemic may affect future educational opportunities, job prospects, and financial stability.

The pandemic and its aftermath will likely have lasting effects on both students and universities. Therefore, there is a pressing need for the collection of reliable data to assess the impact of the pandemic on student well-being and academic outcomes. This would improve our understanding of student experiences and concerns, informing institutions' approaches to addressing these.

In this study, we aimed to explore university student experiences and concerns during the COVID-19 pandemic, including worries related to the pandemic and the associated impact on education, daily life, career prospects, and mental health support. We leveraged an ongoing longitudinal survey study of undergraduate students attending Queen's University in Canada and the University of Oxford in the UK.[4-5]

2 Methods

COVID-specific measures were added to the ongoing U-Flourish Student Well-Being and Academic Success survey,[6] which invites first-year university students at Queen's (Canada) and Oxford (UK) to complete electronic surveys at the beginning and end of each academic year. The surveys ask about risk and protective factors for well-being and mental health using validated measures. COVID-related questions were added to the U-Flourish follow-up survey for participating first-year Oxford students (May 2020) and sent out as a supplementary survey to all registered Queen's undergraduate students (July 2020).

2.1 Study Variables

2.1.1 Demographic Characteristics.

Age in years and gender were self-reported and international student status, and program and year of study were obtained from university administrative data.

2.1.2 COVID-19 related measures.

Queen's participants were asked to describe their approach to self-isolation during the pandemic by selecting all options that applied from a list of nine options, grouped into: (1) No change (i.e., "I have lived my life as normal"), (2) Minor change, but not self-isolation (e.g., social distancing, working from home), and (3) Self-isolation (i.e., staying at home and avoiding contact with people outside of your household). Participants rated their knowledge level on COVID-19 from "1 – Very Poor" to "7- Very Good", and whether they have been following government recommendations from "1 – Not at all" to "7 – Very much so".

At both Queen's and Oxford, anxiety surrounding the pandemic was assessed using the COVID-19 Pandemic Anxiety Scale.[7] A series of nine statements asked, how serious an issue do you think COVID-19 is, and how worried are you about the following: catching COVID-19, friends and family catching COVID-19, leaving the house, infecting others, having enough food and other essential items, missing university, and the impact on your finances and long-term academic and job prospects. Each statement was rated on a five-point scale according to level of agreement, re-categorised into 'Disagree' (1-2), 'Neither disagree or agree' (3), and 'Agree' (4-5).

To gauge the impact of COVID-19 on student life, students were asked about the impact of the pandemic on studies and learning opportunities, future academic/professional prospects, lifestyle, relationships and connectedness, and for those in need, access to mental health support. Participants rated the impact of the pandemic and associated social distancing on a five-point scale from 1= Very negative to 5= Very positive (categorised into 'Negative', 'Neither', or 'Positive'). On the Oxford survey, 7 of the 13 impact items were included. Participants were asked if any mental health support they receive had been stopped, postponed or negatively affected due to the pandemic.

Finally, participants were asked "Are there any other significant impacts related to the COVID-19 pandemic on your mental health, wellbeing, or education that you would like to comment on?"

2.2 Statistical Analysis

The primary analysis utilised data from the Queen's COVID-19 survey. Responses to the Pandemic Anxiety Scale and questions assessing the impact of the pandemic and associated social distancing were examined in the Oxford sample in an exploratory manner to compare between institutions and countries. Samples were restricted to participants with complete data on the variables of interest. Analyses were conducted using RStudio.[8] Descriptive statistics were used to describe the sample, and responses to the Pandemic Anxiety Scale and COVID-19 impact items overall and by gender, age group and year of study. The Oxford sample only included first-year students of similar ages, so analyses were limited to examining differences by gender. Students identifying as other than 'male' or 'female' were not included in the gender-stratified analyses because of small numbers (n= 34/3013 in the Queen's sample). Differences in proportions between strata were examined using chi-square tests. The difference in average knowledge of COVID-19 between males and females, and age groups were examined using a t-test.

Qualitative data from the Queen's and Oxford surveys were extracted from free text responses. Qualitative analysis used a framework technique.[9-10] Participant data were interpreted and summarized. Codes comprised of similar information were merged leading to a framework of specific phenomena that appeared increasingly likely to reflect the participant's experience. The study team met regularly to discuss the findings and refine the emerging framework. To reduce researcher bias, the team analysing the qualitative data were not made aware of the quantitative findings until the framework had been agreed.

The STROBE cross-sectional reporting guidelines were used in the reporting of this study.[11]

2.3 Patient and public involvement

The ongoing UFlourish survey is a student-informed research effort.[6] Peer health educators (PHEs) are included at all stages of the research from design to implementation and we will include the student perspective in the interpretation and dissemination of findings.

3 Results

3.1 Description of the sample

The response rate among Queen's undergraduate students was 13.5% (n= 3,452). In this report, we describe the responses of 3,013 Queen's students with complete data on the variables of interest (Table 1). Students with missing data (n=439) were similar in age (Mean(SD)= 19.6(3.1) vs 19.8(2.9), p=0.34), but more likely to identify as male (38.5% vs 28.8%, p<.001) and be international students (21.7% vs 7.5%, p<.001). The Queen's sample was broadly representative of the eligible student population by year and program of study, full versus part-time, and international versus domestic status. However, more students in the sample identified as female (70.1% vs. 57.7%, χ^2 p<.01) and were younger than 19 years old (40.6% vs 35.0%, χ^2 p<.01). The average age of the study sample was 19.6 (SD= 2.8), and most students were domestic (92.5%). Students were most likely to be preparing to begin first year (25.4%) or finishing first year (23.9%), and the most common programs of study were Arts, Humanities, and Social Sciences (33.8%), Life and Physical Sciences (27.4%), and Engineering and Applied Science (20.2%).

The response rate among the first-year Oxford student cohort was 45.0% (n=356). The Oxford sample also had a higher proportion of females (62.1% vs 54.3%) than the university database. Participants' programs of study included: Humanities (34.6%), Mathematical, Physical and Life Sciences (32.0%), Medical Sciences (19.9%), Social Sciences (13.6%), and unknown (13.6%). In this report we describe the responses of 339 students with complete data on the Pandemic Anxiety Scale and the impact of COVID-19 items. The average age of student respondents was 18.4 years old, and the majority identified as female (61.7%). In comparison, Queen's first-year students were an average age of 18.6 (SD=2.4) years and 72.1% identified as female.

Table 1. Description of the Queen's (Canadian) summer 2020 survey sample, including student levels of knowledge on COVID-19, following of recommendations, and approaches to self-isolation

	n	(%)
Age		
≤18	1222	(40.6)
19-20	1062	(35.3)
≥21	729	(24.2)
Gender		
Female	2111	(70.1)
Male	868	(28.8)
Other	34	(1.13)
Program of Study		
Arts, Humanities & Social Sciences	1019	(33.8)
Life and Physical Sciences	824	(27.4)
Engineering and Applied Science	607	(20.2)
Business	166	(5.5)
Computing	93	(3.1)
Nursing	92	(3.1)
Health Sciences	64	(2.1)
Law	74	(2.5)
Medicine	74	(2.5)
Year of Study		
Incoming	765	(25.4)
First	721	(23.9)
Second	517	(17.2)
Third	536	(17.8)
Fourth	369	(12.3)
Fifth or Sixth	105	(3.5)
International/Domestic Status		
Domestic	2788	(92.5)
International	225	(7.5)
Knowledge level on COVID-19		
1 (Very poor) to 3	209	(6.9)
4	664	(22.0)
5 to 7 (Very good)	2140	(71.0)
Following COVID-19 recommendations		
1 (Not at all) to 3	91	(3.0)
4	203	(6.7)
5 to 7 (Very much so)	2719	(90.2)
Approach to self-isolation		
No change/ life as usual	125	(4.0)
Minor change but not isolation	1075	(34.2)
Self-isolation	1946	(61.9)

3.2 Knowledge about COVID-19 and associated experiences

Overall, Queen's students rated their knowledge of COVID-19 as good to very good (Mean= 5.0 out of 7, SD=1.1). Most reported following government recommendations (90% ≥5 out of 7). Female students were more likely than males to report following recommendations (91.3% vs 86.7%, p<.01). Average knowledge levels ((Mean=4.9, SD=1.1) and following of recommendations (87.3%) were lowest in students aged 18 and younger and highest in students aged 21 and older (Mean=5.2, SD=1.0; 93.3%). Most students (61.9%) reported self-isolating, defined here as "staying at home and avoiding contact with people outside of your household" (Table 1). A minority reported continuing to live life as normal (n= 125 (4.0%)). Females were more likely to report self-isolating (63.9% vs 57.0%, χ^2 p<0.01), and males were more likely to report no change in behaviour (8.0% vs 2.3%, χ^2 p<0.01). There was no significant difference in self-isolation practices by age.

3.3 COVID-19 related worries

Responses to the COVID-19 Pandemic Anxiety Scale (Figure 1) showed that almost all Queen's students agreed that COVID-19 is a serious issue (93.7%). Although many students reported concerns about catching COVID-19 (48.1%), a greater proportion were worried about infecting others (64.0%), or friends and family catching it (74.9%). Few students reported being afraid to leave the house (14.7%), and most were not worried about access to food and essential items (87.6%). Worries about catching and transmitting COVID-19 were greatest in females, older students, and upper years of study (Table 2). These overall trends and differences between females and males were consistent with responses from first-year Oxford students (Figure 2; Supplemental Table 1).

Most Queen's students reported concerns about missing university (67.8%), with younger students most worried (age 18 or younger= 80.4%, age 19-20= 72.1%, and age 21 or older= 47.7%; χ^2 p<0.01). Many students reported worries about their finances (58.4%), and long-term academic and job prospects (78.9%). Male and incoming students were less worried about the impact on finances and long-term prospects than female and current students (Table 2). Oxford student responses to the Pandemic Anxiety Scale were largely consistent with Queen's student responses, except for a smaller percentage of Oxford students reporting concerns about finances (26.5%) and long-term academic and job prospects (50.4%, Figure 2). Consistent with Queen's, females at Oxford were more worried about their finances and long-term prospects than males (Supplemental Table 1).

[INSERT FIGURE 1 HERE]

[INSERT FIGURE 2 HERE]

Table 2. Queen's University percentage ratings on the COVID-19 Pandemic Anxiety Scale items by gender, age group, and year of study

	Gender			Age Group				Year of Study			
	Male	**Female**	**p***	**≤18**	**19-20**	**≥21**	**p***	**Incoming**	**1st/2nd**	**≥3rd**	**p***
Think COVID-19 is a very serious issue											
Agree	90.5	94.9	<.01	91.6	94.8	95.5	<.01	91.8	92.8	96.1	<.01
Neutral	4.3	2.8		4.4	2.5	2.2		4.7	3.5	1.8	
Disagree	5.2	2.3		4.0	2.6	2.3		3.5	3.7	2.1	
Worried that I will catch COVID-19											
Agree	38.2	52.1	<.01	43.6	50.7	51.7	<.01	38.4	49.6	53.5	<.01
Neutral	28.1	25.6		28.7	23.5	26.2		32.2	24.9	23.5	
Disagree	33.8	22.3		27.7	25.9	22.1		29.4	25.5	23.1	
Worried friends and family will catch COVID-19											
Agree	67.5	78.1	<.01	68.4	78.4	80.8	<.01	65.1	75.3	82.0	<.01
Neutral	16.0	13.2		17.0	12.0	12.2		19.2	14.1	10.1	
Disagree	16.5	8.7		14.6	9.6	7.0		15.7	10.6	7.9	
I am afraid to leave the house right now											
Agree	9.3	16.6	<.01	12.2	16.4	16.3	0.01	9.4	16.0	17.0	<.01
Neutral	15.1	19.4		17.4	17.8	19.5		16.6	18.6	18.4	
Disagree	75.6	64.0		70.5	65.8	64.2		74.0	65.4	64.6	
I am worried that I might transmit the infection to someone else											
Agree	54.2	67.7	<.01	58.4	66.6	69.4	<.01	51.2	66.6	70.4	<.01
Neutral	18.8	16.2		18.6	16.0	15.2		22.1	14.9	15.3	
Disagree	27.0	16.0		23.0	17.4	15.4		26.7	18.5	14.4	
I am worried I will not have enough food and other essential items during the outbreak											
Agree	4.6	4.6	0.12	4.0	4.0	6.9	0.02	3.5	5.0	5.2	0.37
Neutral	6.1	8.4		7.1	8.1	8.2		6.9	8.2	7.8	
Disagree	89.2	87.0		88.9	88.0	84.9		89.5	86.8	87.0	
I am worried about missing university											
Agree	63.8	69.5	<.01	79.7	71.2	43.1	<.01	79.9	73.4	51.9	<.01
Neutral	12.6	12.6		9.7	11.5	19.2		9.7	11.2	16.5	
Disagree	23.5	17.9		10.6	17.3	37.7		10.5	15.4	31.6	
I am worried about the impact on my finances											
Agree	50.0	61.6	<.01	53.8	61.8	61.5	<.01	47.1	63.2	61.3	<.01
Neutral	18.8	15.8		19.7	14.7	14.0		22.5	14.9	14.1	
Disagree	31.2	22.6		26.5	23.5	24.6		30.5	21.9	24.7	
I am worried about the long-term impact this will have on my academic and job prospects											
Agree	72.7	81.4	<.01	77.7	80.8	78.1	0.09	74.8	80.3	80.3	<.01
Neutral	10.1	8.9		10.9	7.9	8.8		12.0	9.4	7.2	
Disagree	17.2	9.7		11.4	11.3	13.2		13.2	10.3	12.5	

Notes: (1) *p-value for chi-square test, (2) sample sizes by strata are: 868 males and 2,111 females; 1,222 ≤18, 1,062 ages 19-20, and 729 ≥21; 765 Incoming, 1,238 1st/2nd year, and 1,010 ≥3rd year.

3.4 Impact of COVID-19

3.4.1 Effects on university and studies

Queen's students commonly reported that the pandemic had negatively impacted their studies (69.9%) (Figure 1). While most students reported neither a positive nor negative impact on their plans to continue at university (61.5%), a notable proportion reported a negative impact (29.4%). Incoming students were more likely to report a negative impact than current students (Table 3) Both positive (22.8%) and negative (27.8%) impact on grades was reported. Most students perceived online learning negatively (61.2%), and reported a negative impact on their prospects for internships, exchanges, and other enriched learning experiences (68.0%). These findings were largely consistent with Oxford students' responses. However, a smaller proportion of Oxford students reported a negative impact on plans to continue at university (14.2%), and negative perceptions of online learning (30.4%; Figure 2; Supplemental Table 2).

3.4.2 Employment and finances

Most students at Queen's (69.3%) and Oxford (72.6%) reported a negative impact on their prospects for summer employment. A greater proportion of females than males reported a negative impact at Queen's (71.4% vs 65.3%, $p<.0.01$) and Oxford (77.5% vs 63.6%, $p=0.02$) (Table 3, Supplemental Table 2). A third of Queen's students reported a negative impact on their prospects to achieve their career aspirations (37.8%). Students in later years of study reported a more negative impact on their career aspirations (χ^2 $p<0.05$). Most students reported a negative impact on their finances (51.8%), and few reported a negative impact on their ability to access food and essentials (10.7%). The perceived negative impact on employment prospects and finances was greatest in females, older students, and students in upper years of study (Table 3).

3.4.3 Exercise, leisure and social life

Queen's students reported both a negative (42.9%) and positive (30.3%) impact on ability to exercise, but most reported a negative impact on hobbies and leisure activities (56.4%). These findings were consistent with Oxford students (Figure 2). Most students reported a negative impact on their social life (74.0%). While many students reported neither a positive nor negative impact on relationships with family members (41.6%), several reported a negative impact (24.9%). A negative impact on family relationships was more commonly reported by females (Table 3)

COVID-19 Impact on University Students

Table 3. Queen's University percentage reporting by gender, age group and year of study. *Could you describe the impact that the COVID-19 pandemic and associated social distancing have had on*:

	Gender			Age Group				Year of Study			
	Male	Female	p*	≤18	19-20	≥21	p*	Incoming	1st/2nd	≥3rd	p*
Your university studies?											
Negative	65.2	71.8	<.01	67.2	73.7	68.7	<.01	60.1	74.7	71.3	<.01
Neutral	28.3	22.9		28.3	20.5	23.7		34.8	20.0	22.2	
Positive	6.5	5.3		4.5	5.7	7.5		5.1	5.3	6.5	
Your plans to continue at university?											
Negative	28.5	29.4	0.14	31.4	31.5	23.2	<.01	33.1	28.6	27.7	<.01
Neutral	60.8	62.2		58.2	60.2	69.1		54.8	62.7	65.2	
Positive	10.7	8.4		10.4	8.4	7.7		12.2	8.7	7.0	
Your perception of online/remote learning?											
Negative	61.1	61.3	0.37	62.8	64.0	54.5	<.01	61.0	61.4	61.1	0.99
Neutral	23.1	24.7		22.1	23.8	27.9		24.1	23.8	24.5	
Positive	15.8	14.0		15.1	12.2	17.7		14.9	14.8	14.5	
Your academic grades?											
Negative	29.0	27.2	0.23	27.3	30.7	24.3	<.01	21.7	32.1	27.0	<.01
Neutral	46.9	50.3		46.9	47.7	56.0		50.6	46.4	52.1	
Positive	24.1	22.5		25.8	21.6	19.8		27.7	21.4	20.9	
Your prospects for summer internships/exchanges/academic pursuits?											
Negative	63.9	69.8	0.01	64.3	73.9	65.6	<.01	56.7	74.3	68.8	<.01
Neutral	32.0	26.8		31.8	21.8	31.7		38.8	22.0	27.9	
Positive	4.1	3.5		3.9	4.3	2.7		4.4	3.7	3.3	
Your prospects for summer employment?											
Negative	65.3	71.4	<.01	68.5	71.4	67.6	<.01	62.2	73.7	69.3	<.01
Neutral	27.2	23.0		23.7	22.3	28.5		28.8	20.6	25.6	
Positive	7.5	5.7		7.9	6.3	3.8		9.0	5.7	5.0	
Your prospects to realize your career aspirations?											
Negative	33.8	39.4	0.01	29.4	42.0	45.8	<.01	25.4	38.7	46.1	<.01
Neutral	57.8	53.9		62.4	50.4	48.6		65.9	54.3	47.1	
Positive	8.5	6.8		8.2	7.6	5.6		8.8	7.0	6.7	
Your finances?											
Negative	46.4	54.1	<.01	46.0	55.7	56.0	<.01	40.3	56.5	54.9	<.01
Neutral	41.7	36.5		43.0	35.1	33.7		47.2	35.1	34.7	
Positive	11.9	9.3		11.0	9.2	10.3		12.5	8.5	10.5	
Your ability to access enough food or other essential items?											
Negative	10.2	10.9	0.86	8.3	12.2	12.6	<.01	9.0	10.3	12.4	0.02
Neutral	81.0	80.6		82.3	78.4	81.5		80.0	81.8	80.0	
Positive	8.8	8.6		9.4	9.4	5.9		11.0	7.8	7.6	
Your ability to exercise?											
Negative	46.6	41.1	<.01	40.4	42.7	47.5	0.01	40.4	42.0	45.9	0.02
Neutral	27.5	26.5		26.2	28.8	25.0		25.9	28.9	25.0	
Positive	25.9	32.4		33.4	28.5	27.6		33.7	29.1	29.1	
Your ability to participate in hobbies/leisure activities?											
Negative	57.1	56.3	<.01	54.1	58.2	57.8	0.02	55.7	56.1	57.3	0.96
Neutral	20.5	14.7		15.7	17.6	15.5		16.3	16.6	16.0	
Positive	22.4	29.1		30.2	24.2	26.8		28.0	27.3	26.6	
Your ability to connect with your friends and your social life?											
Negative	72.7	74.6	0.56	70.8	77.2	74.9	<.01	68.8	75.7	76.0	<.01
Neutral	16.8	15.5		16.2	14.8	17.2		17.9	14.5	16.2	
Positive	10.4	9.9		13.0	8.0	8.0		13.3	9.9	7.7	
Your relationships with your family members?											
Negative	20.2	26.6	<.01	24.6	24.4	26.1	0.44	23.1	26.4	24.4	0.22
Neutral	48.3	39.0		40.1	42.8	42.4		43.0	39.3	43.4	

Positive	31.6	34.4	35.3	32.9	31.6	33.9	34.3	32.3

Notes: (1) *p-value for chi-square test, (2) sample size by strata: 868 males and 2,111 females; 1,222 ≤18, 1,062 ages 19-20, and 729 ≥21); 765 Incoming, 1,238 1st/2nd year, and 1,010 ≥3rd year.

3.4.4 Receipt of Mental Health Support

Among Queen's students who receive mental health support (n=1,256), most reported this was unaffected by COVID-19 (66.9%). However, significantly more females reported their support being negatively affected than males (37.4% of females, 18.2% of males, χ^2 $p<0.005$). There was no significant difference in the proportions of students reporting a negative impact according to age or year of study.

3.5 Common Pandemic Impact Themes – Qualitative analysis

Free text responses to an open-ended question asking Queen's (n= 815) and Oxford (n= 60) students to describe other impacts related to COVID-19 were analysed for major themes. See Supplemental Materials Appendix A1 for representative quotes.

3.5.1 Negative impact due to social isolation

Many students (56.0% Queen's, 33.3% Oxford) described feelings of anxiety, loneliness, and restlessness associated with social isolation due to loss of in-person contact with peers, friends, and significant others. Many students described friends as key supports, and that reduced contact worsened their well-being: "Forced separation from part of my support system has had a negative impact on both my academics and mental health". Students reported that isolation with roommates or family members, with whom they had already-strained relationships, increased stress and caused feelings of being trapped in a negative environment which worsened mental health: "Having no break from my fairly stressful home situation has not been great for my mental health". Overall, reduced interaction with support networks and forced confinement increased stress.

3.5.2 Challenging academic and institutional changes

Students described challenges adapting to new learning methods (32.1% of Queen's students, 23.3% of Oxford students). Online learning was reported as difficult or less effective than in-person instruction due to lack of quiet study spaces, blurred school and home boundaries, and distance from peers: "Getting myself into an exam or essay-writing mindset at home is much harder than I thought it would be". Students reported difficulty coping with high work demands outside their usual surroundings, isolated from peers during a stressful time: "I am finding it hard to keep a balanced perspective on work and assignments working at home by myself and not being around friends". Concerns about learning experiences and future preparedness stemmed from loss of practical course components, cancellation of professional placements, and reduced access to specialized facilities. The cancellation of key milestones contributed to worries about personal development and the quality of students' social experience at university. Responses concerning institutional pandemic responses were mixed, including understanding given the circumstances, and frustration with decisions regarding tuition, campus closure, and a perceived lack of support.

3.5.3 Financial Challenges

Some Queen's students (11.4%), but no Oxford students, expressed specific financial concerns. These included frustration and anxiety regarding reduced income due to fewer career opportunities and employment termination, and expenses due to student housing and university tuition fees. Reduced income combined with maintained expenses amplified financial stress.

3.5.4 Disruptions to support services and means of coping

A small proportion of students (5.6% Queen's, 5.0% Oxford) described disrupted access to health and support services, including difficulties accessing medication and obtaining healthcare appointments and in-person counselling. Fear of accessing services in-person due to risk of COVID-19 exposure was reported as impeding usual care: "Too afraid to visit hospital for routine problems". Students described reluctance to use online services, outlining difficulties adapting to or navigating them. Reduced engagement in leisure or physical group activities usually key to managing stress and protective for mental health was reported as negatively impacting the ability to cope: "It has removed my ability to train for my sport which was a crucial part of my weekly structure 6 days a week, and was critical in my being able to maintain my mental health and work/study productively".

4 Discussion

The COVID-19 pandemic has caused major disruption to university and has had far-reaching impacts on students' daily lives, well-being and perception of their future. Our study explored undergraduate student experiences and worries in the early part of the pandemic, and the associated impact on their education, daily life, career prospects and mental health support. To our knowledge, this is the first study to compare the impact of the pandemic on university students across different countries. We hope that this information can be used to support students during and beyond the pandemic.

Nearly all students across both universities agreed that COVID-19 is a serious issue, but females were more likely than males to report following government recommendations and adapting their lifestyle. This may be partly due to increased anxiety among female students. Screening positive for anxiety and depression has been found to be higher in female university students and females of similar age in the general population when compared to males.[4,5,12] Moreover, females appear more susceptible to anxiety and depression surrounding COVID-19,[13-15] and are more likely to follow COVID-19-related public health guidelines.[16] In our study a greater proportion of females reported worries and concerns around the pandemic than males according to the Pandemic Anxiety Scale.

Younger students were significantly more likely to report concerns about missing university than older students, who were more likely to be worried about the impact on their career prospects. This may reflect different priorities: missing university is a more immediate concern for younger students who are years away from graduating. In contrast, older students may be more concerned about applying for jobs at a time where workers are being furloughed or made redundant, and employment rates are falling.[17-18] This is supported by consistent concern about long-term academic and job prospects across age groups, and our qualitative analysis. Queen's, but not Oxford students discussed concerns surrounding employment, which may reflect the older students in the Queen's sample. Overall, students at different stages of study require targeted approaches to address immediate concerns regarding future academic or career prospects.

While students expressed worries about catching COVID-19, many more were worried about infecting others, or friends and family contracting it. Most students are relatively young with few co-morbidities and therefore at low-risk for severe COVID-19 disease but may have family members at higher risk due to their age and co-morbidities.[19] This is important for decisions regarding bringing students to campus, as students may worry about returning home and potentially exposing family or friends in high-risk groups to COVID-19. The UK government introduced plans for university students to receive COVID-19 tests before returning home for Christmas, which may have allayed students' worries about exposing family members to COVID-19, but was challenging for students who tested positive and were required to isolate.

Several students at expressed concern about the impact of the pandemic on their finances. A smaller proportion of Oxford students reported these concerns compared to Queen's students, which may be associated with differences in year of study and concerns about employment after graduation. Our qualitative analysis supported the contribution of mandatory continued payment for university accommodation and tuition with reduced perceived value, and loss of income to financial anxiety.[20] Additionally, many students rely on their ability to work part-time or seasonally, or money from family members whose income may have been negatively affected by the pandemic. Previous studies have indicated student concern about finances during COVID-19, particularly those remaining in student residences during lockdown.[21]

Most students indicated that COVID-19 negatively impacted their studies, as may be expected due to online learning or course suspension. Negative perceptions of online learning suggest dissatisfaction with alternative teaching methods, which may be worsened by unchanged tuition fees and how quickly these changes were introduced. However, most Queen's students reported little impact on grades, suggesting disruption is accounted for in assessments, that students and/or professors are adapting to maintain grades, or it is too early to measure the impact on academic performance. Negative perceptions of online learning were lower in the Oxford sample than in Queen's students (30.9% vs 61.2%). This could reflect the move to online learning in Oxford taking place when the majority of first year students would ordinarily have been sitting exams. The tutorial system at Oxford may also be more readily transferred online. Finally, on-line learning may have been more prevalent at Oxford pre-pandemic, requiring less adjustment for teaching to move fully online during the pandemic. Nearly 30% of Queen's students and 15% of Oxford students reported a negative impact on their plans to continue at university. This may suggest students are more likely to discontinue their studies due to the pandemic, and would have significant repercussions for universities' income. Most students also reported a negative impact on their prospects for summer internships, employment, learning exchanges, and other academic pursuits. Explanations include travel restrictions, workplace closures, reluctance to employ non-essential workers, social distancing restrictions, and student concerns regarding COVID-19 exposure. Students' worries surrounding future academic and career prospects might be related to fewer opportunities compared to their predecessors, and increased competition on graduation with less work or academic experience. Reassuringly, most students reported no impact on their ability to access food and other essentials.

Students reported both positive and negative impacts on exercise. Disruption to routines, closure of gyms or lack of university sports societies cited in our qualitative analysis may account for the negative impact. More time to exercise, availability of online classes, and more space for exercise at home may account for the positive impact. Most students reported

a negative impact on their participation in hobbies and leisure activities, and unsurprisingly, on their social life. The combination of these factors suggests a significant impact of COVID-19 on student mental well-being, given the importance of recreation, exercise and social connectedness to the support of mental health.[13,22]

Select populations, that may not be readily identified as requiring tailored support, reported unique challenges. Students with dependents described challenges balancing their studies and caring responsibilities due to reduced childcare services and closure of schools. International students reported inability to travel home to visit family and friends, and anxiety surrounding remaining in a foreign country during a pandemic. Affordability of remaining away from home, high tuition costs, and lack of financial support were concerns for these students.

Strengths of our study include providing timely, important information on a largely unknown and highly relevant topic: the impact of a global pandemic on the lives and experiences of university students. Responses from large, diverse samples of university students were utilized and allowed comparison between countries and institutions. Our findings build on those of previous studies that have focused specifically on mental health impacts,[15,23-25] or been limited to medical students or much smaller samples.[26-31] We assessed the impact of COVID-19 using a validated Pandemic Anxiety Scale.

One study limitation relates to the low response rate in the Queen's sample, which likely reflects the timing of the survey during summer break without a preceding student engagement campaign. Nonetheless, the student sample appeared broadly representative of the Queen's undergraduate population in terms of demographics and program of study. Secondly the Oxford data pertains only to first-year students and served as a descriptive exploratory analysis to compliment the Canadian data. That said, increased surveying of younger students may be more informative for higher education policies, as these students are more likely to be studying at university when these policies are enacted. In this analysis, students at both universities were surveyed early in the pandemic, and worries and impacts may change over the course of the pandemic. Therefore, we will repeatedly survey students at both universities to better understand student concerns and the impact of the pandemic on student experiences and well-being over time. We hope that this information will be helpful to inform universities as to how best to address student priority learning and well-being needs.

5 Conclusion

The COVID-19 pandemic has had wide-ranging impacts on university student experience and mental health. Our findings support that undergraduate students have concerns regarding disruptions to university studies, the inadequacies of online learning as a substitute for in-person learning, and their finances and future academic and career prospects. A concerning number of students reported the possibility of discontinuing their studies due to the pandemic. Many students reported negative impacts of COVID-19 on protective factors for well-being, including socializing, exercise, hobbies and leisure activities, family relationships, and mental health support. Higher education institutions must prepare to address students' concerns in the short term during the pandemic, and provide ongoing support for students in the aftermath of COVID-19 as the long-term impacts become apparent.

COVID-19 Impact on University Students

Figure legends

Figure 1: Queen's university students' (n=3,013) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

Figure 2. Oxford University first-year undergraduate students' (n= 339) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

Contributors

AD developed the protocol in collaboration with colleagues including KEAS and students including DR, NK and SC. DR led the student engagement campaign at Queen's and SC and AD the survey launch, while CK supervised by AD and KEAS led the engagement and survey launch at Oxford. JA, NK and AD led the quantitative analysis, whilst KEAS, AB, JB and DR the qualitative analysis. All named authors contributed to the writing and reviewed the final manuscript.

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Competing interests

KEAS is supported by the NIHR Oxford Health Biomedical Research Centre (grant BRC-1215-20005). The views expressed are those of the authors and not necessarily those of the UK National Health Service, the National Institute for Health Research, or the UK Department of Health.

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Data sharing statement

Deidentified raw data is available upon reasonable request to the corresponding author.

Ethical approval

Ethical approval was obtained from the Central University Research Ethics Committee in Oxford (R60998 – RE001), and the Queens University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (HSREB) in Canada (PSIY-669-19). Participants gave informed consent as part of the survey.

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References

[1]Adhikari, S. P., Meng, S., Wu, Y. J., Mao, Y. P., Ye, R. X., Wang, Q. Z, et al. (2020). Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infectious diseases of poverty*, *9*(1), 29. https://doi.org/10.1186/s40249-020-00646-x

[2]Pfefferbaum, B., & North, C. (2020). Mental health and the Covid-19 pandemic. *New England Journal of Medicine*, 383(6): 510–12. https://doi.org/10.1056/nejmp2013466.

[3]Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Magni, P et al. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*, 3(1). https://doi.org/10.37074/jalt.2020.3.1.7

[4]King, N., Pickett, W., McNevin, S., Bowie, C., Rivera, D., Keown-Stoneman, C., et al. (2020). Mental health need of students at entry to university: Baseline findings from the U-Flourish Student Well-Being and Academic Success Study. *Early Intervention in Psychiatry*, 1–10. https://doi.org/10.1111/eip.12939

[5]Duffy, A., Keown-Stoneman, C., Goodday, S., Horrocks, J., Lowe, M., King, N, et al. (2020). Predictors of mental health and academic outcomes in first-year university students: Identifying prevention and early-intervention targets. *BJPsych open*, *6*(3), e46. https://doi.org/10.1192/bjo.2020.24

[6]Goodday SM, Rivera D, Foran H, et al. (2019). U-Flourish university students well-being and academic success longitudinal study: a study protocol. *BMJ Open,* 9:e029854. doi:10.1136/ bmjopen-2019-029854

[7]McElroy, E., Patalay, P., Moltrecht, B., Shevlin, M., Shum, A., Creswell, C., et al. (2020). Demographic and health factors associated with pandemic anxiety in the context of COVID-19. *British journal of health psychology*, *25*(4), 934–944. https://doi.org/10.1111/bjhp.12470

[8]RStudio Team (2020). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL *http://www.rstudio.com/*.

[9]Ritchie, J. & Spencer, L. 1994. Qualitative data analysis for applied policy research by Jane Ritchie and Liz Spencer in A. Bryman and R. G. Burgess [eds.] 'Analysing qualitative data', (pp.173-194). London: Routledge.

[10]Gale, N. K., Heath, G., Cameron, E., Rashid, S. & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology,* **13**:117. https://doi.org/10.1186/1471-2288-13-117

[11]von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. 2007. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *BMJ, 335* doi: https://doi.org/10.1136/bmj.39335.541782.AD

[12]McManus, S., Bebbington, P. E., Jenkins, R., Morgan, Z., Brown, L., Collinson, D., et al. (2020). Data Resource Profile: Adult Psychiatric Morbidity Survey (APMS). *International journal of epidemiology*, *49*(2), 361–362e. https://doi.org/10.1093/ije/dyz224

[13]Xiong, J., Lipsitz, O., Nasri, F., Lui, L., Gill, H., Phan, L., et al. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *Journal of affective disorders*, *277*, 55–64. https://doi.org/10.1016/j.jad.2020.08.001

[14]Smith, L., Jacob, L., Yakkundi, A., McDermott, D., Armstrong, N. C., Barnett, Y., et al. (2020). Correlates of symptoms of anxiety and depression and mental wellbeing associated with COVID-19: a cross-sectional study of UK-based respondents. *Psychiatry research*, *291*, 113138. https://doi.org/10.1016/j.psychres.2020.113138

[15]Elmer, T., K. Mepham, and C. Stadtfeld. 2020. Students under Lockdown: Comparisons of Students' Social Networks and Mental Health before and during the COVID-19 Crisis in Switzerland. *PloS one*, 15 (7): e0236337. https://doi.org/10.1371/journal.pone.0236337

[16]Guzek, D., Skolmowska, D., & Głąbska, D. (2020). Analysis of Gender-Dependent Personal Protective Behaviors in a National Sample: Polish Adolescents' COVID-19 Experience (PLACE-19) Study. *International journal of environmental research and public health*, *17*(16), 5770. https://doi.org/10.3390/ijerph17165770

[17]Statistics Canada. 2020. Canadian Economic Dashboard and COVID-19 https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2020009-eng.htm [Accessed 31st October 2020]

[18]Office for National Statistics. 2020. Coronavirus (COVID-19) roundup: Economy, business and jobs. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/articles/coronaviruscovid19roundupeconomybusinessandjobs/2020-07-02#youngperson [Accessed 31st October 2020]

[19]Clift, A.K., Coupland, C.A.C., Keogh, R.H., Diaz-Ordaz, K., Williamson, E. (2020). Living risk prediction algorithm (QCOVID) for risk of hospital admission and mortality from coronavirus 19 in adults: national derivation and validation cohort study. *BMJ*, 371, pp. m3731. https://doi.org/10.1136/bmj.m3731

[20]Office for National Statistics. 2020. Labour market overview, UK: October 2020. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/october2020 [Accessed 31st October 2020]

[21]Husky, M., Kovess-Masfety, V., & Swendsen, J. (2020). Stress and anxiety among university students in France during Covid-19 mandatory confinement. *Compr. Psychiatry* **102**, 152-191. doi: 10.1016/j.comppsych.2020.152191

[22]Rastegar Kazerooni, A., Amini, M., Tabari, P., & Moosavi, M. (2020). Peer mentoring for medical students during the COVID-19 pandemic via a social media platform. *Medical education*, *54*(8), 762–763. https://doi.org/10.1111/medu.14206

[23]Copeland, William E., Ellen McGinnis, Yang Bai, Zoe Adams, Hilary Nardone, Vinay Devadanam, Jeffrey Rettew, and Jim J. Hudziak. 2021. Impact of COVID-19 Pandemic on College Student Mental Health and Wellness. *Journal of the American Academy of Child &*

Adolescent Psychiatry, 60 (1): 134-141.e2. https://doi.org/https://doi.org/10.1016/j.jaac.2020.08.466.

[24]Essadek, A., and T. Rabeyron. 2020. Mental Health of French Students during the Covid-19 Pandemic. *Journal of affective disorders*, 277 (December): 392–93. https://doi.org/S0165-0327(20)32648-3

[25]Wathelet, M., S. Duhem, G. Vaiva, T. Baubet, E. Habran, E. Veerapa, C. Debien, et al. 2020. Factors Associated With Mental Health Disorders Among University Students in France Confined During the COVID-19 Pandemic. *JAMA network open*, 3 (10): e2025591. https://doi.org/10.1001/jamanetworkopen.2020.25591 [doi].

[26]Alsoufi, A., A. Alsuyihili, A. Msherghi, A. Elhadi, H. Atiyah, A. Ashini, A. Ashwieb, et al. 2020. Impact of the COVID-19 Pandemic on Medical Education: Medical Students' Knowledge, Attitudes, and Practices Regarding Electronic Learning. *PloS one*, 15 (11): e0242905. https://doi.org/10.1371/journal.pone.0242905 [doi].

[27]Byrnes, Y. M., A. M. Civantos, B. C. Go, T. L. McWilliams, and K. Rajasekaran. 2020. Effect of the COVID-19 Pandemic on Medical Student Career Perceptions: A National Survey Study. *Medical education online*, 25 (1): 1798088. https://doi.org/10.1080/10872981.2020.1798088 [doi].

[28]Choi, B., L. Jegatheeswaran, A. Minocha, M. Alhilani, M. Nakhoul, and E. Mutengesa. 2020. The Impact of the COVID-19 Pandemic on Final Year Medical Students in the United Kingdom: A National Survey. *BMC medical education*, 20 (1): 206-020-02117–1. https://doi.org/10.1186/s12909-020-02117-1 [doi].

[29]Kecojevic, A., C. H. Basch, M. Sullivan, and N. K. Davi. 2020. The Impact of the COVID-19 Epidemic on Mental Health of Undergraduate Students in New Jersey, Cross-Sectional Study. *PloS one*, 15 (9): e0239696. https://doi.org/10.1371/journal.pone.0239696 [doi].

[30]Lyons, Z., H. Wilcox, L. Leung, and O. Dearsley. 2020. COVID-19 and the Mental Well-Being of Australian Medical Students: Impact, Concerns and Coping Strategies Used. *Australasian psychiatry : bulletin of Royal Australian and New Zealand College of Psychiatrists*, 28 (6): 649–52. https://doi.org/10.1177/1039856220947945 [doi].

[31]Son, C., S. Hegde, A. Smith, X. Wang, and F. Sasangohar. 2020. Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study. *Journal of medical Internet research,* 22 (9): e21279. https://doi.org/10.2196/21279 [doi].

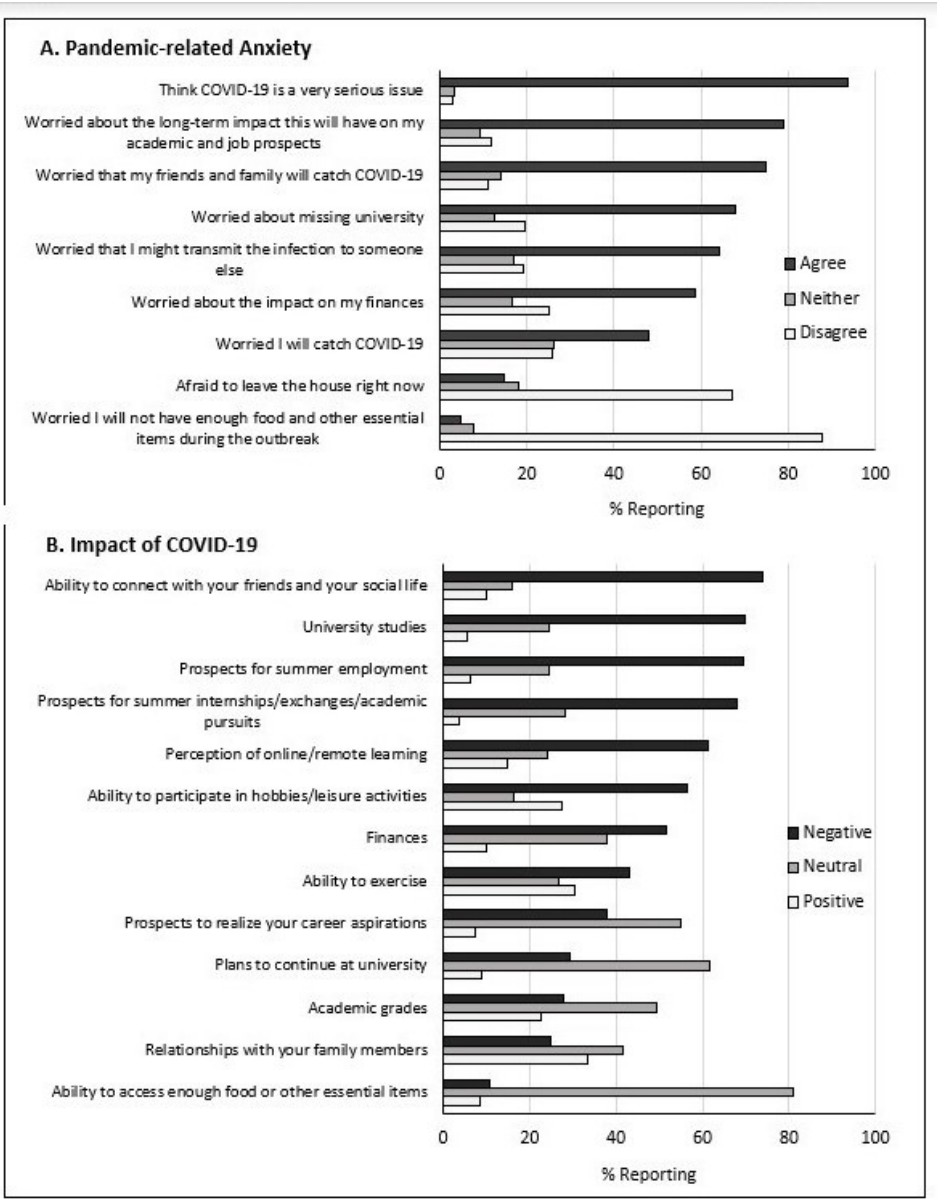

Figure 1: Queen's university students' (n=3,013) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

155x197mm (96 x 96 DPI)

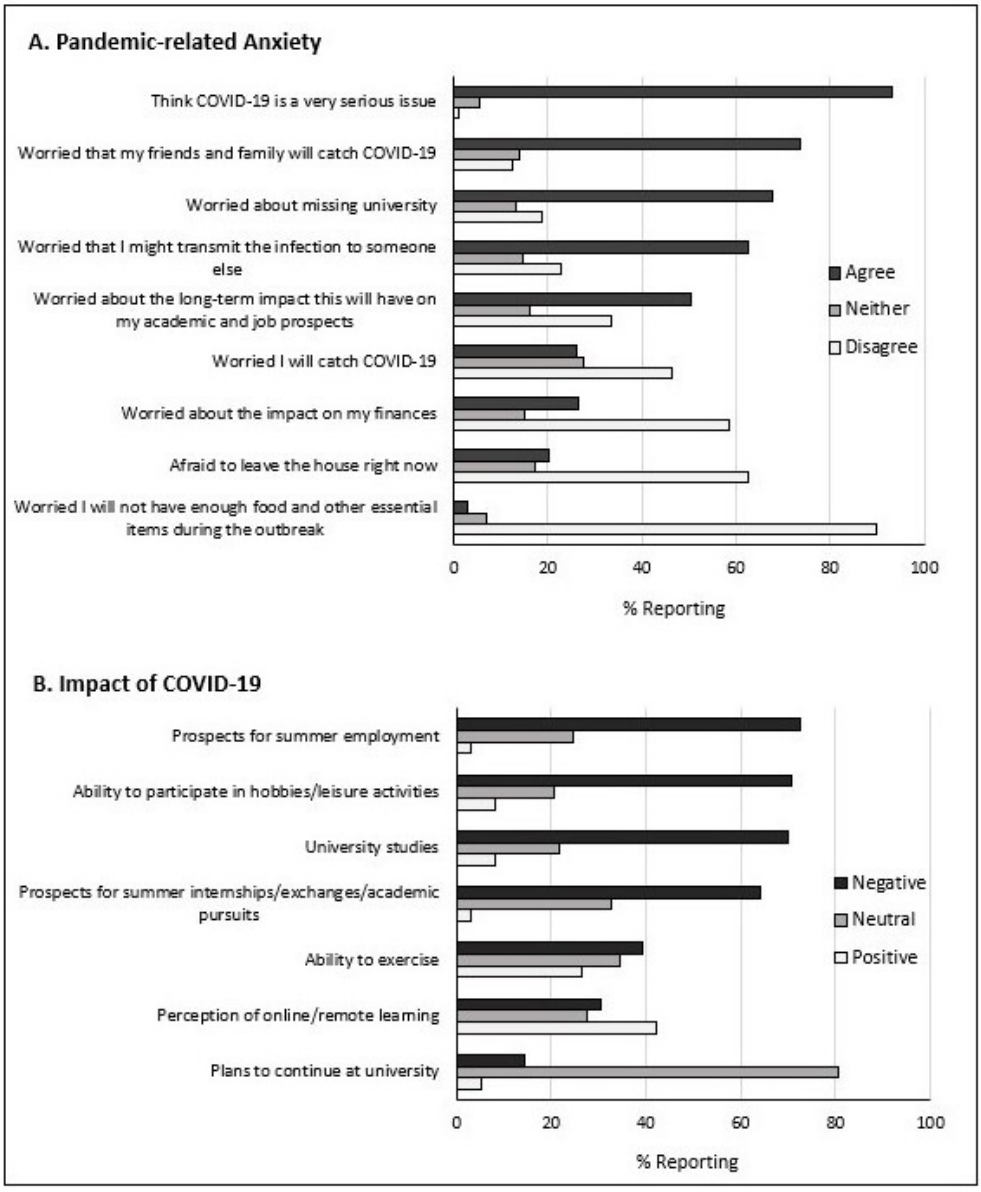

Figure 2. Oxford University first-year undergraduate students' (n= 339) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

152x182mm (96 x 96 DPI)

Supplemental Table 1. Oxford University first-year student percentage ratings on the COVID-19 Pandemic Anxiety Scale items overall and by gender

	TOTAL (n=339)*	GENDER Male (n=121)	GENDER Female (n=209)	p**
Think COVID-19 is a very serious issue				
Agree	93.2	89.3	95.2	0.02
Neutral	5.6	7.4	4.8	
Disagree	1.2	3.3	0	
Worried that I will catch COVID-19				
Agree	26.0	16.5	31.1	0.01
Neutral	27.7	26.4	28.2	
Disagree	46.3	57.0	40.7	
Worried friends and family will catch COVID-19				
Agree	73.7	60.3	81.3	<0.001
Neutral	13.9	20.7	10.0	
Disagree	12.4	19.0	8.6	
I am afraid to leave the house right now				
Agree	20.1	10.7	24.4	0.004
Neutral	17.4	15.7	18.7	
Disagree	62.5	73.6	56.9	
I am worried that I might transmit the infection to someone else				
Agree	62.5	52.9	68.4	0.02
Neutral	14.7	19.0	12.4	
Disagree	22.7	28.1	19.1	
I am worried I will not have enough food and other essential items during the outbreak				
Agree	2.9	1.7	3.3	0.53
Neutral	7.1	8.3	6.2	
Disagree	90.0	90.1	90.4	
I am worried about missing university				
Agree	67.8	62.8	69.9	0.47
Neutral	13.3	15.7	12.4	
Disagree	18.6	20.7	17.7	
I am worried about the impact on my finances				
Agree	26.5	19.0	31.6	0.04
Neutral	15.0	15.7	14.8	
Disagree	58.4	65.3	53.6	
I am worried about the long-term impact on my academic and job prospects				
Agree	50.4	39.7	54.5	0.03
Neutral	16.2	19.8	14.8	
Disagree	33.3	40.5	30.6	

Notes: (1) *not all participants reported gender, (2) **p-value for chi-square test

Supplemental Table 2. Oxford University first-year student percentage reporting overall and by gender. *Could you describe the impact that the COVID-19 pandemic and associated social distancing have had on*:

		GENDER		
	TOTAL (n=339)*	**Male** (n=121)	**Female** (n=209)	**p****
Your university studies?				
Negative	69.9	70.2	69.4	0.90
Neutral	21.8	20.7	22.5	
Positive	8.3	9.1	8.1	
Your plans to continue at university?				
Negative	14.2	5.0	19.6	<0.001
Neutral	80.5	90.9	74.2	
Positive	5.3	4.1	6.2	
Your perception of online/remote learning				
Negative	30.4	25.6	33.5	0.046
Neutral	27.4	34.7	22.5	
Positive	42.2	39.7	44.0	
Your prospects for summer internships/exchanges/academic pursuits?				
Negative	64.0	62.0	64.1	0.33
Neutral	32.7	36.4	31.6	
Positive	3.2	1.7	4.3	
Your prospects for summer employment?				
Negative	72.6	63.6	77.5	0.02
Neutral	24.5	31.4	20.6	
Positive	2.9	5.0	1.9	
Your ability to exercise?				
Negative	39.2	43.8	37.3	0.17
Neutral	34.5	35.5	32.5	
Positive	26.3	20.7	30.1	
Your ability to participate in your usual hobbies/ leisure activities?				
Negative	70.8	67.8	73.2	0.49
Neutral	20.6	24.0	18.7	
Positive	8.3	7.4	8.1	

Notes: (1) *not all participants reported gender, (2) **p-value for chi-square test

Supplemental Materials Appendix A1: Quotes from qualitative data analysis of free text responses

Social isolation

"I highly depend on social environments to support my mental health, so not being able to see friends is quite challenging as it makes my depression worse"

"Forced separation from part of my support system has had a negative impact on both my academics and mental health"

"Impacts of the pandemic on family members have reverberating effects to all members of household"

"Being stuck in a house with my parents has negatively impacted my mental health"

"I have to be near my emotionally abusive mother, I self harm a lot more now and I really need access to university student wellness center but I cannot call them while here"

"I've been feeling more lonely and restless with the pandemic going on. There are less outlets to relax due to isolation (ie sports leagues, meeting with friends, etc.)"

"As much as I would sometimes find social interaction difficult and draining, being starved of it is definitely having a negative impact on my mental health."

"Not being able to meet up with friends in person has been somewhat of a blow to mental health"

"Not being able to see my partner has had a significant impact on my mental health."

"Having no break from my fairly stressful home situation has not been great for my mental health"

"I find being stuck inside with my family is very stressful and it leaves me sometimes feeling unable to work which compounds the already existing stress about work and it often becomes a cycle I find difficult to break"

Work adaptation

"Living and working in the same place is a struggle. I am concerned about this going into another year of school with little opportunity for in person learning or access to on campus study spaces.

I am nervous about completing my final year of my undergraduate degree remotely, as my program is very lab-based."

"I am finding it hard to keep a balanced perspective on work and assignments working at home by myself and not being around friends."

"Getting myself into an exam or essay-writing mindset at home is much harder than I thought it would be."

"I am much less motivated to do my university assignments when I am home compared to when I am at university"

Coping skills

"I have found that with the pandemic and social distancing requirements I have had more difficulty than normal maintaining my mental wellness. I have struggled with some anxiety at several points in the past few months as I haven't have school or work to focus on, and small problems are exacerbated as they are taking up more focus."

"It's devastating that we won't get a normal orientation week or first year, but I do understand that Queen's is doing everything they can to try and make it better."

"Severely imparts my ability to spend time outdoors and with my friends, things like rock climbing and hiking and yoga, which are all very important to maintaining my mental health and managing anxiety. It's been a lot harder to deal with in the absence of these things. School was much more stressful online without support of classmates and less connection to professors."

"It has removed my ability to train for my sport which was a crucial part of my weekly structure 6 days a week, and was critical in my being able to maintain my mental health and work/study productively"

Unique populations

"I have been too scared to see my doctor about my physical ~~digestive~~ health issues and they have gotten much worse. I will likely need a lot of treatment when this is all over. I'm too scared to go to a hospital or doctors office because of the virus at the moment as I live with vulnerable individuals"

"Too afraid to visit hospital for routine problems."

"I lost my childcare for two children under 3. Completing online synchronous school while my partner works long hours in the emergency department, and having no help from family because of COVID-19 has left me feeling overwhelmed, un-engaged, frustrated, and easily angered. It has impacted my relationship with my partner and to some extent my self worth as I am being forced to be a stay-at-home mother and student and am unsure if I'll be able to work which gives me a lot of fulfillment, and much needed mental stimulation."

"Trying to juggle dependents alone while in school, as my spouse continues to work"

"Being an international student, I couldn't go back home due to the pandemic. As a result I am all alone. It's lonely and i get restless at times. all this negatively affects by study"

"Not being able to go home as an international student, it was scary to be in this situation in another country"

"Local regulations on flights and exit and entry make international travel difficult, and this also results in the increase in the price of air tickets. An one-way ticket from Canada to China is above 7000 dollars, which is not affordable for me."

"As an international student, I had trouble coming back home, which caused severe stress and started a period of worse mental health for me."

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	#3	State specific objectives, including any prespecified hypotheses	1,2
Methods			
Study design	#4	Present key elements of study design early in the paper	3
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3

Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	3
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	3-4
Bias	#9	Describe any efforts to address potential sources of bias	3-4
Study size	#10	Explain how the study size was arrived at	4
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	3-4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	3-4
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	3-4
Statistical methods	#12c	Explain how missing data were addressed	3-4
Statistical	#12d	If applicable, describe analytical methods taking account of	n/a

methods		sampling strategy	Not done
Statistical methods	#12e	Describe any sensitivity analyses	n/a Not done
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	4
Participants	#13b	Give reasons for non-participation at each stage	4
Participants	#13c	Consider use of a flow diagram	n/a Described in prose
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	4-5
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	4
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	5-8

Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	5-7
Main results	#16b	Report category boundaries when continuous variables were categorized	3,5
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a Not relevant to this study
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	3-5
Discussion			
Key results	#18	Summarise key results with reference to study objectives	5-8
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	10
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	10
Generalisability	#21	Discuss the generalisability (external validity) of the study results	10
Other Information			

Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11

BMJ Open

Impact of the COVID-19 pandemic on the experience and mental health of university students studying in Canada and the United Kingdom: a cross-sectional study

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Impact of the COVID-19 pandemic on the experience and mental health of university students studying in Canada and the United Kingdom: a cross-sectional study

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COVID-19 Impact on University Students

Abstract

Objectives: To explore the impact of the COVID-19 pandemic on the experiences and mental health of university students.

Design: A cross-sectional study consisting of an electronic survey about students' experiences and concerns during the pandemic and the associated impact. In addition to the quantitative analysis, free text responses were extracted and analysed using a framework technique

Setting: Queen's university in Canada and the University of Oxford in the UK

Participants: Undergraduate students at Queen's university and first year undergraduate students at the University of Oxford were invited to complete the COVID supplement survey. This study included data from 3013 Queen's students as the primary focus and 339 Oxford students as a secondary comparison.

Results: Females at Queen's reported greater adherence to government recommendations to prevent the spread of COVID-19 (91.3% vs 86.7%, χ^2 p<.01) and were more likely to self-isolate (63.9% vs 57.0%, χ^2 p<.01) than males. A similar trend was seen among Oxford students. Students' concerns were wide-ranging including those related to their learning experience, finances, and future academic and career prospects. 78.9% of Queen's students and 50.4% of first-year Oxford students reported worries about the long-term impact on their academic and job prospects. A sizeable proportion of students also reported that the pandemic negatively impacted their plans to continue at university (29.4% of Queen's, 14.2% of Oxford), and disrupted activities important to their mental well-being.. Key themes identified in the qualitative component included the negative impacts of social isolation, challenging academic changes, and disruption to support services and means of coping.

Conclusions: Overall, findings underscore the importance of addressing areas of student concern and the aspects of student life negatively impacted by the pandemic in order to maintain student well-being and support a successful university experience.

Article Summary: Strengths and limitations of this study

- The first study to compare the impact of the COVID-19 pandemic on university students across different countries.
- Responses were obtained from large, diverse samples of university students.
- Validated measures were used to assess the impact of the pandemic on students.
- A low response rate was obtained from the Queen's University sample.
- Participants were surveyed early in the pandemic, and the impact on students may change over time.

1 Introduction

In late 2019, the novel Coronavirus (COVID-19) was detected in Wuhan, China, causing disease ranging from asymptomatic infection to life-threatening respiratory compromise.[1] The restrictions imposed to limit viral transmission and the direct impact of the virus profoundly affected daily life and well-being, with heightened anxiety and reduced access to usual coping mechanisms including exercise, socialisation, and leisure activities.[2]

University students have been particularly affected by COVID-19. Remote teaching and social distancing measures implemented across institutions worldwide have dramatically changed campus life.[3] In addition to the changes experienced by the general population, students have experienced disruption to their learning, assessment and schedules, and the cancellation of enriched learning opportunities including field trips, laboratory courses, and learning exchanges. Additionally, the pandemic may affect future educational opportunities, job prospects, and financial stability.

The pandemic and its aftermath will likely have lasting effects on students and universities. Therefore, there is a need for the collection of reliable data to assess the impact of the pandemic on student well-being and academic outcomes. This would improve our understanding of student experiences and concerns, informing institutions' approaches to addressing these.

In this study, we aimed to explore university student experiences during the COVID-19 pandemic, including concerns related to the pandemic and the associated impact on education, daily life, career prospects, and mental health support. We leveraged an ongoing longitudinal survey study of undergraduate students attending Queen's University in Canada and the University of Oxford in the UK.[4-5]

2 Methods

COVID-specific measures were added to the ongoing U-Flourish Student Well-Being and Academic Success survey,[6] which invites first-year university students at Queen's (Canada) and Oxford (UK) to complete electronic surveys at the beginning and end of each academic year. The surveys ask about risk and protective factors for well-being and mental health using validated measures. COVID-related questions were added to the U-Flourish follow-up survey for participating first-year Oxford students (May 2020) and sent out as a supplementary survey to all registered Queen's undergraduate students (July 2020).

2.1 Study Variables

2.1.1 Demographic Characteristics.

Age in years and gender were self-reported and international student status, and program and year of study were obtained from university administrative data.

2.1.2 COVID-19 related measures.

Queen's participants were asked to describe their approach to self-isolation during the pandemic by selecting all options that applied from a list of nine options, grouped into: (1) No change (i.e., "I have lived my life as normal"), (2) Minor change, but not self-isolation (e.g., social distancing, working from home), and (3) Self-isolation (i.e., staying at home and avoiding contact with people outside of your household). Participants rated their knowledge level on COVID-19 from "1 – Very Poor" to "7- Very Good", and whether they have been following government recommendations from "1 – Not at all" to "7 – Very much so".

At both Queen's and Oxford, anxiety surrounding the pandemic was assessed using the COVID-19 Pandemic Anxiety Scale.[7] A series of nine statements asked, how serious an issue do you think COVID-19 is, and how worried are you about the following: catching COVID-19, friends and family catching COVID-19, leaving the house, infecting others, having enough food and other essential items, missing university, and the impact on your finances and long-term academic and job prospects. Each statement was rated on a five-point scale according to level of agreement, re-categorised into 'Disagree' (1-2), 'Neither disagree or agree' (3), and 'Agree' (4-5).

Students were also asked about the impact of the pandemic on studies and learning opportunities, future academic/professional prospects, lifestyle, relationships and connectedness, and for those in need, access to mental health support. Participants rated the impact of the pandemic and associated social distancing on a five-point scale from 1=Very negative to 5=Very positive (categorised into 'Negative', 'Neither', or 'Positive'). On the Oxford survey, 7 of the 13 impact items were included. Participants were asked if any mental health support they receive had been stopped, postponed or negatively affected due to the pandemic.

Finally, participants were asked "Are there any other significant impacts related to the COVID-19 pandemic on your mental health, wellbeing, or education that you would like to comment on?"

2.2 Statistical Analysis

The primary analysis utilised data from the Queen's COVID-19 survey. Responses to the Pandemic Anxiety Scale and questions assessing the impact of the pandemic and associated social distancing were examined in the Oxford sample in an exploratory manner to compare between institutions and countries. Samples were restricted to participants with complete data on the variables of interest. Analyses were conducted using RStudio.[8] Descriptive statistics were used to describe the sample, and responses to the Pandemic Anxiety Scale and COVID-19 impact items overall and by gender, age group and year of study. The Oxford sample only included first-year students of similar ages, so analyses were limited to examining differences by gender. Students identifying as other than 'male' or 'female' were not included in the gender-stratified analyses because of small numbers (n=34/3013 in the Queen's sample). Differences in proportions between strata were examined using chi-square tests.

Qualitative data from the Queen's and Oxford surveys were extracted from free text responses. Qualitative analysis used a framework technique.[9-10] Participant data were interpreted and summarized. Coding comprised identification of experiences, referred to as 'themes'. As understanding increased, data were summarised and re-interpreted, new codes generated, redundant codes deleted and overlapping codes merged. Through this process a stable framework emerged that appeared increasingly likely to describe participant experience. The study team met regularly to discuss the findings and refine the emerging framework. To reduce researcher bias, the team analysing the qualitative data were not made aware of the quantitative findings until the framework had been agreed.

The STROBE cross-sectional reporting guidelines were used in the reporting of this study.[11]

2.3 Patient and public involvement

The ongoing UFlourish survey is a student-informed research effort.[6] Peer health educators (PHEs) are included at all stages of the research from design to implementation and we will include the student perspective in the interpretation and dissemination of findings.

3 Results

3.1 Description of the sample

The response rate among Queen's undergraduate students was 13.5% (n=3,452). The sample was broadly representative of the eligible student population by year and program of study, full versus part-time, and international versus domestic status. However, more students in the sample identified as female (70.1% vs. 57.7%, χ^2 p<.01) and were younger than 19 years old (40.6% vs 35.0%, χ^2 p<.01). In this report, we describe the responses of 3,013 students with complete data on the variables of interest (Table 1). Students with missing data (n=439) were similar in age (Mean(SD)= 19.6(3.1) vs 19.8(2.9), t-test p=0.34), but more likely to identify as male (38.5% vs 28.8%, χ^2 p<.001) and be international students (21.7% vs 7.5%, p<.001). The average age of the study sample was 19.6 (SD=2.8), and most students were domestic (92.5%). Students were most likely to be preparing to begin first year (25.4%) or finishing first year (23.9%), and the most common programs of study were Arts, Humanities, and Social Sciences (33.8%), Life and Physical Sciences (27.4%), and Engineering and Applied Science (20.2%).

The response rate among the first-year Oxford student cohort was 45.0% (n=356). The sample also had a higher proportion of females (62.1% vs 54.3%) than the university database. Participants' courses included: Humanities (34.6%), Mathematical, Physical and Life Sciences (32.0%), Medical Sciences (19.9%), Social Sciences (13.6%), and unknown (13.6%). Here we describe the responses of 339 students with complete data on the Pandemic Anxiety Scale and the impact of COVID-19 items. The average age of respondents was 18.4 years old, and the majority identified as female (61.7%). In comparison, Queen's first-year students were an average age of 18.6 (SD=2.4) years and 72.1% identified as female.

Table 1. Description of the Queen's (Canadian) summer 2020 survey sample, including student levels of knowledge on COVID-19, following of recommendations, and approaches to self-isolation

	n	(%)
Age		
≤18	1222	(40.6)
19-20	1062	(35.3)
≥21	729	(24.2)
Gender		
Female	2111	(70.1)
Male	868	(28.8)
Other	34	(1.13)
Program of Study		
Arts, Humanities & Social Sciences	1019	(33.8)
Life and Physical Sciences	824	(27.4)
Engineering and Applied Science	607	(20.2)
Business	166	(5.5)
Computing	93	(3.1)
Nursing	92	(3.1)
Health Sciences	64	(2.1)
Law	74	(2.5)
Medicine	74	(2.5)
Year of Study		
Incoming	765	(25.4)
First	721	(23.9)
Second	517	(17.2)
Third	536	(17.8)
Fourth	369	(12.3)
Fifth or Sixth	105	(3.5)
International/Domestic Status		
Domestic	2788	(92.5)
International	225	(7.5)
Knowledge level on COVID-19		
1 (Very poor) to 3	209	(6.9)
4	664	(22.0)
5 to 7 (Very good)	2140	(71.0)
Following COVID-19 recommendations		
1 (Not at all) to 3	91	(3.0)
4	203	(6.7)
5 to 7 (Very much so)	2719	(90.2)
Approach to self-isolation		
No change/ life as usual	125	(4.0)
Minor change but not isolation	1075	(34.2)
Self-isolation	1946	(61.9)

3.2 Knowledge about COVID-19 and associated experiences

Overall, Queen's students rated their knowledge of COVID-19 as good to very good (71% ≥5 out of 7). Most reported following government recommendations (90% ≥5 out of 7). Female students were more likely than males to report following recommendations (91.3% vs 86.7%, χ^2 p<.01). Knowledge and following of recommendations were lowest in students aged 18 and younger (68.0% and 87.3% ≥5) and highest in students aged 21 and older (79.0% and 93.3%). Most students (61.9%) reported self-isolating, defined as "staying at home and avoiding contact with people outside of your household" (Table 1). A minority reported continuing as normal (n= 125 (4.0%)). Females were more likely to report self-isolating (63.9% vs 57.0%, χ^2 p<0.01), and males were more likely to report no change in behaviour (8.0% vs 2.3%, χ^2 p<0.01). There was no significant difference in self-isolation practices by age.

3.3 COVID-19 related worries

Responses to the Pandemic Anxiety Scale (Figure 1) showed that almost all Queen's students agreed that COVID-19 is a serious issue (93.7%). Although many students reported concerns about catching COVID-19 (48.1%), a greater proportion were worried about infecting others (64.0%), or friends and family catching it (74.9%). Few students reported being afraid to leave the house (14.7%), and most were not worried about access to food and essential items (87.6%). Worries about catching and transmitting COVID-19 were greatest in females, older students, and upper years of study (Table 2). These overall trends and differences between genders were consistent with responses from Oxford students (Figure 2; Supplemental Table 1).

Most Queen's students reported concerns about missing university (67.8%), with younger students most worried (age 18 or younger= 80.4%, age 19-20= 72.1%, and age 21 or older= 47.7%; χ^2 p<0.01). Many students reported worries about their finances (58.4%), and long-term academic and job prospects (78.9%). Male and incoming students were less worried about the impact on finances and long-term prospects than female and current students (Table 2). Oxford student responses to the Pandemic Anxiety Scale were largely consistent with Queen's student responses, but a smaller percentage of Oxford students reported concerns about finances (26.5%) and long-term academic and job prospects (50.4%, Figure 2). Consistent with Queen's, females at Oxford were more worried about their finances and long-term prospects (Supplemental Table 1).

[INSERT FIGURE 1 HERE]

[INSERT FIGURE 2 HERE]

Table 2. Queen's University percentage ratings on the COVID-19 Pandemic Anxiety Scale items by gender, age group, and year of study

	Gender			Age Group				Year of Study			
	Male	**Female**	p*	**≤18**	**19-20**	**≥21**	p*	**Incoming**	**1st/2nd**	**≥3rd**	**p***
Think COVID-19 is a very serious issue											
Agree	90.5	94.9	<.01	91.6	94.8	95.5	<.01	91.8	92.8	96.1	<.01
Neutral	4.3	2.8		4.4	2.5	2.2		4.7	3.5	1.8	
Disagree	5.2	2.3		4.0	2.6	2.3		3.5	3.7	2.1	
Worried that I will catch COVID-19											
Agree	38.2	52.1	<.01	43.6	50.7	51.7	<.01	38.4	49.6	53.5	<.01
Neutral	28.1	25.6		28.7	23.5	26.2		32.2	24.9	23.5	
Disagree	33.8	22.3		27.7	25.9	22.1		29.4	25.5	23.1	
Worried friends and family will catch COVID-19											
Agree	67.5	78.1	<.01	68.4	78.4	80.8	<.01	65.1	75.3	82.0	<.01
Neutral	16.0	13.2		17.0	12.0	12.2		19.2	14.1	10.1	
Disagree	16.5	8.7		14.6	9.6	7.0		15.7	10.6	7.9	
I am afraid to leave the house right now											
Agree	9.3	16.6	<.01	12.2	16.4	16.3	0.01	9.4	16.0	17.0	<.01
Neutral	15.1	19.4		17.4	17.8	19.5		16.6	18.6	18.4	
Disagree	75.6	64.0		70.5	65.8	64.2		74.0	65.4	64.6	
I am worried that I might transmit the infection to someone else											
Agree	54.2	67.7	<.01	58.4	66.6	69.4	<.01	51.2	66.6	70.4	<.01
Neutral	18.8	16.2		18.6	16.0	15.2		22.1	14.9	15.3	
Disagree	27.0	16.0		23.0	17.4	15.4		26.7	18.5	14.4	
I am worried I will not have enough food and other essential items during the outbreak											
Agree	4.6	4.6	0.12	4.0	4.0	6.9	0.02	3.5	5.0	5.2	0.37
Neutral	6.1	8.4		7.1	8.1	8.2		6.9	8.2	7.8	
Disagree	89.2	87.0		88.9	88.0	84.9		89.5	86.8	87.0	
I am worried about missing university											
Agree	63.8	69.5	<.01	79.7	71.2	43.1	<.01	79.9	73.4	51.9	<.01
Neutral	12.6	12.6		9.7	11.5	19.2		9.7	11.2	16.5	
Disagree	23.5	17.9		10.6	17.3	37.7		10.5	15.4	31.6	
I am worried about the impact on my finances											
Agree	50.0	61.6	<.01	53.8	61.8	61.5	<.01	47.1	63.2	61.3	<.01
Neutral	18.8	15.8		19.7	14.7	14.0		22.5	14.9	14.1	
Disagree	31.2	22.6		26.5	23.5	24.6		30.5	21.9	24.7	
I am worried about the long-term impact this will have on my academic and job prospects											
Agree	72.7	81.4	<.01	77.7	80.8	78.1	0.09	74.8	80.3	80.3	<.01
Neutral	10.1	8.9		10.9	7.9	8.8		12.0	9.4	7.2	
Disagree	17.2	9.7		11.4	11.3	13.2		13.2	10.3	12.5	

Notes: (1) *p-value for chi-square test, (2) sample sizes by strata are: 868 males and 2,111 females; 1,222 ≤18, 1,062 ages 19-20, and 729 ≥21; 765 Incoming, 1,238 1st/2nd year, and 1,010 ≥3rd year.

3.4 Impact of COVID-19

3.4.1 Effects on university and studies

Queen's students commonly reported that the pandemic had negatively impacted their studies (69.9%) (Figure 1). While most students reported neither a positive nor negative impact on their plans to continue at university (61.5%), a notable proportion reported a negative impact (29.4%). Incoming students were more likely to report a negative impact than current students (Table 3) Both positive (22.8%) and negative (27.8%) impact on grades was reported. Most students perceived online learning negatively (61.2%), and reported a negative impact on their prospects for internships, exchanges, and other enriched learning experiences (68.0%). These findings were largely consistent with Oxford students' responses. However, a smaller proportion of Oxford students reported a negative impact on plans to continue at university (14.2%), and negative perceptions of online learning (30.4%; Figure 2; Supplemental Table 2).

3.4.2 Employment and finances

Most students at Queen's (69.3%) and Oxford (72.6%) reported a negative impact on their prospects for summer employment. A greater proportion of females than males reported a negative impact at Queen's (71.4% vs 65.3%, $p<.0.01$) and Oxford (77.5% vs 63.6%, χ^2 $p=0.02$) (Table 3, Supplemental Table 2). A third of Queen's students reported a negative impact on their prospects to achieve their career aspirations (37.8%). Students in later years of study reported a more negative impact on their career aspirations (χ^2 $p<0.05$). Most students reported a negative impact on their finances (51.8%), and few reported a negative impact on their ability to access food and essentials (10.7%). The perceived negative impact on employment prospects and finances was greatest in females, older students, and students in upper years of study (Table 3).

3.4.3 Exercise, leisure and social life

Queen's students reported both a negative (42.9%) and positive (30.3%) impact on ability to exercise, but most reported a negative impact on hobbies and leisure activities (56.4%). These findings were consistent with Oxford students (Figure 2). Most students reported a negative impact on their social life (74.0%). While many students reported neither a positive nor negative impact on relationships with family members (41.6%), several reported a negative impact (24.9%). A negative impact on family relationships was more commonly reported by females (Table 3)

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Table 3. Queen's University percentage reporting by gender, age group and year of study. *Could you describe the impact that the COVID-19 pandemic and associated social distancing have had on*:

	Gender			Age Group				Year of Study			
	Male	Female	p*	≤18	19-20	≥21	p*	Incoming	1st/2nd	≥3rd	p*
Your university studies?											
Negative	65.2	71.8	<.01	67.2	73.7	68.7	<.01	60.1	74.7	71.3	<.01
Neutral	28.3	22.9		28.3	20.5	23.7		34.8	20.0	22.2	
Positive	6.5	5.3		4.5	5.7	7.5		5.1	5.3	6.5	
Your plans to continue at university?											
Negative	28.5	29.4	0.14	31.4	31.5	23.2	<.01	33.1	28.6	27.7	<.01
Neutral	60.8	62.2		58.2	60.2	69.1		54.8	62.7	65.2	
Positive	10.7	8.4		10.4	8.4	7.7		12.2	8.7	7.0	
Your perception of online/remote learning?											
Negative	61.1	61.3	0.37	62.8	64.0	54.5	<.01	61.0	61.4	61.1	0.99
Neutral	23.1	24.7		22.1	23.8	27.9		24.1	23.8	24.5	
Positive	15.8	14.0		15.1	12.2	17.7		14.9	14.8	14.5	
Your academic grades?											
Negative	29.0	27.2	0.23	27.3	30.7	24.3	<.01	21.7	32.1	27.0	<.01
Neutral	46.9	50.3		46.9	47.7	56.0		50.6	46.4	52.1	
Positive	24.1	22.5		25.8	21.6	19.8		27.7	21.4	20.9	
Your prospects for summer internships/exchanges/academic pursuits?											
Negative	63.9	69.8	0.01	64.3	73.9	65.6	<.01	56.7	74.3	68.8	<.01
Neutral	32.0	26.8		31.8	21.8	31.7		38.8	22.0	27.9	
Positive	4.1	3.5		3.9	4.3	2.7		4.4	3.7	3.3	
Your prospects for summer employment?											
Negative	65.3	71.4	<.01	68.5	71.4	67.6	<.01	62.2	73.7	69.3	<.01
Neutral	27.2	23.0		23.7	22.3	28.5		28.8	20.6	25.6	
Positive	7.5	5.7		7.9	6.3	3.8		9.0	5.7	5.0	
Your prospects to realize your career aspirations?											
Negative	33.8	39.4	0.01	29.4	42.0	45.8	<.01	25.4	38.7	46.1	<.01
Neutral	57.8	53.9		62.4	50.4	48.6		65.9	54.3	47.1	
Positive	8.5	6.8		8.2	7.6	5.6		8.8	7.0	6.7	
Your finances?											
Negative	46.4	54.1	<.01	46.0	55.7	56.0	<.01	40.3	56.5	54.9	<.01
Neutral	41.7	36.5		43.0	35.1	33.7		47.2	35.1	34.7	
Positive	11.9	9.3		11.0	9.2	10.3		12.5	8.5	10.5	
Your ability to access enough food or other essential items?											
Negative	10.2	10.9	0.86	8.3	12.2	12.6	<.01	9.0	10.3	12.4	0.02
Neutral	81.0	80.6		82.3	78.4	81.5		80.0	81.8	80.0	
Positive	8.8	8.6		9.4	9.4	5.9		11.0	7.8	7.6	
Your ability to exercise?											
Negative	46.6	41.1	<.01	40.4	42.7	47.5	0.01	40.4	42.0	45.9	0.02
Neutral	27.5	26.5		26.2	28.8	25.0		25.9	28.9	25.0	
Positive	25.9	32.4		33.4	28.5	27.6		33.7	29.1	29.1	
Your ability to participate in hobbies/leisure activities?											
Negative	57.1	56.3	<.01	54.1	58.2	57.8	0.02	55.7	56.1	57.3	0.96
Neutral	20.5	14.7		15.7	17.6	15.5		16.3	16.6	16.0	
Positive	22.4	29.1		30.2	24.2	26.8		28.0	27.3	26.6	
Your ability to connect with your friends and your social life?											
Negative	72.7	74.6	0.56	70.8	77.2	74.9	<.01	68.8	75.7	76.0	<.01
Neutral	16.8	15.5		16.2	14.8	17.2		17.9	14.5	16.2	
Positive	10.4	9.9		13.0	8.0	8.0		13.3	9.9	7.7	
Your relationships with your family members?											
Negative	20.2	26.6	<.01	24.6	24.4	26.1	0.44	23.1	26.4	24.4	0.22
Neutral	48.3	39.0		40.1	42.8	42.4		43.0	39.3	43.4	

Positive	31.6	34.4	35.3	32.9	31.6	33.9	34.3	32.3

Notes: (1) *p-value for chi-square test, (2) sample size by strata: 868 males and 2,111 females; 1,222 ≤18, 1,062 ages 19-20, and 729 ≥21); 765 Incoming, 1,238 1st/2nd year, and 1,010 ≥3rd year.

3.4.4 Receipt of Mental Health Support

Among Queen's students receiving mental health support (n=1,256), most reported this was unaffected by COVID-19 (66.9%). However, significantly more females reported their support being negatively affected than males (37.4% of females, 18.2% of males, χ^2 $p<0.005$). There was no significant difference in the proportions of students reporting a negative impact according to age or year of study.

3.5 Common Pandemic Impact Themes – Qualitative analysis

Free text responses to an open-ended question asking students to describe other impacts related to COVID-19 were analysed for major themes. Of these responses (Queen's n=815, Oxford n=60), the proportion pertaining to each theme is described below. See Supplemental Materials Appendix A1 for representative quotes.

3.5.1 Negative impact due to social isolation

Many students (56.0% Queen's, 33.3% Oxford) described feelings of anxiety, loneliness, and restlessness associated with social isolation due to loss of in-person contact with peers, friends, and significant others. Many students described friends as key supports, and that reduced contact worsened their well-being: "Forced separation from part of my support system has had a negative impact on both my academics and mental health". Students reported that isolation with roommates or family members, with whom they had already-strained relationships, increased stress and caused feelings of being trapped in a negative environment which worsened mental health: "Having no break from my fairly stressful home situation has not been great for my mental health". Overall, reduced interaction with support networks and forced confinement increased stress.

3.5.2 Challenging academic and institutional changes

Students described challenges adapting to new learning methods (32.1% of Queen's students, 23.3% of Oxford students). Online learning was reported as difficult or less effective than in-person instruction due to lack of quiet study spaces, blurred school and home boundaries, and distance from peers: "Getting myself into an exam or essay-writing mindset at home is much harder than I thought it would be". Students reported difficulty coping with high work demands outside their usual surroundings, isolated from peers during a stressful time: "I am finding it hard to keep a balanced perspective on work and assignments working at home by myself and not being around friends". Concerns about learning experiences and future preparedness stemmed from loss of practical course components, cancellation of professional placements, and reduced access to specialized facilities. The cancellation of key milestones contributed to worries about personal development and the quality of students' social experience at university. Responses concerning institutional pandemic responses were mixed, including understanding given the circumstances, and frustration with decisions regarding tuition, campus closure, and a perceived lack of support.

3.5.3 Financial Challenges

Some Queen's students (11.4%), but no Oxford students, expressed specific financial concerns. These included frustration and anxiety regarding reduced income due to fewer career opportunities and employment termination, and expenses due to student housing and university tuition fees. Reduced income combined with maintained expenses amplified financial stress.

3.5.4 Disruptions to support services and means of coping

A small proportion of students (5.6% Queen's, 5.0% Oxford) described disrupted access to health and support services, including difficulties accessing medication and obtaining healthcare appointments and in-person counselling. Fear of accessing services in-person due to risk of COVID-19 exposure was reported as impeding usual care: "Too afraid to visit hospital for routine problems". Students described reluctance to use online services, outlining difficulties adapting to or navigating them. Reduced engagement in leisure or physical group activities usually key to managing stress and protective for mental health was reported as negatively impacting the ability to cope: "It has removed my ability to train for my sport which was a crucial part of my weekly structure 6 days a week, and was critical in my being able to maintain my mental health and work/study productively".

4 Discussion

The COVID-19 pandemic has caused major disruption to university and has had far-reaching impacts on students' daily lives, well-being and perception of their future. Our study explored undergraduate student experiences and worries in the early part of the pandemic, and the associated impact on their education, daily life, career prospects and mental health support. To our knowledge, this is the first study to compare the impact of the pandemic on university students across different countries. We hope that this information can be used to support students during and beyond the pandemic.

Nearly all students across both universities agreed that COVID-19 is a serious issue, but females were more likely than males to report following government recommendations and adapting their lifestyle. This may be partly due to increased anxiety among female students. Screening positive for anxiety and depression has been found to be higher in female university students and females of similar age in the general population when compared to males.[4,5,12] Moreover, females appear more susceptible to anxiety and depression surrounding COVID-19,[13-15] and are more likely to follow COVID-19-related public health guidelines.[16] In our study a greater proportion of females reported worries and concerns around the pandemic than males according to the Pandemic Anxiety Scale.

Younger students were significantly more likely to report concerns about missing university than older students, who were more likely to be worried about the impact on their career prospects. This may reflect different priorities: missing university is a more immediate concern for younger students who are years away from graduating. In contrast, older students may be more concerned about applying for jobs at a time where workers are being furloughed or made redundant, and employment rates are falling.[17-18] This is supported by consistent concern about long-term academic and job prospects across age groups, and our qualitative analysis. Queen's, but not Oxford students discussed concerns surrounding employment, which may reflect the older students in the Queen's sample. Overall, students at different stages of study require targeted approaches to address immediate concerns regarding future academic or career prospects.

While students expressed worries about catching COVID-19, many more were worried about infecting others, or friends and family contracting it. Most students are relatively young with few co-morbidities and therefore at low-risk for severe COVID-19 disease but may have family members at higher risk due to their age and co-morbidities.[19] This is important for decisions regarding bringing students to campus, as students may worry about returning home and potentially exposing family or friends in high-risk groups to COVID-19. The UK government introduced plans for university students to receive COVID-19 tests before returning home for Christmas, which may have allayed students' worries about exposing family members to COVID-19, but was challenging for students who tested positive and were required to isolate.

Several students at expressed concern about the impact of the pandemic on their finances. A smaller proportion of Oxford students reported these concerns compared to Queen's students, which may be associated with differences in year of study and concerns about employment after graduation. Our qualitative analysis supported the contribution of mandatory continued payment for university accommodation and tuition with reduced perceived value, and loss of income to financial anxiety.[20] Additionally, many students rely on their ability to work part-time or seasonally, or money from family members whose income may have been negatively affected by the pandemic. Previous studies have indicated student concern about finances during COVID-19, particularly those remaining in student residences during lockdown.[21]

Most students indicated that COVID-19 negatively impacted their studies, as may be expected due to online learning or course suspension. Negative perceptions of online learning suggest dissatisfaction with alternative teaching methods, which may be worsened by unchanged tuition fees and how quickly these changes were introduced. However, most Queen's students reported little impact on grades, suggesting disruption is accounted for in assessments, that students and/or professors are adapting to maintain grades, or it is too early to measure the impact on academic performance. Negative perceptions of online learning were lower in the Oxford sample than in Queen's students (30.9% vs 61.2%). This could reflect the move to online learning in Oxford taking place when the majority of first year students would ordinarily have been sitting exams. The tutorial system at Oxford may also be more readily transferred online. Finally, on-line learning may have been more prevalent at Oxford pre-pandemic, requiring less adjustment for teaching to move fully online during the pandemic. Nearly 30% of Queen's students and 15% of Oxford students reported a negative impact on their plans to continue at university. This may suggest students are more likely to discontinue their studies due to the pandemic, and would have significant repercussions for universities' income. Most students also reported a negative impact on their prospects for summer internships, employment, learning exchanges, and other academic pursuits. Explanations include travel restrictions, workplace closures, reluctance to employ non-essential workers, social distancing restrictions, and student concerns regarding COVID-19 exposure. Students' worries surrounding future academic and career prospects might be related to fewer opportunities compared to their predecessors, and increased competition on graduation with less work or academic experience. Reassuringly, most students reported no impact on their ability to access food and other essentials.

Students reported both positive and negative impacts on exercise. Disruption to routines, closure of gyms or lack of university sports societies cited in our qualitative analysis may account for the negative impact. More time to exercise, availability of online classes, and more space for exercise at home may account for the positive impact. Most students reported

a negative impact on their participation in hobbies and leisure activities, and unsurprisingly, on their social life. The combination of these factors suggests a significant impact of COVID-19 on student mental well-being, given the importance of recreation, exercise and social connectedness to the support of mental health.[13,22]

Select populations, that may not be readily identified as requiring tailored support, reported unique challenges. Students with dependents described challenges balancing their studies and caring responsibilities due to reduced childcare services and closure of schools. International students reported inability to travel home to visit family and friends, and anxiety surrounding remaining in a foreign country during a pandemic. Affordability of remaining away from home, high tuition costs, and lack of financial support were concerns for these students.

Strengths of our study include providing timely, important information on a largely unknown and highly relevant topic: the impact of a global pandemic on the lives and experiences of university students. Responses from large, diverse samples of university students were utilized and allowed comparison between countries and institutions. Our findings build on those of previous studies that have focused specifically on mental health impacts,[15,23-25] or been limited to medical students or much smaller samples.[26-31] We assessed the impact of COVID-19 using a validated Pandemic Anxiety Scale.

One study limitation relates to the low response rate in the Queen's sample, which likely reflects the timing of the survey during summer break without a preceding student engagement campaign. Nonetheless, the student sample appeared broadly representative of the Queen's undergraduate population in terms of demographics and program of study. Secondly the Oxford data pertains only to first-year students and served as a descriptive exploratory analysis to compliment the Canadian data. Differing pandemic responses may have impacted comparability across the universities, but the overall consistency of the findings strengthens our conclusions and their generalisability. The increased surveying of younger Oxford students may be more informative for higher education policies, as these students are more likely to be at university when these policies are enacted. In this analysis, students at both universities were surveyed early in the pandemic, and worries and impacts may change over the course of the pandemic. Therefore, we will repeatedly survey students at both universities to better understand student concerns and the impact of the pandemic on student experiences and well-being over time. We hope that this information will help to inform universities regarding how best to address student priority learning and well-being needs.

5 Conclusion

The COVID-19 pandemic has had wide-ranging impacts on university student experience and mental health. Our findings support that undergraduate students have concerns regarding disruptions to university studies, the inadequacies of online learning as a substitute for in-person learning, and their finances and future academic and career prospects. A concerning number of students reported the possibility of discontinuing their studies due to the pandemic. Many students reported negative impacts of COVID-19 on protective factors for well-being, including socializing, exercise, hobbies and leisure activities, family relationships, and mental health support. Higher education institutions must prepare to address students' concerns in the short term during the pandemic, and provide ongoing support for students in the aftermath of COVID-19 as the long-term impacts become apparent.

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Figure legends

Figure 1: Queen's university students' (n=3,013) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

Figure 2. Oxford University first-year undergraduate students' (n=339) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

Contributors

AD developed the protocol in collaboration with colleagues including KEAS and students including DR, NK and SC. DR led the student engagement campaign at Queen's and SC and AD the survey launch, while CK supervised by AD and KEAS led the engagement and survey launch at Oxford. JA, NK and AD led the quantitative analysis, whilst KEAS, AB, JB and DR the qualitative analysis. All named authors contributed to the writing and reviewed the final manuscript.

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Competing interests

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Data sharing statement

Deidentified raw data is available upon reasonable request to the corresponding author.

Ethical approval

Ethical approval was obtained from the Central University Research Ethics Committee in Oxford (R60998 – RE001), and the Queens University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (HSREB) in Canada (PSIY-669-19). Participants gave informed consent as part of the survey.

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References

[1]Adhikari, S. P., Meng, S., Wu, Y. J., Mao, Y. P., Ye, R. X., Wang, Q. Z, et al. (2020). Epidemiology, causes, clinical manifestation and diagnosis, prevention and control of coronavirus disease (COVID-19) during the early outbreak period: a scoping review. *Infectious diseases of poverty*, *9*(1), 29. https://doi.org/10.1186/s40249-020-00646-x

[2]Pfefferbaum, B., & North, C. (2020). Mental health and the Covid-19 pandemic. *New England Journal of Medicine*, 383(6): 510–12. https://doi.org/10.1056/nejmp2013466.

[3]Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Magni, P et al. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*, 3(1). https://doi.org/10.37074/jalt.2020.3.1.7

[4]King, N., Pickett, W., McNevin, S., Bowie, C., Rivera, D., Keown-Stoneman, C., et al. (2020). Mental health need of students at entry to university: Baseline findings from the U-Flourish Student Well-Being and Academic Success Study. *Early Intervention in Psychiatry*, 1–10. https://doi.org/10.1111/eip.12939

[5]Duffy, A., Keown-Stoneman, C., Goodday, S., Horrocks, J., Lowe, M., King, N, et al. (2020). Predictors of mental health and academic outcomes in first-year university students: Identifying prevention and early-intervention targets. *BJPsych open*, *6*(3), e46. https://doi.org/10.1192/bjo.2020.24

[6]Goodday SM, Rivera D, Foran H, et al. (2019). U-Flourish university students well-being and academic success longitudinal study: a study protocol. *BMJ Open,* 9:e029854. doi:10.1136/ bmjopen-2019-029854

[7]McElroy, E., Patalay, P., Moltrecht, B., Shevlin, M., Shum, A., Creswell, C., et al. (2020). Demographic and health factors associated with pandemic anxiety in the context of COVID-19. *British journal of health psychology*, *25*(4), 934–944. https://doi.org/10.1111/bjhp.12470

[8]RStudio Team (2020). RStudio: Integrated Development for R. RStudio, PBC, Boston, MA URL *http://www.rstudio.com/*.

[9]Ritchie, J. & Spencer, L. 1994. Qualitative data analysis for applied policy research by Jane Ritchie and Liz Spencer in A. Bryman and R. G. Burgess [eds.] 'Analysing qualitative data', (pp.173-194). London: Routledge.

[10]Gale, N. K., Heath, G., Cameron, E., Rashid, S. & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC Medical Research Methodology,* **13**:117. https://doi.org/10.1186/1471-2288-13-117

[11]von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. 2007. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies. *BMJ, 335* doi: https://doi.org/10.1136/bmj.39335.541782.AD

[12]McManus, S., Bebbington, P. E., Jenkins, R., Morgan, Z., Brown, L., Collinson, D., et al. (2020). Data Resource Profile: Adult Psychiatric Morbidity Survey (APMS). *International journal of epidemiology*, *49*(2), 361–362e. https://doi.org/10.1093/ije/dyz224

[13]Xiong, J., Lipsitz, O., Nasri, F., Lui, L., Gill, H., Phan, L., et al. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *Journal of affective disorders*, *277*, 55–64. https://doi.org/10.1016/j.jad.2020.08.001

[14]Smith, L., Jacob, L., Yakkundi, A., McDermott, D., Armstrong, N. C., Barnett, Y., et al. (2020). Correlates of symptoms of anxiety and depression and mental wellbeing associated with COVID-19: a cross-sectional study of UK-based respondents. *Psychiatry research*, *291*, 113138. https://doi.org/10.1016/j.psychres.2020.113138

[15]Elmer, T., K. Mepham, and C. Stadtfeld. 2020. Students under Lockdown: Comparisons of Students' Social Networks and Mental Health before and during the COVID-19 Crisis in Switzerland. *PloS one*, 15 (7): e0236337. https://doi.org/10.1371/journal.pone.0236337

[16]Guzek, D., Skolmowska, D., & Głąbska, D. (2020). Analysis of Gender-Dependent Personal Protective Behaviors in a National Sample: Polish Adolescents' COVID-19 Experience (PLACE-19) Study. *International journal of environmental research and public health*, *17*(16), 5770. https://doi.org/10.3390/ijerph17165770

[17]Statistics Canada. 2020. Canadian Economic Dashboard and COVID-19 https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2020009-eng.htm [Accessed 31st October 2020]

[18]Office for National Statistics. 2020. Coronavirus (COVID-19) roundup: Economy, business and jobs. https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/articles/coronaviruscovid19roundupeconomybusinessandjobs/2020-07-02#youngperson [Accessed 31st October 2020]

[19]Clift, A.K., Coupland, C.A.C., Keogh, R.H., Diaz-Ordaz, K., Williamson, E. (2020). Living risk prediction algorithm (QCOVID) for risk of hospital admission and mortality from coronavirus 19 in adults: national derivation and validation cohort study. *BMJ*, 371, pp. m3731. https://doi.org/10.1136/bmj.m3731

[20]Office for National Statistics. 2020. Labour market overview, UK: October 2020. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/uklabourmarket/october2020 [Accessed 31st October 2020]

[21]Husky, M., Kovess-Masfety, V., & Swendsen, J. (2020). Stress and anxiety among university students in France during Covid-19 mandatory confinement. *Compr. Psychiatry* **102**, 152-191. doi: 10.1016/j.comppsych.2020.152191

[22]Rastegar Kazerooni, A., Amini, M., Tabari, P., & Moosavi, M. (2020). Peer mentoring for medical students during the COVID-19 pandemic via a social media platform. *Medical education*, *54*(8), 762–763. https://doi.org/10.1111/medu.14206

[23]Copeland, William E., Ellen McGinnis, Yang Bai, Zoe Adams, Hilary Nardone, Vinay Devadanam, Jeffrey Rettew, and Jim J. Hudziak. 2021. Impact of COVID-19 Pandemic on College Student Mental Health and Wellness. *Journal of the American Academy of Child &*

Adolescent Psychiatry, 60 (1): 134-141.e2. https://doi.org/https://doi.org/10.1016/j.jaac.2020.08.466.

[24]Essadek, A., and T. Rabeyron. 2020. Mental Health of French Students during the Covid-19 Pandemic. *Journal of affective disorders*, 277 (December): 392–93. https://doi.org/S0165-0327(20)32648-3

[25]Wathelet, M., S. Duhem, G. Vaiva, T. Baubet, E. Habran, E. Veerapa, C. Debien, et al. 2020. Factors Associated With Mental Health Disorders Among University Students in France Confined During the COVID-19 Pandemic. *JAMA network open*, 3 (10): e2025591. https://doi.org/10.1001/jamanetworkopen.2020.25591 [doi].

[26]Alsoufi, A., A. Alsuyihili, A. Msherghi, A. Elhadi, H. Atiyah, A. Ashini, A. Ashwieb, et al. 2020. Impact of the COVID-19 Pandemic on Medical Education: Medical Students' Knowledge, Attitudes, and Practices Regarding Electronic Learning. *PloS one*, 15 (11): e0242905. https://doi.org/10.1371/journal.pone.0242905 [doi].

[27]Byrnes, Y. M., A. M. Civantos, B. C. Go, T. L. McWilliams, and K. Rajasekaran. 2020. Effect of the COVID-19 Pandemic on Medical Student Career Perceptions: A National Survey Study. *Medical education online*, 25 (1): 1798088. https://doi.org/10.1080/10872981.2020.1798088 [doi].

[28]Choi, B., L. Jegatheeswaran, A. Minocha, M. Alhilani, M. Nakhoul, and E. Mutengesa. 2020. The Impact of the COVID-19 Pandemic on Final Year Medical Students in the United Kingdom: A National Survey. *BMC medical education*, 20 (1): 206-020-02117–1. https://doi.org/10.1186/s12909-020-02117-1 [doi].

[29]Kecojevic, A., C. H. Basch, M. Sullivan, and N. K. Davi. 2020. The Impact of the COVID-19 Epidemic on Mental Health of Undergraduate Students in New Jersey, Cross-Sectional Study. *PloS one*, 15 (9): e0239696. https://doi.org/10.1371/journal.pone.0239696 [doi].

[30]Lyons, Z., H. Wilcox, L. Leung, and O. Dearsley. 2020. COVID-19 and the Mental Well-Being of Australian Medical Students: Impact, Concerns and Coping Strategies Used. *Australasian psychiatry : bulletin of Royal Australian and New Zealand College of Psychiatrists*, 28 (6): 649–52. https://doi.org/10.1177/1039856220947945 [doi].

[31]Son, C., S. Hegde, A. Smith, X. Wang, and F. Sasangohar. 2020. Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study. *Journal of medical Internet research,* 22 (9): e21279. https://doi.org/10.2196/21279 [doi].

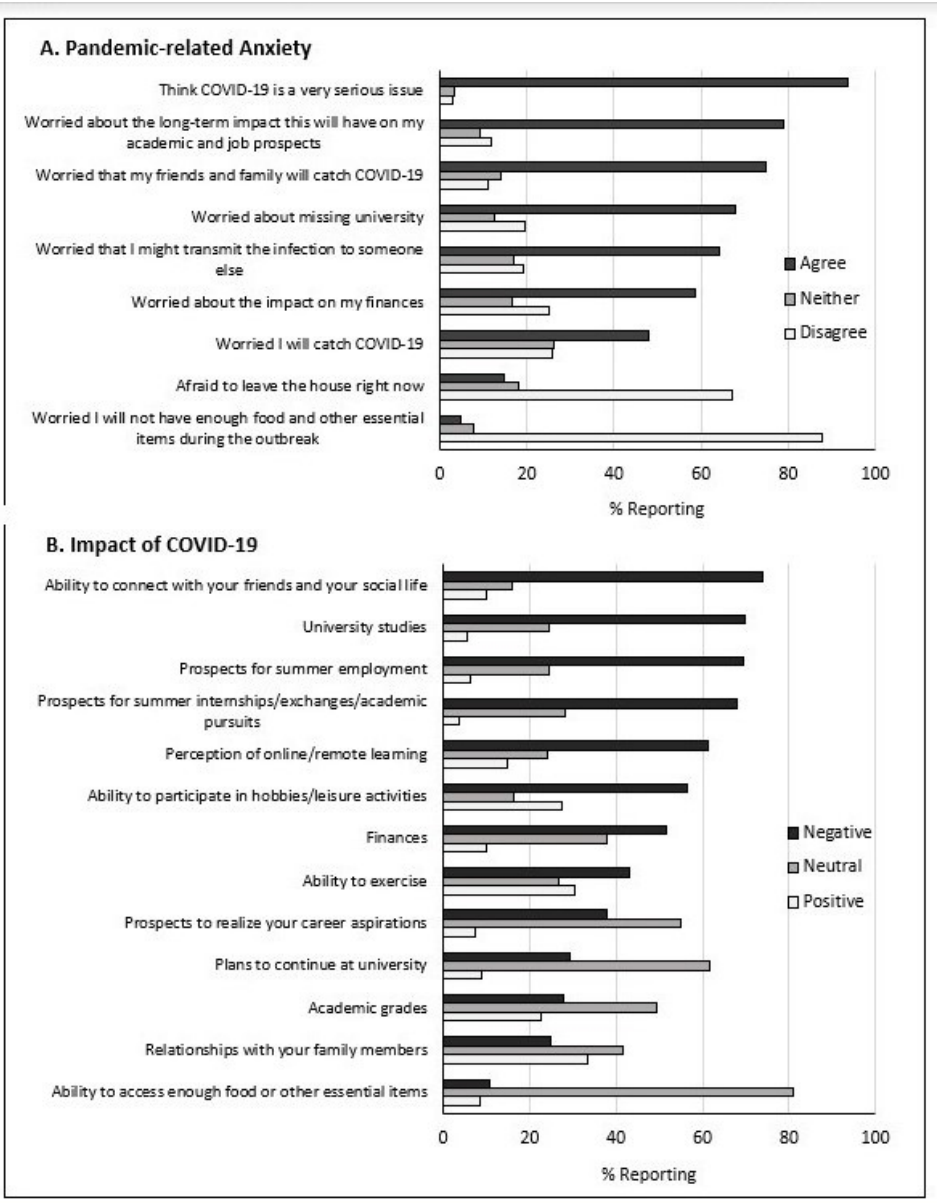

Figure 1: Queen's university students' (n=3,013) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

155x197mm (96 x 96 DPI)

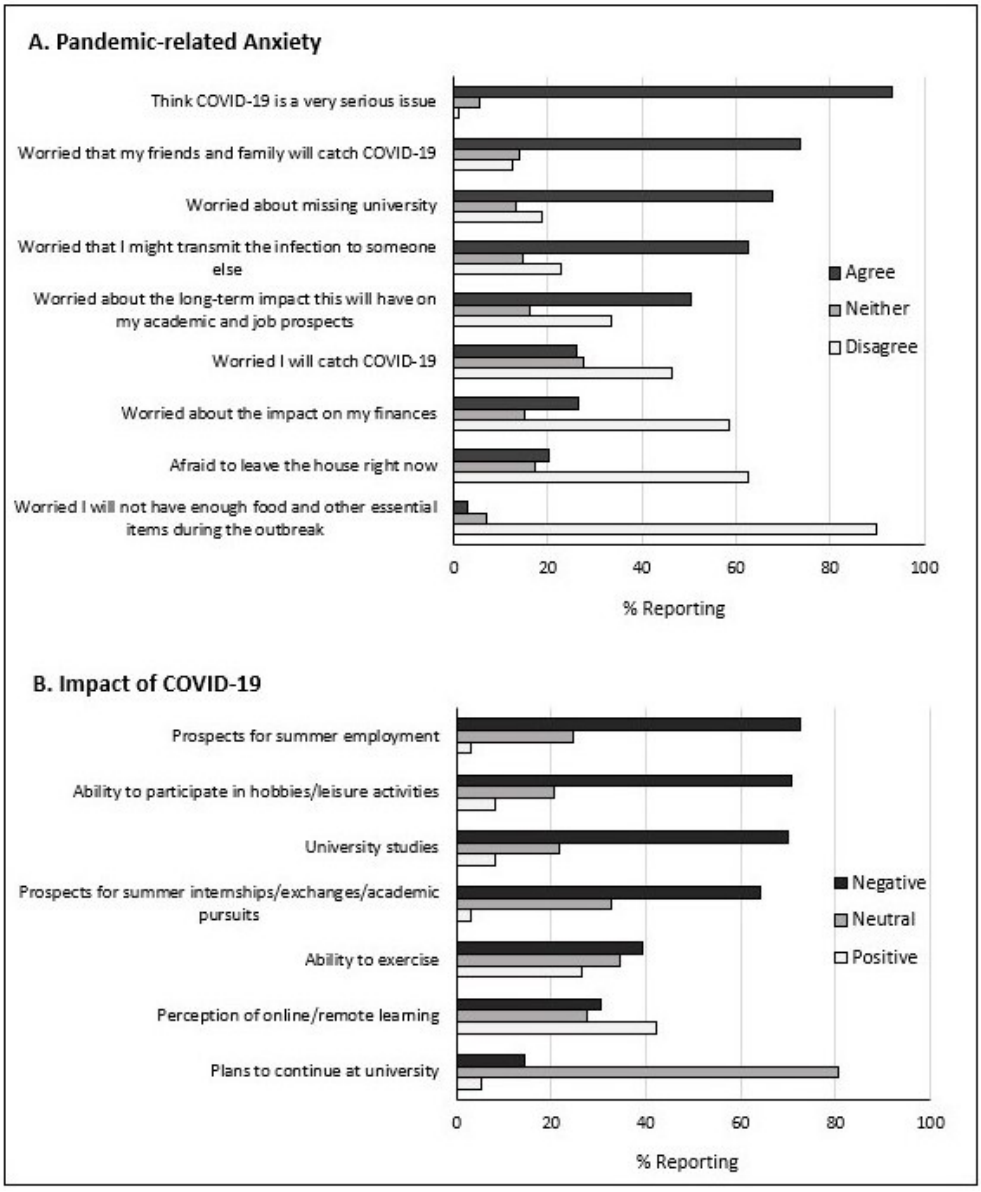

Figure 2. Oxford University first-year undergraduate students' (n= 339) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

152x182mm (96 x 96 DPI)

Supplemental Table 1. Oxford University first-year student percentage ratings on the COVID-19 Pandemic Anxiety Scale items overall and by gender

	TOTAL (n=339)*	GENDER Male (n=121)	GENDER Female (n=209)	p**
Think COVID-19 is a very serious issue				
Agree	93.2	89.3	95.2	0.02
Neutral	5.6	7.4	4.8	
Disagree	1.2	3.3	0	
Worried that I will catch COVID-19				
Agree	26.0	16.5	31.1	0.01
Neutral	27.7	26.4	28.2	
Disagree	46.3	57.0	40.7	
Worried friends and family will catch COVID-19				
Agree	73.7	60.3	81.3	<0.001
Neutral	13.9	20.7	10.0	
Disagree	12.4	19.0	8.6	
I am afraid to leave the house right now				
Agree	20.1	10.7	24.4	0.004
Neutral	17.4	15.7	18.7	
Disagree	62.5	73.6	56.9	
I am worried that I might transmit the infection to someone else				
Agree	62.5	52.9	68.4	0.02
Neutral	14.7	19.0	12.4	
Disagree	22.7	28.1	19.1	
I am worried I will not have enough food and other essential items during the outbreak				
Agree	2.9	1.7	3.3	0.53
Neutral	7.1	8.3	6.2	
Disagree	90.0	90.1	90.4	
I am worried about missing university				
Agree	67.8	62.8	69.9	0.47
Neutral	13.3	15.7	12.4	
Disagree	18.6	20.7	17.7	
I am worried about the impact on my finances				
Agree	26.5	19.0	31.6	0.04
Neutral	15.0	15.7	14.8	
Disagree	58.4	65.3	53.6	
I am worried about the long-term impact on my academic and job prospects				
Agree	50.4	39.7	54.5	0.03
Neutral	16.2	19.8	14.8	
Disagree	33.3	40.5	30.6	

Notes: (1) *not all participants reported gender, (2) **p-value for chi-square test

Supplemental Table 2. Oxford University first-year student percentage reporting overall and by gender. *Could you describe the impact that the COVID-19 pandemic and associated social distancing have had on*:

		GENDER		
	TOTAL (n=339)*	**Male** (n=121)	**Female** (n=209)	**p****
Your university studies?				
Negative	69.9	70.2	69.4	0.90
Neutral	21.8	20.7	22.5	
Positive	8.3	9.1	8.1	
Your plans to continue at university?				
Negative	14.2	5.0	19.6	<0.001
Neutral	80.5	90.9	74.2	
Positive	5.3	4.1	6.2	
Your perception of online/remote learning				
Negative	30.4	25.6	33.5	0.046
Neutral	27.4	34.7	22.5	
Positive	42.2	39.7	44.0	
Your prospects for summer internships/exchanges/academic pursuits?				
Negative	64.0	62.0	64.1	0.33
Neutral	32.7	36.4	31.6	
Positive	3.2	1.7	4.3	
Your prospects for summer employment?				
Negative	72.6	63.6	77.5	0.02
Neutral	24.5	31.4	20.6	
Positive	2.9	5.0	1.9	
Your ability to exercise?				
Negative	39.2	43.8	37.3	0.17
Neutral	34.5	35.5	32.5	
Positive	26.3	20.7	30.1	
Your ability to participate in your usual hobbies/ leisure activities?				
Negative	70.8	67.8	73.2	0.49
Neutral	20.6	24.0	18.7	
Positive	8.3	7.4	8.1	

Notes: (1) *not all participants reported gender, (2) **p-value for chi-square test

Supplemental Materials Appendix A1: Quotes from qualitative data analysis of free text responses

Social isolation

"I highly depend on social environments to support my mental health, so not being able to see friends is quite challenging as it makes my depression worse"

"Forced separation from part of my support system has had a negative impact on both my academics and mental health"

"Impacts of the pandemic on family members have reverberating effects to all members of household"

"Being stuck in a house with my parents has negatively impacted my mental health"

"I have to be near my emotionally abusive mother, I self harm a lot more now and I really need access to university student wellness center but I cannot call them while here"

"I've been feeling more lonely and restless with the pandemic going on. There are less outlets to relax due to isolation (ie sports leagues, meeting with friends, etc.)"

"As much as I would sometimes find social interaction difficult and draining, being starved of it is definitely having a negative impact on my mental health."

"Not being able to meet up with friends in person has been somewhat of a blow to mental health"

"Not being able to see my partner has had a significant impact on my mental health."

"Having no break from my fairly stressful home situation has not been great for my mental health"

"I find being stuck inside with my family is very stressful and it leaves me sometimes feeling unable to work which compounds the already existing stress about work and it often becomes a cycle I find difficult to break"

Work adaptation

"Living and working in the same place is a struggle. I am concerned about this going into another year of school with little opportunity for in person learning or access to on campus study spaces.

I am nervous about completing my final year of my undergraduate degree remotely, as my program is very lab-based."

"I am finding it hard to keep a balanced perspective on work and assignments working at home by myself and not being around friends."

"Getting myself into an exam or essay-writing mindset at home is much harder than I thought it would be."

"I am much less motivated to do my university assignments when I am home compared to when I am at university"

Coping skills

"I have found that with the pandemic and social distancing requirements I have had more difficulty than normal maintaining my mental wellness. I have struggled with some anxiety at several points in the past few months as I haven't have school or work to focus on, and small problems are exacerbated as they are taking up more focus."

"It's devastating that we won't get a normal orientation week or first year, but I do understand that Queen's is doing everything they can to try and make it better."

"Severely imparts my ability to spend time outdoors and with my friends, things like rock climbing and hiking and yoga, which are all very important to maintaining my mental health and managing anxiety. It's been a lot harder to deal with in the absence of these things. School was much more stressful online without support of classmates and less connection to professors."

"It has removed my ability to train for my sport which was a crucial part of my weekly structure 6 days a week, and was critical in my being able to maintain my mental health and work/study productively"

Unique populations

"I have been too scared to see my doctor about my physical ~~digestive~~ health issues and they have gotten much worse. I will likely need a lot of treatment when this is all over. I'm too scared to go to a hospital or doctors office because of the virus at the moment as I live with vulnerable individuals"

"Too afraid to visit hospital for routine problems."

"I lost my childcare for two children under 3. Completing online synchronous school while my partner works long hours in the emergency department, and having no help from family because of COVID-19 has left me feeling overwhelmed, un-engaged, frustrated, and easily angered. It has impacted my relationship with my partner and to some extent my self worth as I am being forced to be a stay-at-home mother and student and am unsure if I'll be able to work which gives me a lot of fulfillment, and much needed mental stimulation."

"Trying to juggle dependents alone while in school, as my spouse continues to work"

"Being an international student, I couldn't go back home due to the pandemic. As a result I am all alone. It's lonely and i get restless at times. all this negatively affects by study"

"Not being able to go home as an international student, it was scary to be in this situation in another country"

"Local regulations on flights and exit and entry make international travel difficult, and this also results in the increase in the price of air tickets. An one-way ticket from Canada to China is above 7000 dollars, which is not affordable for me."

"As an international student, I had trouble coming back home, which caused severe stress and started a period of worse mental health for me."

Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

		Reporting Item	Page Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary of what was done and what was found	1
Introduction			
Background / rationale	#2	Explain the scientific background and rationale for the investigation being reported	2
Objectives	#3	State specific objectives, including any prespecified hypotheses	1,2
Methods			
Study design	#4	Present key elements of study design early in the paper	3
Setting	#5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	3

Eligibility criteria	#6a	Give the eligibility criteria, and the sources and methods of selection of participants.	3
	#7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3
Data sources / measurement	#8	For each variable of interest give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group. Give information separately for for exposed and unexposed groups if applicable.	3-4
Bias	#9	Describe any efforts to address potential sources of bias	3-4
Study size	#10	Explain how the study size was arrived at	4
Quantitative variables	#11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen, and why	3-4
Statistical methods	#12a	Describe all statistical methods, including those used to control for confounding	3-4
Statistical methods	#12b	Describe any methods used to examine subgroups and interactions	3-4
Statistical methods	#12c	Explain how missing data were addressed	3-4
Statistical	#12d	If applicable, describe analytical methods taking account of	n/a

methods		sampling strategy	Not done
Statistical methods	#12e	Describe any sensitivity analyses	n/a Not done
Results			
Participants	#13a	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed. Give information separately for for exposed and unexposed groups if applicable.	4
Participants	#13b	Give reasons for non-participation at each stage	4
Participants	#13c	Consider use of a flow diagram	n/a Described in prose
Descriptive data	#14a	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.	4-5
Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	4
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	5-8

Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	5-7
Main results	#16b	Report category boundaries when continuous variables were categorized	3,5
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a Not relevant to this study
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	3-5
Discussion			
Key results	#18	Summarise key results with reference to study objectives	5-8
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	10
Interpretation	#20	Give a cautious overall interpretation considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence.	10
Generalisability	#21	Discuss the generalisability (external validity) of the study results	10
Other Information			

Funding	#22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	11