Stressed and distressed: how is the COVID-19 pandemic associated with sexual frequency, sexual satisfaction, and relationship satisfaction?

Jacinthe Dion, PhD[1,2,*] [iD], Catherine Hamel, BA[1,2], Benjamin Prévost, BA[1],

Christiane Bergeron-Leclerc, PhD[1], Eve Pouliot, PhD[1], Danielle Maltais, PhD[1], Josée Grenier, PhD[3],

Myriam Dubé, PhD[4], Claudiane Ouellet-Plamondon, PhD[5], Marie-Pier Vaillancourt-Morel, PhD[2,6]

[1]Intersectoral Center for Sustainable Health, Department of Health Sciences, Université du Québec à Chicoutimi, Saguenay, G7H 2B1, Canada
[2]Interdisciplinary Research Center on Intimate Relationship Problems and Sexual Abuse, Department of Psychology, Université de Montréal, Montréal, H3C 3J7, Canada
[3]Department of Social Work, Université du Québec en Outaouais, Saint-Jérôme, J7Z 0B7, Canada
[4]School of Social Work, Université du Québec à Montréal, Montréal, H2L 4Y2, Canada
[5]École de technologie supérieure, Montréal, H3C 1K3, Canada
[6]Department of Psychology, Université du Québec à Trois-Rivières, Trois-Rivières, G8Z 4M3, Canada

*Corresponding author: Department of Health Sciences, Université du Québec à Chicoutimi, 555 Bd de l Université, Chicoutimi, QC G7H 2B1.
Email: jacinthe_dion@uqac.ca

Abstract

Background: The Canadian government's response to the ongoing COVID-19 pandemic included the implementation of several restrictive measures since March 2020. These actions sought to decrease social contact and increase physical distancing, including that within universities. Such constraints were required to impede the transmission of the virus; however, concerns remain about their impact on the sexual and intimate relationships of university employees and students.

Aim: This study examined the associations between COVID-19–related stress and sexual frequency, sexual satisfaction, and relationship satisfaction, also testing the mediating role of psychological distress.

Methods: The models were tested with Canadian data collected from university employees and students in 2 phases: the first wave in April-May 2020 (T1; n = 2754) and the second wave in November-December 2021 (T2; n = 1430), 18 months afterward. Participants completed self-report questionnaires online. Path analyses were performed to test the associations of the mediation models.

Outcomes: The principal outcomes included psychological distress determined via the Patient Health Questionnaire–4, relationship satisfaction measured via the Dyadic Adjustment Scale, and sexual satisfaction and sexual frequency ascertained through a single item each.

Results: Overall, COVID-19–related stress was associated with higher psychological distress, which in turn was related to lower sexual frequency, sexual satisfaction, and relationship satisfaction. Similar results were obtained with T1 and T2 data, indicating the mediating effect of psychological distress.

Clinical Implications: These findings increase scholarly comprehension of the negative associations between stress/distress and sexual and romantic relationships. Sexuality and close relationships are vital to the quality of human life; thus, targeted interventions should be developed to reduce COVID-19–related stress and its impact on sexual and romantic relationships to mitigate the long-term influences of this unique global challenge.

Strengths and Limitations: To our knowledge, this study is the first to use a large sample size and replicate findings in 2 waves. Nonetheless, it is limited by the use of cross-sectional data. Longitudinal studies with the same participants are mandated to better understand the evolution of these outcomes.

Conclusion: COVID-19–related stress and psychological distress were found among participating university students and employees and were associated with lower sexual satisfaction, sexual frequency, and intimate relationship satisfaction. These results were observed at the early onset of the pandemic and 18 months afterward, suggesting that the stress generated by the pandemic were not mere reactions to the onset of the pandemic but persisted over time.

Keywords: sexuality; marital relationships; COVID-19; anxiety; depression; university employees; students; couple life.

Introduction

The first outbreak of coronavirus disease 2019 (COVID-19) occurred in Wuhan, China, in December 2019.[1] It caused the current pandemic, which is exhibiting deleterious consequences on human life worldwide. In March 2020, the Canadian province of Québec responded to the emerging health crisis by instructing its population to limit social contact.[2]

Thus, all nonessential businesses, schools, and daycare services were shut down for 7 weeks. Many people experienced a drastic shift in lifestyles, facing temporary unemployment or having to work at home in the presence of children, becoming isolated at home for a long period, or being affected by financial anxieties. Studies conducted in different countries reported increased levels of stress—which can be defined as

"the non-specific response of the body to any demand"[3]—since the beginning of the COVID-19 pandemic.[4-8] Stress can affect individuals' interactions, specifically within the romantic and sexual spheres. Studies conducted before the COVID-19 pandemic have evidenced that sexual frequency, sexual satisfaction, and relationship satisfaction decrease with increasing stress levels.[9,10] Stress is thus negatively related to the sexual and romantic relationships of couples. For example, a multilevel cyclic analysis study based on a daily diary approach to record subjective stress levels and sexual activities reported that external stressors lowered the frequency of sexual encounters and reduced satisfaction in relationships.[11]

Hence, in the public discourse, different narratives have been posited—for instance, that there would be a baby boom as a result of couples sheltering in place during the early phase of the COVID pandemic[12] or that once restrictions diminish, individuals would engage more in sexual activities as a means to "making up for lost time."[13] Although some studies indicated that around 3% to 26% of the participants reported an increase in sexual frequency or relationship satisfaction during the lockdown, a higher percentage (6%-53%) noted a decrease in these parameters.[14-18] Similar results were observed in other studies.[19-23] The decrease in sexual frequency and/or satisfaction was higher in women than men and was felt more strongly by those who experienced the pandemic negatively[14,18] rather than with positivity.[15] Lower levels of sexual satisfaction or frequency were also associated with stress,[18] manifestations of depression,[24] and anxiety.[16,22] Altogether, these results suggest that the pandemic could influence the sexual and romantic lives of adult couples worldwide. The examination of whether and how this stress relates to sexual satisfaction and pleasure in romantic affiliations may increase our understanding of the impact of COVID-19–related stress. However, studies that have investigated stress and sexuality during the pandemic were conducted outside the university setting and did not explore different phases of the pandemic. Moreover, no studies have yet been conducted to specifically investigate the mechanisms linking COVID-19–related stress to sexual frequency and satisfaction with sexual relations and romantic bonds.

This study posits that psychological distress could represent such a mechanism.[4,6-8] Psychological distress is a crucial component of psychological functioning and may be defined as "a state of emotional suffering characterized by symptoms of depression and anxiety, sometimes accompanied by somatic symptoms."[25(p123)] The Canadian province of Québec reported the highest number of COVID-19–positive cases between March and June 2020, and increased psychological distress was observed among its population,[26] as in other regions of the world. This distress has remained palpable since the beginning of the pandemic.[27] Therefore, the pandemic could have affected and may continue to affect the sexual and relational well-being of couples because of the psychological distress that it has generated. A study conducted in Italy evinced the association of psychological distress with sexual health among women, including sexual satisfaction.[21] That study tested a model in which the lower frequency of sexual activities during the COVID-19 pandemic was correlated to lower sexual health through psychological distress.[21] The current study examines sexual frequency separately from sexual and relationship satisfaction, as these variables are not always correlated.[28] The numerous psychological issues characterizing the pandemic might have affected the frequency of

sexual activities, sexual satisfaction, and intimate relationship satisfaction. Moreover, it is speculated that these associations could still exist because the pandemic has endured for >2 years.

Multiple institutions were affected by the COVID-19 pandemic; however, postsecondary institutions were especially targeted by government regulations because they were required to immediately cease their academic activities between March and June 2020. This sudden alteration in the daily lives of university students and staff could have influenced their physiological well-being in some manner. Universities have reopened since that time. Although there was no official lockdown in November-December 2021 (apart from the imposition of quarantines for people who contracted COVID-19 or had come into contact with a person infected with the virus), telework persisted extensively during this period as the virus continued to spread through communities. These factors, combined with the heavy reliance placed by the education system on technology, justify the present study's decision to sample universities. To our knowledge, no investigations have yet been conducted on this topic with university employees or students.

Research aims

The relationships among mental health, sexual vigor, and the well-being sensed by couples are generally amply understood but are rarely examined in times of major crises such as the current COVID-19 pandemic. Therefore, this cross-sectional study purposed to elucidate the pathways connecting COVID-19–related stress and the sexual and romantic well-being among employees and students during the pandemic. Specifically, the study's overarching objective was to examine the mediating role of psychological distress in the associations between COVID-19–related stress and 3 outcomes: sexual frequency, sexual satisfaction, and intimate relationship satisfaction at the beginning of the pandemic and 18 months later. Sociodemographic variables such as age, having children, student status, and relationship status were included as covariates because these factors have been associated with distress in the outcomes of studies conducted before the pandemic. For instance, a younger age, female sex, single status, student occupation, and unemployment are all factors deemed to increase distress levels.[29-32] Based on previous findings, it was hypothesized that COVID-19–related stress would be associated with higher psychological distress, which would then be connected to lower sexual frequency, lower sexual satisfaction, and lower relationship satisfaction. It was further expected that these mediational models would evince similar results for both rounds of data collection. The extant studies have reported significant differences between men and women in their reactions to the pandemic.[14,18] Therefore, this study also examined whether the models exhibited differences with respect to men and women.

Methods
Participants

The first round of a questionnaire-based survey (T1) was filled between April and May 2020 by 2754 students and employees of 11 universities across the province of Québec in Canada. The same questionnaire was distributed again

through multiple data collection phases. The last round was administered between November and December 2021 (T2) to all the students and employees of 12 universities. Only participants currently involved in a romantic relationship completed the measures on sexual satisfaction, sexual frequency, and relationship satisfaction at T2 and were thus included in our analyses of the aggregate of 1430 participants who completed the survey. Overall, 29.1% (T1) and 22.4% (T2) respondents identified as men, 69.6% (T1) and 76.5% (T2) as women, and 1.3% (T1) and 1.1% (T2) as nonbinary. The respondents ranged in age from 18 to 82 years (mean = 37.2, SD = 12.8) in T1 and from 18 to 80 years (mean = 39.3, SD = 11.2) in T2. An overall 57.0% (T1) and 51.1% (T2) were students. In terms of romantic relationships, 71.4% (T1) and 100.0% (T2) reported currently being in a romantic relationship, 23.7% (T1) were single, and 4.7% (T1) were separated or divorced. Moreover, 46.0% (T1) and 57.1% (T2) of the respondents were parents. Just 151 participants reported undergoing a COVID-19 test at T1, and only 8 of them tested positive during the past month. At T2, 25 participants stated that they were infected by COVID-19 over the past month.

Procedure

This cross-sectional study was part of a larger online survey that purposed to elucidate the impact exerted by the COVID-19 pandemic on psychological, social, physical, and spiritual existence. The survey was sent to students and staff members in 11 university institutions (12 at T2) all across the Canadian province of Québec by professional and school unions and associations and took approximately 25 minutes to complete. The pool of participants was eligible to enter a lucky draw of 20 gift cards of CAN$50 as compensation for their engagement with the study. This study was approved by the Université du Québec à Chicoutimi and by the 11 other institutional review boards of the participating universities. The current study used data of the first wave (T1) and last (named T2 to simplify). The same target audience comprising students and university employees was approached, but different participants could complete the survey in every round. Some participants offered their email addresses and agreed to be contacted again, but only 8.4% in T1 completed T2 (n = 120 of those in a romantic relationship). Therefore, it was not possible to longitudinally follow the same participants, and the 2 samples were examined independently.

Measures

Sociodemographic data were collected, such as age, gender, relationship status, occupation as student or employee, and parenthood status.

COVID-19–related stress

This study used 4 of the 5 items of the Primary Stress Appraisal and Coping Scale[33] adapted for the COVID-19 pandemic to assess stress levels associated with it. The 4 items were rated on a 5-point Likert-type scale (from *not at all* to *entirely*) evaluating the degree to which respondents felt that the following situations applied to them as related to the COVID-19 crisis: "This event was stressful for me," "This event stopped me from performing an activity or a project that was important to me," "I thought this event could harm me in the future," and "This event made me lose something important to me." The questionnaire exhibited adequate internal consistency for the current study ($\alpha = 0.76$ and 0.82 for T1 and T2, respectively).

Psychological distress

Psychological distress was assessed with the 4-item Patient Health Questionnaire, a widely used and validated measure.[34,35] This questionnaire encompasses the 2-item Generalized Anxiety Disorder Screener to measure anxiety[36] and the 2-item Patient Health Questionnaire to determine depression.[37,38] The respondents indicated the frequency of being concerned by any of the listed problems over the last 2 weeks on a 4-point Likert-type scale (from *not at all* to *nearly every day*). The items were as follows: (1) "feeling nervous, anxious, or on edge," (2) "not being able to stop or control worrying," (3) "little interest or pleasure in doing things," and (4) "feeling down, depressed, or hopeless." The total scores ranged from 0 to 12, and higher scores indicated greater psychological distress. This questionnaire demonstrated adequate internal consistency for the current study ($\alpha = 0.86$ and 0.85 for T1 and T2, respectively).

Sexual frequency

A single question was asked to assess sexual frequency: "In the past month, how many times have you had sex with a partner (including but not limited to oral sex, manual stimulation, and vaginal or anal penetration)." Participants could answer on a scale ranging from 1 (*never*) to 8 (*many times a day*).

Sexual satisfaction

Sexual satisfaction was evaluated through a single 5-point Likert-type scale question (from *very dissatisfied* to *very satisfied*): "To what degree were you sexually satisfied during the last month?" Higher scores indicated greater satisfaction with sex life.

Relationship satisfaction

Relationship satisfaction was assessed among participants currently in a romantic relationship with the 4-item version of the Dyadic Adjustment Scale.[39] The first 3 items presented the same 6-point Likert-type scale (from *never* to *always*) while the fourth item explored degrees of happiness on a 7-point scale (from *extremely unhappy* to *perfectly happy*). The total scores ranged from 0 (dissatisfaction) to 21 (utmost level of satisfaction). This questionnaire is widely used and evinced adequate internal consistency for the current study ($\alpha = 0.81$ and 0.76 for T1 and T2, respectively).

Statistical analyses

Descriptive analyses were conducted with SPSS version 27 (IBM) to examine the distribution of and the associations among the study variables. The 3 hypothesized mediational models were then tested via path analyses with Mplus 8.[40] Specifically, we examined whether psychological distress mediated the associations between COVID-19–related stress and the 3 dependent variables (sexual frequency, sexual satisfaction, and relationship satisfaction). The following were entered as control variables: age, parenthood (0 = no child, 1 = at least 1 child), status as student (0 = not a student, 1 = student), and relationship status for T1 (0 = not in a romantic relationship, 1 = currently in a romantic relationship). The models were tested by the maximum likelihood estimator, and missing data were handled through the full information maximum likelihood estimation method.[40] Indirect effects were examined via the calculation of bias-corrected bootstrap (10 000 iterations) at 95% CIs.[41-43]

Table 1. Sociodemographic characteristics of the study participants.

		Mean (SD) or %	
Variable	Range	T1 (n = 2754)	T2 (n = 1430)
Age, y	18-82	37.2 (12.8)	39.3 (11.3)
Having children	0-1	46.0	57.1
Being a student	0-1	57.0	51.1
Gender			
Women		69.6	76.5
Men		29.1	22.4
Nonbinary		1.3	1.1
Being in a relationship		71.4	100.0
COVID-19–related stress	0-16	6.98 (4.03)	4.85 (4.23)
Psychological distress	0-12	5.28 (3.41)	5.87 (3.21)
Sexual frequency	1-8	3.61 (1.98)	4.02 (1.62)
Sexual satisfaction	1-5	2.99 (1.26)	3.22 (1.13)
Relationship satisfaction	0-21	16.26 (3.37)	15.45 (3.43)

Table 2. Correlations between T1 and T2 variables.

	1	2	3	4	5	6	7	8
1. COVID-19–related stress	—	0.34***	0.03	−0.11***	−0.11***	−0.10***	−0.06*	0.15***
2. Psychological distress	0.58***	—	−0.04	−0.18***	−0.27***	−0.25***	−0.14***	0.16***
3. Sexual frequency	−0.08***	−0.09***	—	0.54***	0.27***	−0.25***	−0.05*	0.09**
4. Sexual satisfaction	−0.22***	−0.26***	0.53***	—	0.44***	−0.12***	−0.07*	0.05*
5. Relationship satisfaction	−0.18***	−0.28***	0.27**	0.43***	—	−0.07**	−0.15***	0.04
6. Age	−0.19***	−0.24***	−0.07**	0.03	−0.07**	—	0.42***	−0.49***
7. Having children	−0.15***	−0.18***	0.08***	0.04*	−0.13***	0.58***	—	−0.27***
8. Being a student	0.17***	0.21***	−0.01	−0.05*	0.02	−0.63***	−0.45***	—
9. Being in a relationship	−0.08***	−0.09***	0.48***	0.20***	—	0.15***	0.29***	−0.18***

*$P < .05$. **$P < .01$. ***$P < .001$.

A multiple-group gender-invariance path analysis was conducted with a corrected chi-square difference test (Satorra-Bentler scaled chi-square) to evaluate the gender moderation hypothesis for the mediational models: a significant chi-square difference between the configural and the constrained models indicated the existence of differences between men and women. The 6 mediational models (3 for T1 and 3 for T2) were first estimated through path analyses, and differences between women and men were examined as a potential moderator. The small subsample of nonbinary individuals rendered it impossible to estimate mediational models for such respondents. The models were fully saturated, as the associations among all variables were estimated ($\chi^2 = 0$, $df = 0$, comparative fit index = 1.00, Tucker-Lewis index = 1.00, root mean square error of approximation = 0.00).

Results

Table 1 presents the descriptive statistics and Table 2 the bivariate correlations between variables for each wave (T1 and T2). Results revealed preliminary associations mostly in line with the proposed hypotheses. COVID-19–related-stress and psychological distress were negatively associated with sexual frequency in T1 and with sexual and relationship satisfaction in T1 and T2.

Mediation models

All analyses were performed while controlling for age, parenthood status, status as a student, and relationship status for T1. The results of the models, including the bootstrapped indirect effects, are presented in Table 3 and depicted in Figures 1 to 3.

The results revealed significant indirect effects in T1 and T2: specifically, the significant links between COVID-19–related stress and our 3 outcomes via psychological distress (mediator). Higher levels of COVID-19–related stress were associated with higher levels of psychological distress, which was in turn related to a lower frequency of sexual activity, reduced sexual satisfaction, and lesser relationship satisfaction (Table 3, Figures 1-3). Overall the 3 models explained between 15.9% and 35.9% of the variance in psychological distress and between 6.5% and 25.6% of the variance of the 3 outcomes over the 2 waves.

Results evaluating whether the models would be different between men and women revealed that the multigroup models were invariant between men and women (ie, no differences detected) in T2 for sexual satisfaction and in both waves for sexual frequency and relationship satisfaction. However, the model was significantly different between men and women for sexual satisfaction in T1 (Table 4), yet the results indicated that the models for men and women were similar to the exemplar encompassing all participants (significant differences were found only between covariables and psychological distress).

In querying sexual satisfaction and sexual frequency, T1 included participants currently in a relationship as well as single participants; hence, we conducted an exploratory probe of significant differences between the groups vis-à-vis these models. Multigroup models indicated the invariance of the models between singles and participants currently in a coupled relationship. In other words, the links between

Table 3. T1/T2 models of the mediating role of psychological distress in the associations between COVID-19–related stress and sexual frequency, sexual satisfaction, and relationship satisfaction.[a]

Model 1	Psychological distress			Sexual frequency		
	b	P value	β	b	P value	β
COVID-19–related stress	0.50/0.26	<.001/<.001	0.55/0.31	−0.01/0.02	.307/.051	−0.02/0.06
Age	−0.03/−0.06	<.001/<.001	−0.09/−0.20	−0.03/−0.05	<.001/<.001	−0.19/−0.31
Having children	−0.06/−0.25	.687/.188	−0.01/−0.04	0.10/0.18	.247/.068	0.03/0.05
Being a student	0.39/0.06	.013/.765	0.05/0.01	−0.07/−0.12	.433/.236	−0.02/−0.04
Being in a relationship	− 00.11	.407	−0.01	2.13	<.001	0.49
Psychological distress				−0.04/−0.06	.001/<.001	−0.07/−0.13
R^2, %		35.7/15.9			25.6/7.7	
Indirect effect	$\beta = -0.04$, 95% CI [−0.07, −0.02]/$\beta = -0.04$, 95% CI [−0.06, −0.02]					

Model 2	Psychological distress			Sexual satisfaction		
COVID-19–related stress	0.50/0.26	<.001/<.001	0.55/0.31	−0.03/−0.01	<.001/.072	−0.09/−0.05
Age	−0.03/−0.06	<.001/<.001	−0.09/−0.20	−0.01/−0.02	.041/<.001	−0.06/−0.15
Having children	−0.07/−0.25	.650/.193	−0.01/−0.04	−0.08/−0.08	.168/.236	−0.03/−0.04
Being a student	0.39/0.05	.014/.796	0.05/0.01	−0.01/0.02	.868/.728	−0.004/0.01
Being in a relationship	−0.12	.391	−0.02	0.54	<.001	0.19
Psychological distress				−0.07/−0.07	<.001/<.001	−0.21/−0.21
R^2, %		35.7/15.8			11.3/6.5	
Indirect effect	$\beta = -0.12$, 95% CI [−0.15, −0.09]/$\beta = -0.07$, 95% CI [−0.09, −0.05]					

Model 3	Psychological distress			Relationship satisfaction		
COVID-19–related stress	0.49/0.26	<.001/<.001	0.55/0.31	−0.03/−0.02	.246/.338	−0.03/−0.03
Age	−0.04/−0.06	<.001/<.001	−0.13/−0.20	−0.03/−0.03	<.001/.003	−0.10/−0.09
Having children	−0.15/−0.23	.363/.221	−0.02/−0.03	−10.03/−10.08	<.001/<.001	−0.15/−0.16
Being a student	0.19/0.07	.260/.725	0.03/0.01	−0.31/0.02	.108/.905	−0.05/0.003
Psychological distress				−0.29/−0.30	<.001/<.001	−0.31/−0.30
R^2, %		35.9/15.9			12.1/11.4	
Indirect effect	$\beta = -0.17$, 95% CI [−0.20, −0.14]/$\beta = -0.09$, 95% CI [−0.12, −0.07]					

[a]Indirect effects were obtained through psychological distress.
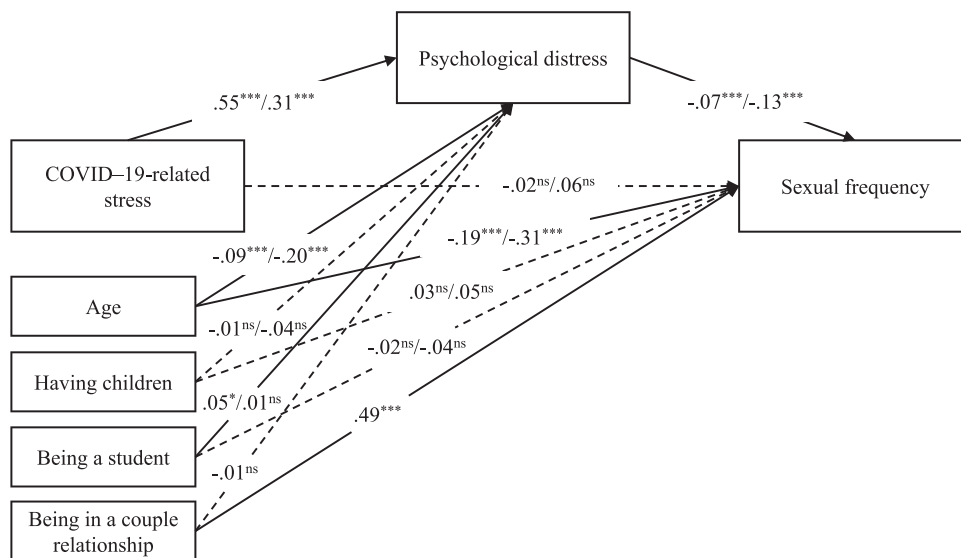
Figure 1. Mediation model for sexual frequency (T1/T2). *$P < .05$. **$P < .01$. ***$P < .001$.

COVID-19–related stress and the 3 outcomes via psychological distress did not diverge as a function of the relationship status.

As shown in Table 3, the results demonstrated the negative association of age with psychological distress: younger participants presented higher levels of psychological distress. Age was negatively associated with the 3 outcomes, especially for sexual frequency and sexual satisfaction in T2. Parenthood was not significantly associated with psychological distress, sexual frequency, and sexual satisfaction. However, parenthood was related to lower relationship satisfaction in both waves. Enrollment as a student was associated with higher psychological distress at T1. Finally, in T1, being in a relationship was associated with higher sexual frequency and higher sexual satisfaction.

Discussion

The current study primarily purposed to examine the mediating role of psychological distress in the associations between COVID-19–related stress and sexual frequency, sexual satisfaction, and relationship satisfaction in a large sample of
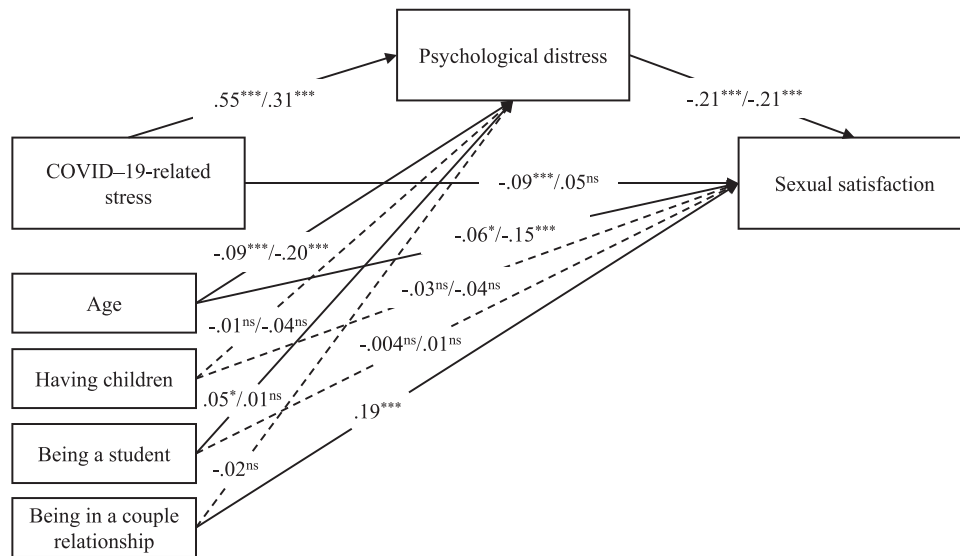
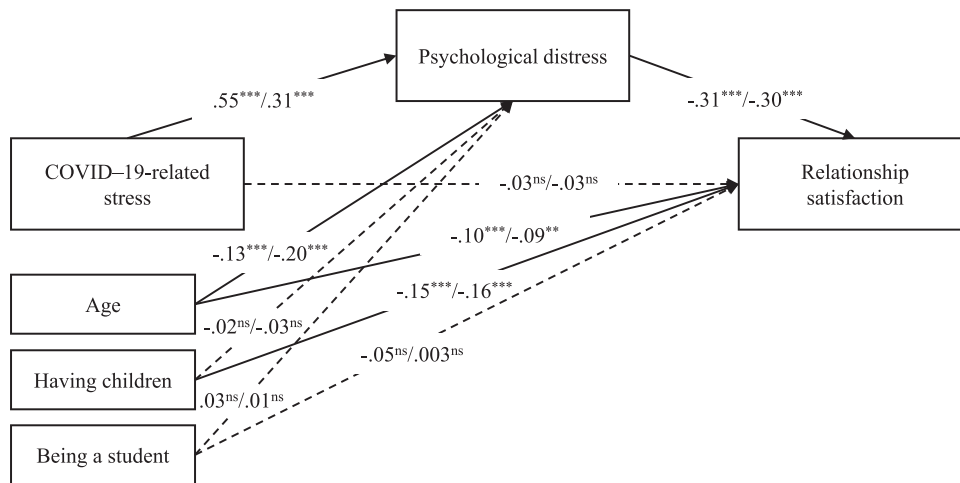**Figure 2.** Mediation model for sexual satisfaction (T1/T2). *$P < .05$. **$P < .01$. ***$P < .001$.

Figure 3. Mediation model for relationship satisfaction (T1/T2). *$P < .05$. **$P < .01$. ***$P < .001$.

Table 4. Results from the mediation model of sexual satisfaction for women/men in T1.[a]

	Psychological distress			Sexual satisfaction		
	b	P value	β	b	P value	β
COVID-19–related stress	0.47/0.56	<.001/<.001	0.54/0.58	−0.03/−0.03	.001/.052	−0.09/−0.09
Age	−0.03/−0.02	.001/.150	−0.10/−0.06	−0.01/−0.004	.169/.362	−0.05/−0.04
Having children	0.06/−0.46	.736/.109	0.01/−0.06	−0.14/−0.02	.055/.878	−0.06/−0.01
Being a student	0.43/0.12	.014/.679	0.06/0.02	−0.02/0.05	.815/.629	−0.01/0.02
Being in a relationship	0.06/−0.63	.729/.024	0.01/−0.08	0.48/0.65	<.001/<.001	0.17/0.23
Psychological distress				−0.07/−0.09	<.001/<.001	−0.19/−0.26
R^2, %		33.8/39.9			9.6/16.9	
Indirect effect			$\beta = -0.11$, 95% CI [−0.14, −0.07]/$\beta = -0.15$, 95% CI [−0.21, −0.10]			

[a]Indirect effects were obtained through psychological distress.

university employees and students at the beginning of the pandemic and to retest these associations 18 months later. Overall, the results supported the study hypotheses, suggesting that the stress induced by the COVID-19 pandemic in the university community was related to lower levels of relationship and sexual satisfaction as well as lower sexual frequency via higher levels of psychological distress. Moreover, although

1 mediational model varied for men and women, the results obtained from the separated models indicated similar results. Therefore, the mediating role of psychological distress appears to be similar for the entire university community and at 2 times of the pandemic: during the first lockdown and 18 months later, when the lockdown was necessary only for those who contracted COVID-19 or were in contact with a

person infected with COVID-19. Thus, the lockdown may have contributed in some ways to psychological distress and may have affected sexual activity and relationships; however, our results indicate that COVID-19–related stress remained associated with sexual and relationships 18 months after the pandemic began.

Controlling for age, parenthood, enrollment as a student, and relationship status, the results indicated that COVID-19–related stress was directly and/or indirectly, through psychological distress, associated with lower levels of sexual frequency, sexual satisfaction, and relationship satisfaction. These findings align with previous studies conducted in China, Taiwan, and Italy.[16-18] Karney and Bradbury's model of vulnerability, adaptation, and stress illuminates that some factors that can influence relationship satisfaction are related to stressful events and special circumstances during a relationship (stress aspect) as well as emotions and communication skills in a relationship (coping aspect).[44] Therefore, relationship satisfaction in couples relies on how the partners cope with certain stressors during their relationship.[45] The COVID-19 pandemic selected for this study certainly represented 1 such stressor. Our measure assessed the stressfulness of this pandemic, whether it stopped participants from performing an important activity/project and whether it could harm them in the future or make them lose something important to them. We did not evaluate whether this stress was related to the fear of becoming sick or being separated from friends and family. We also did not examine issues such as whether students worried about being able to complete their programs or about the quality of education delivered via online/virtual methods. For example, a recent study investigated 2 forms of COVID-19–related stress, health and isolation, and yielded different results even though both forms were related to lower sexual and couple functioning.[23] These results suggest the importance of assessing various forms of stress. Another study determined that contracting the virus and not completing the academic year denoted the strongest pandemic-associated concerns among university staff members.[46] Similarly, even though only a few participants indicated being infected by COVID-19 in our study, there has been some evidence that COVID-19 infections could adversely affect sexual function for men and women.[47,48] This consideration may be crucial for the future management of sexual health apprehensions and relationships. Overall, our results, like the outcomes reported by Pollard et al,[23] signify that higher stress levels could result in reduced sexual pleasure or make sexual intercourse more difficult, diminishing an individual's interest in sex.[49] Thus, a decrease may be observed in sexual frequency and sexual satisfaction.

Moreover, the links between stress and sexual and romantic well-being in couples were mediated by psychological distress. Hence, the experience of higher levels of stress apropos the COVID-19 pandemic was associated in participants with more intense psychological distress, which was in turn associated with lower levels of sexual frequency, sexual satisfaction, and relationship satisfaction. These results are congruent with previous findings specifying higher levels of distress during the COVID-19 pandemic[6,50] and indicate that greater pandemic-generated stress is related to stronger psychological distress. Consequently, university employees and students highly stressed by the current pandemic situation could become more vulnerable to higher levels of psychological distress, which could impede their capacity to

experience sexual pleasure or feel satisfied with a romantic relationship. These findings align with studies that previously established the connections of psychological distress to lower sexual frequency,[24,51] lower sexual satisfaction,[24] and lower relationship satisfaction.[52] That psychological distress associated with COVID-19–related stress can make it difficult to enjoy sexual experiences could denote a possible explanation, either because of difficulties in letting go and appreciating the moment or because of problems with emotion regulation, which can cause conflicts in relationships.[53]

The pandemic-related stress appears to increase psychological distress; however, prepandemic studies have noteworthily reported high levels of psychological distress in university students. Such distress can be influenced by financial concerns, worries about academic performance, and relationships with friends and family.[54,55] In addition, being away from home for university and family incomes are noted to affect the well-being of university students.[54] Therefore, university students represent a very high-risk population and may be more vulnerable than other university members, such as research support staff or researchers (even though researchers also experience psychological distress).[56] Nonetheless, the current results suggest that COVID-related stress increases the burden on university students and employees. The added pressure was observed at the beginning of the pandemic and remained visible 18 months later, suggesting that the stress generated by the pandemic was not a mere reaction to its onset. Rather, the stress seems to persist over time.

Strengths and limitations

The results of the present study offer preliminary answers to current concerns about the consequences of the pandemic vis-à-vis sexuality and relationships. Nevertheless, some limitations must be acknowledged. Although the sample of students and university employees was large, participation was voluntary, and the survey comprised the completion of a self-reporting instrument. In particular, the higher proportion of women, which is quite commonplace in voluntary participation studies,[57-60] may limit generalizability. Moreover, it is customary to reduce the number of items per construct in large-scale studies with adults. Thus, sexual satisfaction and sexual frequency were each measured via 1 item and could yield biased findings. Although the outcomes could be replicated by using 2 sets of data collected at an 18-month interval, the prospective effect of COVID-19–related stress could not be measured, and no causal link could be derived from the study's methodology. Longitudinal studies are therefore mandated to appropriately assess the potential long-term outcomes of the COVID-19 pandemic on sexuality and intimate relationships. Such prospective studies could incorporate a more refined assessment of intimate relationships and sexuality. Nonetheless, the current results suggest that the sexual behaviors of the respondents did not change substantially to adapt to the pandemic context.

Conclusion

Overall, the study's findings indicate that the stress and psychological distress experienced by the university students and employees were indeed associated with reduced sexual frequency and lower sexual and relationship satisfaction.

Connections with others are crucial for human health and longevity,[61] and specially designed interventions are mandated for adults reporting high levels of COVID-19–related stress to mitigate its negative impact on psychological distress and sexual and intimate relationships. Such programs could help individuals more effectively regulate their negative emotions in stressful situations and may increase the satisfaction that people sense with their sexual encounters and romantic relationships. Therefore, sexual pleasure and intimacy can be ameliorated in pandemic circumstances by attending to stress management.

Acknowledgments

Funding

References

1. World Health Organization. *Novel coronavirus: China*. Accessed October 12, 2020. http://www.who.int/csr/don/12-january-2020-novel-coronavirus-china/en/
2. Institut national de santé publique du Québec. *COVID-19: Mesures Sanitaires recommandées Pour la Population générale*. 2020. Accessed March 3, 2020. https://www.inspq.qc.ca/sites/default/files/covid/3008-mesures-sanitaires-population-generale-covid19.pdf
3. Selye H. The stress concept. *Can Med Assoc J*. 1976;**115**(8):718
4. Mazza C, Ricci E, Biondi S, *et al*. A nationwide survey of psychological distress among Italian people during the COVID-19 pandemic: immediate psychological responses and associated factors. *Int J Environ Res Public Health*. 2020;**17**(9):3165. https://doi.org/10.3390/ijerph17093165.
5. Halliburton AE, Hill MB, Dawson BL, Hightower JM, Rueden H. Increased stress, declining mental health: emerging adults' experiences in college during COVID-19. *Emerg Adulthood*. 2021;**9**(5):433–448. https://doi.org/10.1177/21676968211025348.
6. Qiu J, Shen B, Zhao M, Wang Z, Xie B, Xu Y. A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *Gen Psychiatr*. 2020;**33**(2):e100213. https://doi.org/10.1136/gpsych-2020-100213.
7. Satici B, Gocet-Tekin E, Deniz ME, Satici SA. Adaptation of the fear of COVID-19 scale: its association with psychological distress and life satisfaction in Turkey. *Int J Ment Health Addict*. 2021;**19**(6):1980–1988. https://doi.org/10.1007/s11469-020-00294-0.
8. Zhang J, Lu H, Zeng H, *et al*. The differential psychological distress of populations affected by the COVID-19 pandemic. *Brain Behav Immun*. 2020;**87**:49–50. https://doi.org/10.1016/j.bbi.2020.04.031.
9. Randall AK, Bodenmann G. Stress and its associations with relationship satisfaction. *Curr Opin Psychol*. 2017;**13**:96–106. https://doi.org/10.1016/j.copsyc.2016.05.010.
10. Tan PL. Stress, fatigue, and sexual spontaneity among married couples in a high-stress society: evidence from sex diary data from Singapore. *Arch Sex Behav*. 2021;**50**(6):2579–2588. https://doi.org/10.1007/s10508-020-01848-y.
11. Bodenmann G, Atkins DC, Schär M, Poffet V. The association between daily stress and sexual activity. *J Fam Psychol*. 2010;**24**(3):271–279. https://doi.org/10.1037/a0019365.
12. Döring N. How is the COVID-19 pandemic affecting our sexualities? An overview of the current media narratives and research hypotheses. *Arch Sex Behav*. 2020;**49**(8):2765–2778. https://doi.org/10.1007/s10508-020-01790-z.
13. Lindberg LD, Bell DL, Kantor LM. The sexual and reproductive health of adolescents and young adults during the COVID-19 pandemic. *Perspect Sex Reprod Health*. 2020;**52**(2):75–79. https://doi.org/10.1363/psrh.12151.
14. Cocci A, Giunti D, Tonioni C, *et al*. Love at the time of the Covid-19 pandemic: preliminary results of an online survey conducted during the quarantine in Italy. *Int J Impot Res*. 2020;**32**(5):556–557. https://doi.org/10.1038/s41443-020-0305-x.
15. Gouvernet B, Bonierbale M. Impact du confinement COVID19 Sur les cognitions et émotions sexuelles. *Theol Sex*. 2021;**30**(1):8–21. https://doi.org/10.1016/j.sexol.2020.11.004.
16. Ko NY, Lu WH, Chen YL, *et al*. Changes in sex life among people in Taiwan during the COVID-19 pandemic: the roles of risk perception, general anxiety, and demographic characteristics. *Int J Environ Res Public Health*. 2020;**17**(16):17. https://doi.org/10.3390/ijerph17165822.
17. Li G, Tang D, Song B, *et al*. Impact of the COVID-19 pandemic on partner relationships and sexual and reproductive health: cross-sectional, online survey study. *J Med Internet Res*. 2020;**22**(8):e20961. https://doi.org/10.2196/20961.
18. Panzeri M, Ferrucci R, Cozza A, Fontanesi L. Changes in sexuality and quality of couple relationship during the COVID-19 lockdown. *Front Psychol*. 2020;**11**:565823. https://doi.org/10.3389/fpsyg.2020.565823.
19. Fuchs A, Matonóg A, Pilarska J, *et al*. The impact of COVID-19 on female sexual health. *Int J Environ Res Public Health*. 2020;**17**(19):17. https://doi.org/10.3390/ijerph17197152.
20. Hille Z, Oezdemir UC, Beier KM, Hatzler L. L'impact de la pandémie de COVID-19 Sur l'activité sexuelle et les pratiques sexuelles des célibataires et des personnes en couple dans Une population germanophone. *Theol Sex*. 2021;**30**(1):22–33. https://doi.org/10.1016/j.sexol.2020.12.010.
21. Mollaioli D, Sansone A, Ciocca G, *et al*. Benefits of sexual activity on psychological, relational, and sexual health during the COVID-19 breakout. *J Sex Med*. 2021;**18**(1):35–49. https://doi.org/10.1016/j.jsxm.2020.10.008.
22. Omar SS, Dawood W, Eid N, Eldeeb D, Munir A, Arafat W. Psychological and sexual health during the COVID-19 pandemic in Egypt: are women suffering more? *J Sex Med*. 2021;**9**(1):100295. https://doi.org/10.1016/j.esxm.2020.100295.
23. Pollard AE, Rogge RD. Love in the time of COVID-19: a multi-wave study examining the salience of sexual and relationship health during the COVID-19 pandemic. *Arch Sex Behav*. 2022;**51**(1):247–271. https://doi.org/10.1007/s10508-021-02208-0.
24. de Rose AF, Chierigo F, Ambrosini F, *et al*. Sexuality during COVID lockdown: a cross-sectional Italian study among hospital workers and their relatives. *Int J Impot Res*. 2021;**33**(1):131–136. https://doi.org/10.1038/s41443-020-00393-5.
25. Drapeau A, Marchand A, Beaulieu-Prévost D. *Epidemiology of psychological distress. In: Mental Illnesses—Understanding, Prediction and Control*. InTech; 2011: 105–134.
26. Dionne M, Roberge M-C, Brousseau-Paradis C, *et al*. COVID-19—Pandémie, bien-être émotionnel et santé mentale. *Institut national de santé publique du Québec*. 2020. Accessed January 21, 2022. https://www.inspq.qc.ca/covid-19/sondages-attitudes-comportements-quebecois/sante-mentale-decembre-2020.
27. Institut national de santé publique du Québec. *L'Enquête québécoise Sur la santé de la Population (EQSP) 2020-2021: Répercussions de la pandémie Sur la Vie Sociale, la santé Mentale,*

les Habitudes de Vie et la réalité du Travail Des Québécois. 2021. Accessed March 3, 2022. https://statistique.quebec.ca/fr/produit/publication/repercussions-pandemie-sur-vie-sociale-sante-mentale-habitudes-de-vie-et-realite-du-travail-des-quebecois.

28. Muise A, Schimmack U, Impett EA. Sexual frequency predicts greater well-being, but more is not always better. *Soc Psychol Personal Sci*. 2016;**7**(4):295–302. https://doi.org/10.1177/1948550615616462.

29. Andrews G, Slade T. Interpreting scores on the Kessler Psychological Distress Scale (K10). *Aust N Z J Public Health*. 2001;**25**(6):494–497. https://doi.org/10.1111/j.1467-842x.2001.tb00310.x.

30. Blanchflower DG, Oswald AJ. Money, sex and happiness: an empirical study. *Scandinavian Journal of Economics*. 2004;**106**(3):393–415. https://doi.org/10.3386/w10499.

31. Phongsavan P, Chey T, Bauman A, Brooks R, Silove D. Social capital, socio-economic status and psychological distress among Australian adults. *Soc Sci Med*. 2006;**63**(10):2546–2561. https://doi.org/10.1016/j.socscimed.2006.06.021.

32. Ueda P, Mercer CH, Ghaznavi C, Herbenick D. Trends in frequency of sexual activity and number of sexual partners among adults aged 18 to 44 years in the US, 2000-2018. *JAMA Netw Open*. 2020;**3**(6):e203833. https://doi.org/10.1001/jamanetworkopen.2020.3833.

33. Landreville P, Dubé M, Lalande G, Alain M. Appraisal, coping, and depressive symptoms in older adults with reduced mobility. *J Soc Behav Pers*. 1994;**9**:269–286.

34. Kroenke K, Spitzer RL, Williams JB, Löwe B. An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics*. 2009;**50**(6):613–621. https://doi.org/10.1176/appi.psy.50.6.613.

35. Löwe B, Wahl I, Rose M, *et al*. A 4-item measure of depression and anxiety: validation and standardization of the Patient Health Questionnaire–4 (PHQ-4) in the general population. *J Affect Disord*. 2010;**122**(1-2):86–95. https://doi.org/10.1016/j.jad.2009.06.019.

36. Kroenke K, Spitzer RL, Williams JB, Monahan PO, Löwe B. Anxiety disorders in primary care: prevalence, impairment, comorbidity, and detection. *Ann Intern Med*. 2007;**146**(5):317–325. https://doi.org/10.7326/0003-4819-146-5-200703060-00004.

37. Kroenke K, Spitzer RL, Williams JB. The Patient Health Questionnaire–2: validity of a two-item depression screener. *Med Care*. 2003;**41**(11):1284–1292. https://doi.org/10.1097/01.Mlr.0000093487.78664.3c.

38. Löwe B, Kroenke K, Gräfe K. Detecting and monitoring depression with a two-item questionnaire (PHQ-2). *J Psychosom Res*. 2005;**58**(2):163–171. https://doi.org/10.1016/j.jpsychores.2004.09.006.

39. Sabourin S, Valois P, Lussier Y. Development and validation of a brief version of the dyadic adjustment scale with a nonparametric item analysis model. *Psychol Assess*. 2005;**17**(1):15–27. https://doi.org/10.1037/1040-3590.17.1.15.

40. Muthén LK, Muthén BO. *Mplus User's Guide*. 8.6 ed. Muthén & Muthén; 1998-2021.

41. Ferguson CJ. An effect size primer: a guide for clinicians and researchers. In: *In: Methodological Issues and Strategies in Clinical Research*. American Psychological Association; 2016: 301–310.

42. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods*. 2008;**40**(3):879–891. https://doi.org/10.3758/brm.40.3.879.

43. Schellenberg BJI, Bailis DS, Mosewich AD. You have passion, but do you have self-compassion? Harmonious passion, obsessive passion, and responses to passion-related failure. *Pers Individ Differ*. 2016;**99**:278–285. https://doi.org/10.1016/j.paid.2016.05.003.

44. Karney BR, Bradbury TN. The longitudinal course of marital quality and stability: review of theory, method, and research. *Psychol Bull*. 1995;**118**(1):3–34. https://doi.org/10.1037/0033-2909.118.1.3.

45. Bradbury TN, Lavner JA. How can we improve preventive and educational interventions for intimate relationships? *Behav*

Ther. 2012;**43**(1):113–122. https://doi.org/10.1016/j.beth.2011.02.008.

46. van Niekerk RL, van Gent MM. Mental health and well-being of university staff during the coronavirus disease 2019 levels 4 and 5 lockdown in an Eastern Cape University. *S Afr J Psychiatr*. 2021;**27**:1589. https://doi.org/10.4102/sajpsychiatry.v27i0.1589.

47. Nawaz MU, Rivera E, Vinayak S, *et al*. Comparison of sexual function before and after COVID-19 infection in female patients. *Cureus*. 2021;**13**(9):e18156. https://doi.org/10.7759/cureus.18156.

48. Hsieh TC, Edwards NC, Bhattacharyya SK, Nitschelm KD, Burnett AL. The epidemic of COVID-19-related erectile dysfunction: a scoping review and health care perspective. *Sex Med Rev*. 2022;**10**(2):286–310. https://doi.org/10.1016/j.sxmr.2021.09.002.

49. Brotto L, Atallah S, Johnson-Agbakwu C, *et al*. Psychological and interpersonal dimensions of sexual function and dysfunction. *J Sex Med*. 2016;**13**(4):538–571. https://doi.org/10.1016/j.jsxm.2016.01.019.

50. Al-Tammemi AB, Akour A, Alfalah L. Is it just about physical health? An online cross-sectional study exploring the psychological distress among university students in Jordan in the midst of COVID-19 pandemic. *Front Psychol*. 2020;**11**:562213. https://doi.org/10.3389/fpsyg.2020.562213.

51. Tutino JS, Ouimet AJ, Shaughnessy K. How do psychological risk factors predict sexual outcomes? A comparison of four models of young women's sexual outcomes. *J Sex Med*. 2017;**14**(10):1232–1240. https://doi.org/10.1016/j.jsxm.2017.07.011.

52. Patrick K, Heywood W, Smith AM, *et al*. A population-based study investigating the association between sexual and relationship satisfaction and psychological distress among heterosexuals. *J Sex Marital Ther*. 2013;**39**(1):56–70. https://doi.org/10.1080/0092623x.2012.665819.

53. Carvalho J, Pascoal PM. Challenges in the practice of sexual medicine in the time of COVID-19 in Portugal. *J Sex Med*. 2020;**17**(7):1212–1215. https://doi.org/10.1016/j.jsxm.2020.05.024.

54. Stallman HM. Psychological distress in university students: a comparison with general population data. *Aust Psychol*. 2010;**45**(4):249–257. https://doi.org/10.1080/00050067.2010.482109.

55. Granieri A, Franzoi IG, Chung MC. Editorial: psychological distress among university students. *Front Psychol*. 2021;**12**:647940. https://doi.org/10.3389/fpsyg.2021.647940.

56. Hill NTM, Bailey E, Benson R, *et al*. Researching the researchers: psychological distress and psychosocial stressors according to career stage in mental health researchers. *BMC Psychol*. 2022;**10**(1):19. https://doi.org/10.1186/s40359-022-00728-5.

57. Christensen AI, Lau CJ, Kristensen PL, *et al*. The Danish National Health Survey: study design, response rate and respondent characteristics in 2010, 2013 and 2017. *Scand J Public Health*. 2022;**50**(2):180–188. https://doi.org/10.1177/1403494820966534.

58. Porter SR, Umbach PD. Student survey response rates across institutions: why do they vary? *Res High Educ*. 2006;**47**(2):229–247. https://doi.org/10.1007/s11162-005-8887-1.

59. Saleh A, Bista K. Examining factors impacting online survey response rates in educational research: perceptions of graduate students. *J Multidiscip Eval*. 2017;**13**:63–74. https://journals.sfu.ca/jmde/index.php/jmde_1/article/view/487.

60. Dickinson ER, Adelson JL, Owen J. Gender balance, representativeness, and statistical power in sexuality research using undergraduate student samples. *Arch Sex Behav*. 2012;**41**(2):325–327. https://doi.org/10.1007/s10508-011-9887-1.

61. Holt-Lunstad J, Smith TB, Layton JB. Social relationships and mortality risk: a meta-analytic review. *PLoS Med*. 2010;**7**(7):e1000316. https://doi.org/10.1371/journal.pmed.1000316.