





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

Jennifer A Appleby ¹, Nathan King ², Kate E Saunders,^{3,4} Anne Bast,¹ Daniel Rivera ⁵, Jin Byun,⁶ Simone Cunningham,⁷ Charandeep Khera,³ Anne C Duffy ^{3,8}

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For numbered affiliations see end of article.

Correspondence to

Dr Anne C Duffy;
anne.duffy@queensu.ca

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-19 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 $p<0.01$) and were more likely to self-isolate (63.9% vs 57.0%, χ^2 $p<0.01$) 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.

INTRODUCTION

In late 2019, COVID-19 was detected in Wuhan, China, causing disease ranging from

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.

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}

METHODS

COVID-19 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-19 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).

Study variables

Demographic characteristics

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

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 and 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, recategorised into 'disagree' (1–2), 'neither disagree or agree' (3) and 'agree' (4–5).

Students were also asked about the impact of the pandemic on their 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?'.

Statistical analysis

The primary analysis used 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 χ^2 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 summarised. Coding comprised identification of experiences, referred to as 'themes'. As understanding increased, data were summarised and reinterpreted, 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 on.

The Strengthening the Reporting of Observational Studies in Epidemiology cross-sectional reporting guidelines were used in the reporting of this study.¹¹

Patient and public involvement

The ongoing UFlourish survey is a student-informed research effort.⁶ Peer health educators 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.

RESULTS

Description of the sample

The response rate among Queen's undergraduate students was 13.5% (n=3452). The sample was broadly representative of the eligible student population by year and programme of study, full time 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<0.01) and were younger than 19 years old (40.6% vs 35.0%, χ^2 p<0.01). In this report, we describe the responses of 3013 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<0.001) and be international students (21.7% vs 7.5%, p<0.001). 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 programmes 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.

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<0.01). Knowledge and following of recommendations were lowest in students aged 18 years and younger (68.0% and 87.3% ≥ 5) and highest in students aged 21 years 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.

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

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

Age (years)	n (%)
≤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)
Programme of study	
Arts, humanities and 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)

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

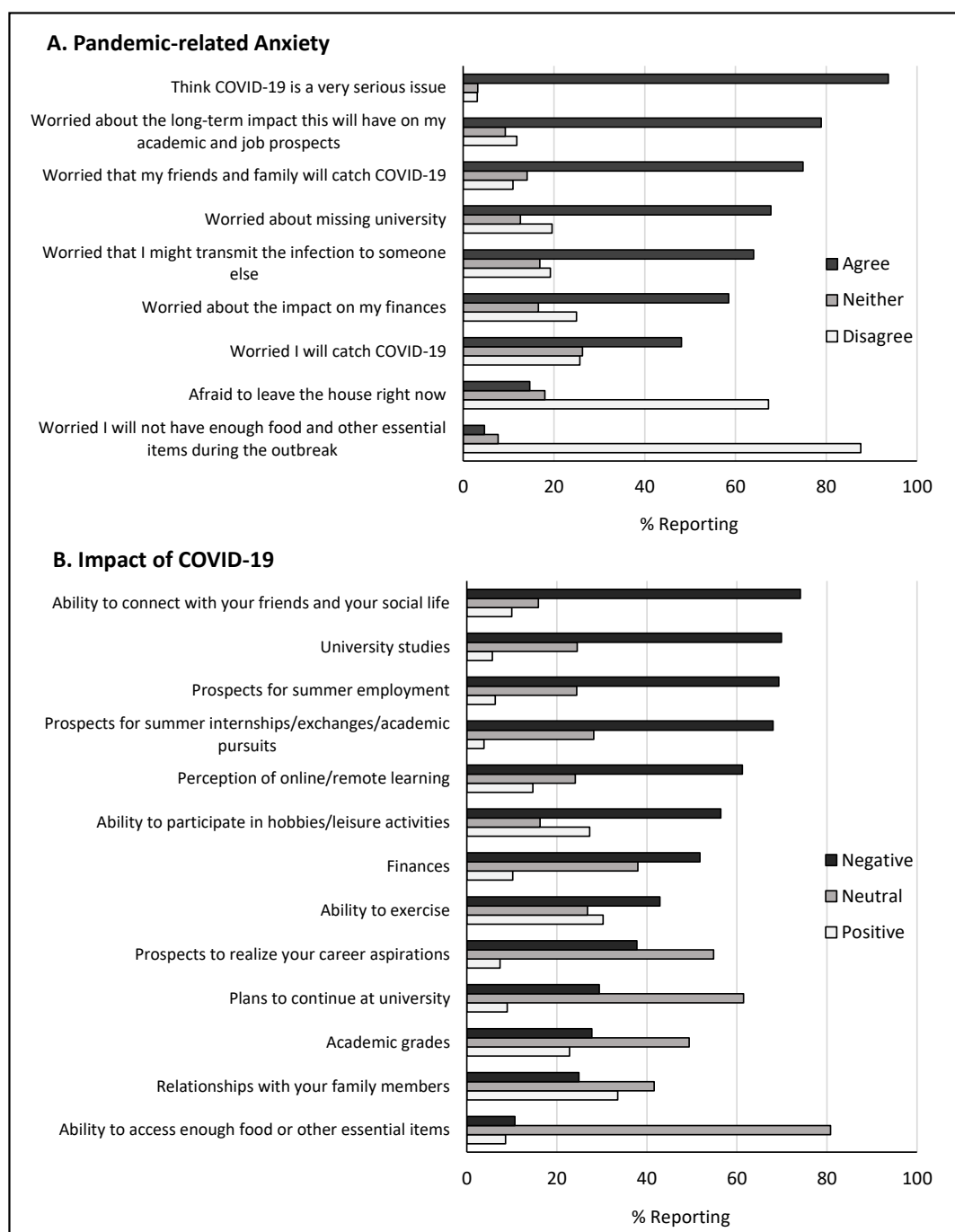


Figure 1. Queen's University undergraduate students' (n= 3,013) responses to the Pandemic Anxiety Scale item (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

Figure 1 Queen's university students' (n=3013) 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).

COVID-19 were greatest in females, older students and students in upper years of study (table 2). These overall trends and differences between genders were consistent with responses from Oxford students (figure 2; online supplemental table 1).

Most Queen's students reported concerns about missing university (67.8%), with younger students most worried (age 18 years or younger=80.4%, age 19–20 years=72.1% and age 21 years 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%).

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 value*	≤18	19–20	≥21	P value*	Incoming	1st/2nd	≥3rd	P value*
Think COVID-19 is a very serious issue										
Agree	90.5	94.9	<0.01	91.6	94.8	95.5	91.8	92.8	96.1	<0.01
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	<0.01	43.6	50.7	51.7	38.4	49.6	53.5	<0.01
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	<0.01	68.4	78.4	80.8	65.1	75.3	82.0	<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	<0.01	12.2	16.4	16.3	9.4	16.0	17.0	<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	<0.01	58.4	66.6	69.4	51.2	66.6	70.4	<0.01
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	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	<0.01	79.7	71.2	43.1	79.9	73.4	51.9	<0.01
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										

Continued

Table 2 Continued

	Gender		Age group				Year of study				
	Male	Female	P value*	≤18	19–20	≥21	P value*	Incoming	1st/2nd	≥3rd	P value*
Agree	50.0	61.6	<0.01	53.8	61.8	61.5	<0.01	47.1	63.2	61.3	<0.01
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	<0.01	77.7	80.8	78.1	0.09	74.8	80.3	80.3	<0.01
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	

I am worried about the long-term impact this will have on my academic and job prospects

Agree	72.7	81.4	<0.01	77.7	80.8	78.1	0.09	74.8	80.3	80.3	<0.01
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 χ^2 test, (2) sample sizes by strata are: 868 males and 2111 females; 1222≤18, 1062 ages 19–20 years and 729≥21; 765 incoming, 1238 1st/2nd year and 1010 ≥3rd year.

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 (online supplemental table 1).

Impact of COVID-19

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 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 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; online supplemental table 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%, $p<0.001$) and Oxford (77.5% vs 63.6%, χ^2 $p=0.02$) (table 3, online 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).

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 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

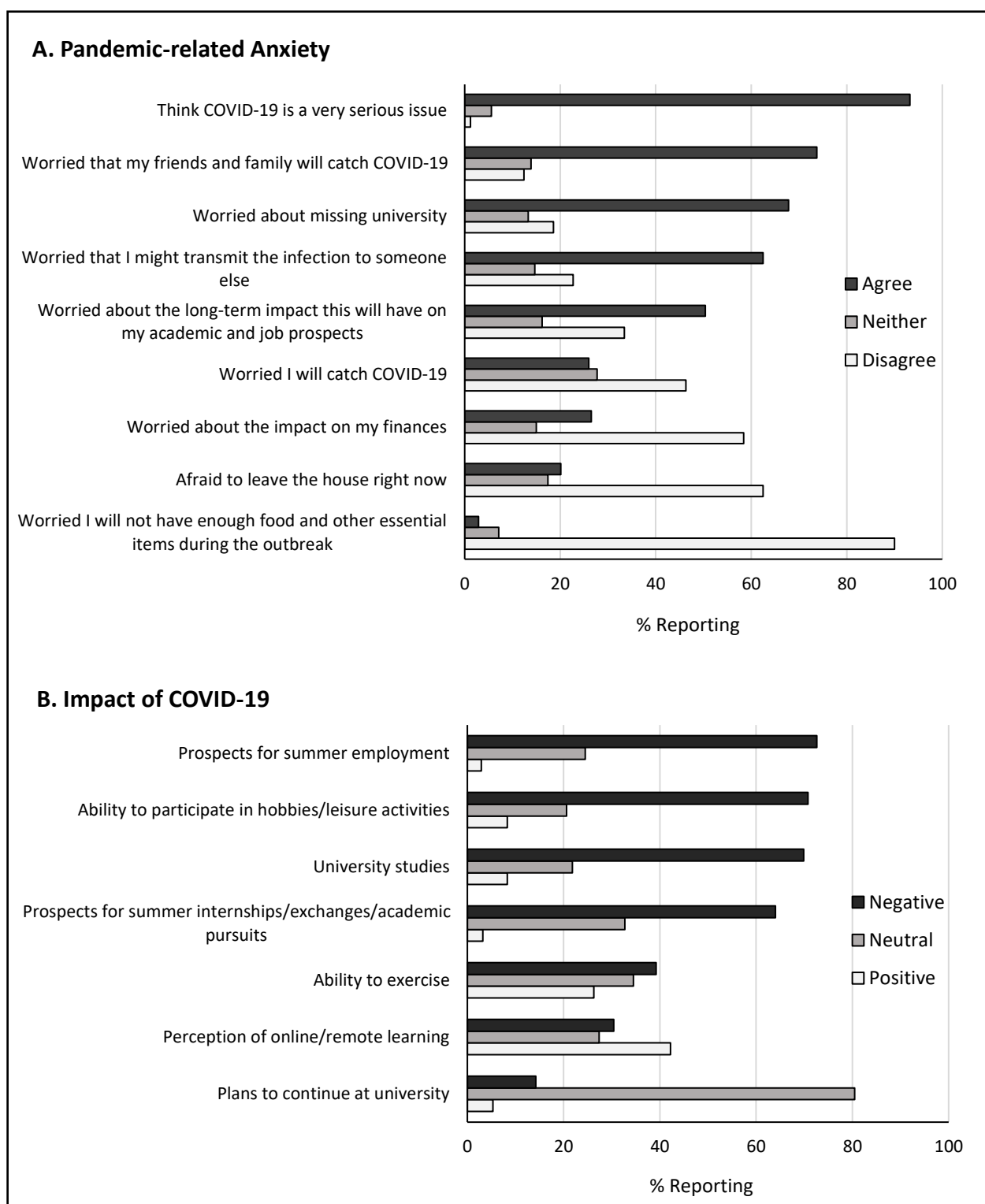


Figure 2. Oxford University first-year undergraduate students' (n= 337) responses to the Pandemic Anxiety Scale items (Panel A), and items relating to the impact that COVID-19 and associated social distancing have had on various aspects of their lives (Panel B).

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).

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 value*	≤18	19–20	≥21	P value*	Incoming	1st/2nd	≥3rd	P value*	
Your university studies?											
Negative	65.2	71.8	<0.01	67.2	73.7	68.7	<0.01	60.1	74.7	71.3	<0.01
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	<0.01	33.1	28.6	27.7	<0.01
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	<0.01	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	<0.01	21.7	32.1	27.0	<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	<0.01	56.7	74.3	68.8	<0.01
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	<0.01	68.5	71.4	67.6	<0.01	62.2	73.7	69.3	<0.01
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 realise your career aspirations?											
Negative	33.8	39.4	0.01	29.4	42.0	45.8	<0.01	25.4	38.7	46.1	<0.01
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?											

Continued

Table 3 Continued

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 value*	≤18	19–20	≥21	P value*	Incoming	1st/2nd	≥3rd	P value*
Negative	46.4	54.1	<0.01	46.0	55.7	56.0	<0.01	40.3	56.5	54.9	<0.01
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	<0.01	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	<0.01	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	<0.01	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	<0.01	68.8	75.7	76.0	<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	<0.01	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 χ^2 test, (2) sample size by strata: 868 males and 2111 females; 1222≤18, 1062 ages 19–20 years and 729≥21; 765 incoming, 1238 1st/2nd year and 1010 ≥3rd year.

reported a negative impact (24.9%). A negative impact on family relationships was more commonly reported by females (table 3).

Receipt of mental health support

Among Queen's students receiving mental health support (n=1256), 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.

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 further. See online supplemental material appendix A1 for representative quotes.

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.

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 specialised 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.

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.

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'.

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 with males.^{4 5 12} Moreover, females appear more susceptible to anxiety and depression surrounding COVID-19¹³⁻¹⁵ 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 students, 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 comorbidities 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 expressed concern about the impact of the pandemic on their finances. A smaller proportion of Oxford students reported these concerns compared with 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, online learning may have been more prevalent at Oxford prepandemic, 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, which 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 with 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, which 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 used 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 programme of study. Second, the Oxford data pertain 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 learning and well-being needs.

CONCLUSION

The COVID-19 pandemic has had wide-ranging impacts on university students' 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 socialising, 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.

Author affiliations

¹Oxford Medical School, University of Oxford Medical Sciences Division, Oxford, UK

²Department of Public Health Sciences, Queen's University, Kingston, Ontario, Canada

³Department of Psychiatry, University of Oxford, Oxford, UK

⁴Oxford Health NHS Foundation Trust, Warneford Hospital, Oxford, UK

⁵Department of Pharmacology and Toxicology, University of Toronto, Toronto, Ontario, Canada

⁶Faculty of Health Sciences, Queen's University, Kingston, Ontario, Canada

⁷Department of Psychology, Queen's University, Kingston, Ontario, Canada

⁸Department of Psychiatry, Queen's University, Kingston, Ontario, Canada

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ORCID iDs

Jennifer A Appleby <http://orcid.org/0000-0002-4862-052X>

Nathan King <http://orcid.org/0000-0003-4664-5456>

Daniel Rivera <http://orcid.org/0000-0001-5343-525X>

Anne C Duffy <http://orcid.org/0000-0002-5895-075X>

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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."

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		p**
		Male (n=121)	Female (n=209)	
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:*

	TOTAL (n=339)*	GENDER		p**
		Male (n=121)	Female (n=209)	
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