

Mental Health, Partnerships, and Sexual Behavior of German Students After the Third Wave During the Corona Pandemic

Max Supke (✉ m.supke@tu-braunschweig.de)

Technische Universität Braunschweig

Prof. Dr. Kurt Hahlweg

Technische Universität Braunschweig

Krenare Kelani

Technische Universität Braunschweig

Prof. Dr. Beate Muschalla

Technische Universität Braunschweig

Prof. Dr. Wolfgang Schulz

Technische Universität Braunschweig

Research Article

Keywords: mental health, college, Germany, students, third wave, corona pandemic

Posted Date: August 26th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-842233/v1>

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Abstract

Background. The corona pandemic has drastically changed students' lives and increased their perceived stress. At the end of winter and in spring 2021, Germany experienced the third wave of the pandemic. This study aims to examine the state of students' mental health after the third wave as well as partnerships and sex life during the pandemic. **Methods.** In June and July 2021, 928 students (mean age: 23.6; 63.5% females) from four universities in Germany completed an online survey. The PHQ-9 and GAD-7 were used to assess mood problems and worrying. **Results.** Our results show that 56.4% were above the cut-off value for clinically relevant mood problems, 35.7% for worrying and 33.4% were above both cut-off values simultaneously (≥ 10). The female gender, higher study stress, low financial resources, higher strain due to corona and more loneliness were associated with severe symptoms, whereas higher life satisfaction, more sleep, and psychological/psychiatric treatment were related to better mental health. Students who started studying in the pandemic showed slightly more mood problems than longer enrolled students. The vast majority (89.3%) of all students were happy with their current relationship. While half of the students noted no change in their relationship, a quarter each reported improvement or deterioration. Every third single student has had less sex and in every fifth partnership it came to more sex during the pandemic. **Conclusion:** Students' mental health seems to be worse compared to pre-pandemic data and also compared to the first wave data, especially concerning mood problems (depressive symptoms). Women are significantly more burdened than men. It should be further investigated whether rates of symptom load will be lower again when universities reopen and study life becomes normal.

Background

At the end of winter and in spring 2021, Germany experienced the third wave of the Corona pandemic. Especially in March, April and May 2021, there were a lot of new infections and many restrictions were applied. Germany was in a strict lockdown for several months during this period. Since June 2021, the new infections were on a low level and the corona restrictions were eased.

To see the effects which came along with the pandemic so far, many studies address the wellbeing of the older generation or other high-risk groups who are likely to be infected and experience a severe course of disease [1]. A qualitative study from Welzel et al. [2] found hints that older people who have experienced a good mental health state still do so during the pandemic. In addition, Kwong et al. [3] have analyzed data from two longitudinal population cohorts in the UK (April-May 2020). They found no clear evidence that probable depression disorders have changed in young adults. However, compared to the time before the pandemic, in the younger generation (mean age = 28) the percentage of probable anxiety disorders had doubled during the pandemic. Furthermore, depressive and anxiety symptoms were higher in the younger populations as well as women. Thus, the younger generation should not be forgotten in pandemic-related research and policies.

Among young people, university students are one group of those who have experienced drastic changes over a long period of time in their daily lives. From live university classes, seeing fellow students and lecturers every day, they had to adjust their studying skills to online courses only and home office jobs without the opportunity to balance it off with social activities. Even without a pandemic, students are in general at an age where a lot of change happens: they move out of home, build relationships and start their career path (e.g.,[4]). On top of these difficulties, a pandemic can become a severe burden to students. A study from July and August 2020 in Germany shows that social and cultural activities, hobbies as well as dating activities were a lot more restricted than before the pandemic [5].

Zhou, Xu and Rief [6] assessed depressive (Patient Health Questionnaire-9 [PHQ-9]) and anxiety symptoms (General Anxiety Disorder-7 [GAD-7]) of German students before the pandemic. For the German students ($n = 416$; 71% female), the mean scores in 2016 were 6.8 ($SD = 4.8$) for the PHQ-9 and 6.2 ($SD = 4.3$) for the GAD-7. Furthermore, a study by Wörfel et al. [7] reported that 14.2% of the German students ($N = 1,707$; 73% female) showed depressive and 16.3% anxiety symptoms, while 8.4% experienced both. This study used the Patient Health Questionnaire-4 (PHQ-4), a shorter form of the previous questionnaires.

There are studies on mental health of students during the pandemic in different countries, for example in Turkey [8], Poland [9], France [10] and Switzerland [11], reporting high mental stress of students. Since the countries differ considerably in the measures taken to contain the virus, the focus of this study will be on Germany in order to ensure comparability.

Regarding students' mental health in Germany, Karing [12] assessed depression and anxiety symptoms among university students during the pandemic. The study was conducted from April to May 2020 ($n = 2,548$; 75% female) and the sample included students from different universities in Germany. Moderate to severe levels of depression symptoms were found in 35.9% of the students, moderate to severe anxiety symptoms were found in 27.7%. In addition, 25.1% perceived a high level of stress. Accordingly, Kohls et al. [5] showed that in July and August 2020 during the pandemic 37% of the students ($n = 3,382$) were affected by depressive symptoms according to the PHQ-9 showing an increase compared to numbers before the pandemic. The German longitudinal study of Voltmer et al. [13], however, found no significant differences in general health, stress, as well as depression symptoms and only a minor elevation of anxiety between 2019 and 2020 (June) in their student sample.

Partnerships and sexuality play an important role in students' lives. A partnership can be associated with better mental health (e.g., [14]). While there are no studies in Germany on the change in partnerships of students during corona, a Chinese study with people aged 16 to 35 ($n = 967$) showed that 31% of the participants reported a deterioration of their partnerships during the pandemic [15].

Böhm, Dekker and Matthiesen's [16] survey ($n = 2,082$) shows that 91% of German university students (20 to 30 years old) have experienced sexual intercourse. On average, women between 23-25 years reported having had six sexual partners and men seven. Also, 90% of sexual behavior took place in committed relationships. Regarding university students in Germany, Kohls et al. [5] reported in their study of July and August 2020 that for the majority of students (58%) the restrictions of the pandemic did not affect or were not relevant for student's sexual activity.

In Germany, studies on mental health, partnerships, and sexual behavior of students within the corona pandemic are barely available. While the previous studies refer to the time after the beginning of the pandemic, this present study reports results about the psychosocial status of students after the third wave of the corona pandemic.

Aims and hypotheses

This study focuses on the following five research questions:

1) What is the current state of mental health of German university students?

We expect mental health to have worsened after the third wave (compared to previously available data from Germany), which was characterized by lasting drastic changes in daily life and social restrictions of the pandemic.

2) What is the current state of mental health of students who started studying during the pandemic compared to students who have been studying at a university for a longer period of time?

We expect that students who started studying in the pandemic should show worse mental health. Many of them have only seen their fellow students online and the daily university life is completely missing. Some have never seen their university from the inside.

3) What characteristics in students are related to poor or good mental health during this period of the pandemic?

We expect that students can be divided into groups characterized by different factors (e.g., financial problems, stress of studying, loneliness) associated with poor mental health and characteristics associated with good mental health (e.g., stable relationship, living arrangement). The aim is to identify particularly vulnerable students.

4) How were students' romantic relationships during this period of the pandemic?

On the one hand, we expect that some of the partnerships became better since students were able to spend more quality time with their partner. On the other hand, some relationships (especially problematic relationships) became worse because the partners had no choice but to spend their time together and additional problems might have happened.

5) How was the sexual behavior of students during this period of pandemic?

We expect that single students' sex life was rather poor due to social constraints, while students in relationships should exhibit more sexual behavior, since they spend more time together.

Methods

Study Design

As part of a research project of the Institute of Psychology at the TU Braunschweig, a student survey on mental health, partnerships, and sexual behavior during the corona pandemic was developed. The goal was to acquire students from different local universities. For this purpose, the online survey was distributed via social media and the student portals as well as news portals of four universities from early June until July the 15th in 2021. Answering the questions took about 15 minutes and among all participants 3x15 Euro vouchers were raffled. The questionnaire was designed in such a way that no question had to be answered and it was possible to stop the survey at any time. The ethics committee of the TU Braunschweig approved all procedures (BA_2021-14).

Sample Characteristics

A total of 1,057 students had started answering the questionnaire, with 928 (87.8%) students answering the last question. The latter represents the final sample for this study. Sociodemographic characteristics are displayed in Table 1.

Of the 928 students, 63.5% were female, 33.9% were male, 0.9% were diverse, non-binary or gender-fluid and 1.7% did not specify. The age ranged from 18 to 60 with an average age of 23.6 years ($SD = 3.9$). Most of the participants (71.3%) were aged between 18 to 24 years. Of the students examined, 36.9% lived in shared flats with others, 22.3% lived alone, 21.0% lived with their partner, 17.9% lived with their parents, and 1.8% with their

own family. The survey mostly attracted students of the Technische Universität Braunschweig (77.4%). Most students at the Technische Universität Braunschweig were members of the Faculty of Life Sciences (30.1%). Most participants were aiming for a bachelor's (64.0%) or master's degree (27.7%) and 130 studied Psychology (14.0%). The students were on average 7.0 ($SD = 4.3$) semesters enrolled at their university.

Measures

Table 2 contains questions from the survey being relevant for this study and the scaling of the response options. Furthermore, standardized questionnaires were used within the survey.

Mood Problems (Depressive Symptoms).

For the measurement of mood problems in terms of depressive symptoms, the German version of the Patient Health Questionnaire-9 (PHQ-9; [17]) was used. The questionnaire consists of nine items (e.g., "Over the last two weeks, how often have you been bothered by poor appetite or overeating?") and assesses depressive symptoms as well as the grade of symptom severity. It measures the DSM-IV criteria for the diagnosis of depressive disorders which subjects have to rate on a four-stage scale from *not at all* (0) to *almost every day* (3), concerning the last two weeks. The questionnaire shows a good internal consistency of $\alpha = .86$ in our sample. The scores of the individual items are added up to a total score. Higher scores indicate more and more severe symptoms of depressive mood problems.

Table 1

Detailed Sample Characteristics

Sample Characteristics	<i>n</i> (%)
Gender	
Female	589 (63.5%)
Male	315 (33.9%)
Diverse, genderfluid, non-binary etc.	8 (0.9%)
Not Specified	16 (1.7%)
Age	
18-24 years	657(71.3%)
25-30 years	219 (23.7%)
>30 years	46 (5.0%)
University (Dual Enrollment Possible)	
Technische Universität Braunschweig	718 (77.4%)
Hochschule für Bildende Künste Braunschweig	113 (12.2%)
Ostfalia – Hochschule für angewandte Wissenschaften	51 (5.5%)
Stiftung Universität Hildesheim	90 (9.7%)
Others	11 (1.2%)
Living Form	
Living in shared flats	342 (36.9%)
Living alone	207 (22.3%)
Living with partner	195 (21.0%)
Living with parents	166 (17.9%)
Living with their own family	17 (1.8%)
Faculties of Technische Universität Braunschweig (<i>n</i> = 712)	
Faculty 1: Carl-Friedrich-Gauß-Faculty (e.g., Computer Science, Mathematics)	120 (16.9%)
Faculty 2: Faculty of Life Sciences (e.g., Psychology, Biology, Pharmacy)	214 (30.1%)
Faculty 3: Faculty of Architecture, Civil Engineering, Environmental Sciences	134 (18.8%)
Faculty 4: Faculty of Mechanical Engineering	89 (12.5%)
Faculty 5: Faculty of Electrical Engineering, Information Technology, Physics	63 (8.8%)
Faculty 6: Faculty of Humanities and Education (e.g., Teaching profession)	92 (12.9%)
Next Degree	
Bachelor	593 (64.0%)
Master	257 (27.7%)
Diploma	15 (1.6%)
State Exam	38 (4.1%)
Promotion (PhD)	18 (1.9%)
Others	6 (0.6%)
Semesters Enrolled at any University	
1-4 semesters	356 (38.7%)
5-10 semester	395 (43.0%)
>10 semesters	168 (18.3%)

Table 2

Overview of the Questions From the Survey and Their Answer Scaling

Question from the Survey	Response Scale
Study stress	Six-point scale: 1 (<i>not burdened</i>) to 6 (<i>heavily burdened</i>)
Concerns about professional future	Six-point scale: 1 (<i>no concerns</i>) to 6 (<i>very strong concerns</i>)
Life satisfaction	Five-point scale: 1 (<i>very unsatisfied</i>) to 5 (<i>very satisfied</i>)
Finances	
Financial problems	Four-point scale: 1 (<i>not applicable</i>) to 4 (<i>applicable</i>)
Financial losses due to corona	Three-point scale: 1 (<i>no</i>) – 2 (<i>small losses</i>) – 3 (<i>large losses</i>)
Corona	
Impairment during corona	Six-point scale: 1 (<i>no impairment</i>) to 6 (<i>very strong impairment</i>)
Strain due to corona impairment	Six-point scale: 1 (<i>no stress</i>) to 6 (<i>very high stress</i>)
Health	
General health status	Six-point scale: 1 (<i>very bad</i>) to 6 (<i>very good</i>)
Loneliness	Four-point scale: 0 (<i>not at all</i>) to 3 (<i>almost every day</i>)
Hours slept per night (last month)	The number of hours was assessed.
Psychological/Psychiatric treatment	Yes/No
Relationships	
Number of relationships	The number of relationships was assessed.
How happy with the relationship	Six-point scale: 0 (<i>very unhappy</i>) to 5 (<i>very happy</i>)
How often sex in relationship	Seven-point scale: 1 (<i>never</i>) to 7 (<i>more than three times per week</i>)
How satisfied with the frequency of sex in the relationship	Four-point scale: 1 (<i>not at all</i>) to 4 (<i>very</i>)
Change in partnership during corona	Five-point scale: 1 (<i>much worse than before</i>) to 5 (<i>much better than before</i>)
Sexual Behavior	
Number of sexual partners	The number of sexual partners was assessed.
Unprotected sex	Yes/No
Number of One-Night-Stands	The number One-Night-Stands was assessed.
Change in sexual behavior during corona	Five-point scale: 1 (<i>much less than before</i>) to 5 (<i>much more than before</i>)
How happy with the expression of sexuality	Six-point scale: 0 (<i>very unhappy</i>) to 5 (<i>very happy</i>)

Worrying.

Global worrying was assessed using the German version of the Generalized Anxiety Disorder Scale-7 (GAD-7; [18]) of the Patient Health Questionnaire which consists of seven items (e.g., "Over the last two weeks, how often have you been bothered by feeling nervous, anxious or on the edge?") measuring symptoms of generalized anxiety disorder during the last two weeks. Here, the students rated their symptoms on the same four-stage scale as for the PHQ-9 (*not at all* (0) to *almost every day* (3)). The questionnaire has a high internal consistency of $\alpha = .87$ in our sample. The scores of the individual items are added up to a total score. Higher scores indicate more and more severe symptoms of unspecific worrying.

Statistical Analyses

The first step is a descriptive presentation of the data on mental health of the students (Question 1). To compare the mental health of students who started their studies within the pandemic (one to four semesters enrolled) and students who have been studying at a university for a longer period of time (five to ten semesters enrolled), t-tests (Question 2) are performed. In order to identify different groups of students which show good mental health or represent a special risk group during the pandemic, multinomial logistic regression models are calculated (Question 3). The assumption

of multicollinearity was not violated (all VIF < 10) in the models. The data on relationships (Question 4) and sexual behavior (Question 5) of the students during the pandemic are also presented descriptively.

Results

Descriptive Data

The students showed a medium level of stress ($M = 4.1$, $SD = 1.1$) from their studies, whereas 62.8% reported no to medium and 37.2% high to very high concerns about their professional future due to corona. Of the participants, 15.8% stated that they did not have or tended to have insufficient financial resources for their living expenses. The majority (62.6%) reported no financial losses during the pandemic, with slight losses reported by 28.7% and severe losses by 8.7%. On average, students experienced a high level of impairment ($M = 4.4$, $SD = 1.2$) due to corona, while the impairment was associated with greater mental strain ($M = 4.0$, $SD = 1.2$).

General Health.

Of the students, 38.5% reported that their general health was very poor (2.3%) to somewhat poor, whereas 62.5% reported somewhat good to very good (4.3%). They slept for 7.1 hours ($SD = 1.4$) and reported a medium level of life satisfaction ($M = 3.1$, $SD = 1.0$). At the time of the survey, 15.4% were undergoing psychological and/or psychiatric treatment. Of the participants, 24.5% said they did not feel lonely at all, 43.7% on single days, 18.0% on more than half of the days, and 13.8% on almost every day.

Current State of Mental Health (Question 1)

Students reported a mean score of 11.0 ($SD = 5.7$) on the PHQ-9, with women ($M = 11.5$, $SD = 5.7$) showing significantly ($p < .001$, $t = -3.6$, $d = -0.25$) higher sum scores than men ($M = 10.1$, $SD = 5.6$). Above the cut-off value of ≥ 10 were 56.4% of the students (men = 49.2%, women = 59.8%). Regarding the item "*Thoughts that you would be better off dead, or of hurting yourself*", 72.2% of the students said they did not have these thoughts at all, 21.1% on single days, 5.0% on more than half of the days, and 1.7% on almost every day.

On the GAD-7, the participants reported a mean score of 8.2 ($SD = 4.9$), with women ($M = 8.7$, $SD = 4.9$) showing significantly ($p < .001$, $t = -4.8$, $d = -0.33$) higher sum scores than men ($M = 7.1$, $SD = 4.6$). Above the cut-off value of ≥ 10 were 35.7% of the students (men = 26.7%, women = 40.1%).

The frequencies of the categories of the symptoms are shown in Table 3. There were significant differences in the distributions between men and women in both the PHQ-9 ($\chi^2 = 17.7$, $p = .001$) and the GAD-7 ($\chi^2 = 24.3$, $p < .001$). Men reported suffering from no/minimal mood problems or worrying more often.

A sum score of ≥ 10 on both the PHQ9 and the GAD 7 was reported by about one-third of the sample (33.4%), with considerably more women (37.5%) than men (25.1%) meeting this criterion. The sum scores showed a high inter-correlation of $r = .77$ ($p < .001$) in our total sample.

Table 3

Frequencies of Mood Problems (Depressive Symptoms; PHQ-9) and Worrying (GAD-7) in the Total Sample as Well as Gender Differences.

	Total sample	Male	Female	Male vs. Female
PHQ-9 (Mood problems)				
None-minimal (0-4)	12.2%	18.1%	9.5%	
Mild (5-9)	31.5%	32.7%	30.7%	Chi ² = 17.7, <i>p</i> = .001
Moderate (10-14)	27.9%	25.7%	29.2%	
Moderately Severe (15-19)	20.5%	17.8%	21.4%	
Severe (20-27)	8.0%	5.7%	9.2%	
GAD-7 (Worrying)				
None-minimal (0-4)	24.6%	33.0%	20.9%	
Mild (5-9)	39.8%	40.3%	39.0%	Chi ² = 24.3, <i>p</i> < .001
Moderate (10-14)	23.6%	19.4%	25.6%	
Severe (15-21)	12.1%	7.3%	14.4%	
PHQ-9 and GAD-7 ≥ 10	33.4%	25.1%	37.5%	

Mental Health of Students Starting During the Pandemic (Question 2)

Students who began studying within the corona pandemic ($n = 356$; enrolled for one to four semesters; $M = 11.5$; $SD = 5.7$) showed significantly ($p < .047$, $t = 2.0$, $d = 0.15$) more mood problems than students who had been studying longer ($n = 395$; enrolled for five to ten semesters; $M = 10.6$; $SD = 5.7$). There were no significant differences regarding the average degree of general worrying ($M_{1-4 \text{ semesters}} = 8.4$; $SD = 4.9$; $M_{5-10 \text{ semesters}} = 8.0$; $SD = 4.9$). Since the standard duration of study for many study fields in Germany is ten semesters, students who were enrolled for more than ten semesters were excluded from these analyses.

Conceptualizing Risk Profiles (Question 3)

Because gender is used in the following analyses, only students who indicated whether they were male or female are included in the models. ($n = 904$). As a first step, the PHQ-9 (normally five dimensions) and GAD-7 (normally four dimensions) dimensions were reduced to three groups for simplification - PHQ-9: 1.) no/mild ($n = 397$; 43.9%) 2.) moderate ($n = 253$; 28.0%) and 3.) moderately severe /severe symptoms ($n = 254$; 28.1%) as well as the GAD-7: 1.) no/mild ($n = 584$; 64.6%) 2.) moderate ($n = 212$; 23.5%) and 3.) severe symptoms ($n = 108$; 11.9%).

To identify risk profiles, multinomial logistic regression models (Table 4) were calculated separately for the PHQ-9 and GAD-7. The reference group in each case was the no/mild symptoms group.

Mood Problems (PHQ-9).

Higher study stress ($p < .001$, $OR = 1.40$), not enough financial resources ($p = .027$, $OR = 1.91$), higher strain due to corona ($p < .001$, $OR = 1.56$), and more loneliness ($p < .001$, $OR = 1.71$) were significantly associated with *moderate depressive symptoms*, whereas increased life satisfaction ($p < .001$, $OR = 0.51$) and psychological/psychiatric treatment ($p = .019$, $OR = 0.51$) were significantly related to better mental health. In contrast, gender, hours slept, and a committed partnership were not systematically associated with the one or other mental health status.

With respect to the category *severe symptoms*, the same factors became significant, but with higher effect sizes. Furthermore, females had an increased risk ($p = .019$, $OR = 1.78$), whereas more sleep was associated with better mental health ($p = .011$, $OR = 0.80$). Being in a committed partnership was also not significant in this model. The regression model explained a large part of the variance (52%).

Worrying (GAD-7).

Being female ($p = .011$, $OR = 1.66$), higher study stress ($p = .009$, $OR = 1.27$), more strain due to corona ($p = .001$, $OR = 1.34$), and more loneliness ($p < .001$, $OR = 1.76$) were significantly related to *moderate worrying symptoms*, while higher life satisfaction ($p < .001$, $OR = 0.50$) was associated with lower worrying. Additionally, being in a current

Table 4

		PHQ-9							GAD-7						
		<i>B</i>	<i>SD</i>	<i>p</i>	Lower	<i>OR</i>	Upper	<i>d</i>	<i>B</i>	<i>SD</i>	<i>p</i>	Lower	<i>OR</i>	Upper	<i>d</i>
	Gender (0 = male; 1 = female)	0.4	0.2	.065	1.0	1.44	2.1	0.20	0.5	0.2	.011	1.1	1.66	2.5	0.28
	Study stress	0.3	0.1	<.001	1.2	1.40	1.7	0.19	0.2	0.1	.009	1.1	1.27	1.5	0.13
	Enough financial resources (0 = yes; 1 = no)	0.6	0.3	.027	1.1	1.91	3.4	0.36	0.5	0.2	.064	1.0	1.58	2.6	0.25
	Strain due to corona	0.4	0.1	<.001	1.3	1.56	1.8	0.25	0.3	0.1	.001	1.1	1.34	1.6	0.16
moderate symptoms	Life satisfaction	-0.7	0.1	<.001	0.4	0.51	0.6	-0.37	-0.7	0.1	<.001	0.4	0.50	0.6	-0.38
	Loneliness	0.5	0.1	<.001	1.3	1.71	2.2	0.30	0.6	0.1	<.001	1.4	1.76	2.2	0.31
	Hours slept	-0.1	0.1	.069	0.8	0.87	1.0	-0.08	-0.1	0.1	.319	0.8	0.93	1.1	-0.04
	Treatment (0 = no; 1 = yes)	-0.7	0.3	.019	0.3	0.51	0.9	-0.37	-0.2	0.3	.519	0.5	0.84	1.4	-0.10
	Partnership (0 = no; 1 = yes)	0.2	0.2	.346	0.8	1.21	1.8	0.11	0.6	0.2	.002	1.2	1.86	2.8	0.34
	Intercept	-0.8	1.1	.453					-2.8	1.0	.007				
	Gender (0 = male; 1 = female)	0.6	0.2	.019	1.1	1.78	2.9	0.32	1.0	0.3	.002	1.4	2.59	4.8	0.53
	Study stress	0.5	0.1	<.001	1.4	1.70	2.1	0.29	0.5	0.1	<.001	1.3	1.71	2.3	0.30
	Enough financial resources (0 = yes; 1 = no)	0.7	0.3	.023	1.1	2.09	4.0	0.41	0.8	0.3	.014	1.2	2.14	3.9	0.42
	Strain due to corona	0.7	0.1	<.001	1.6	1.95	2.4	0.37	0.4	0.1	.001	1.2	1.50	1.9	0.22
severe symptoms	Life satisfaction	-1.7	0.2	<.001	0.1	0.19	0.3	-0.92	-1.0	0.2	<.001	0.3	0.37	0.5	-0.54
	Loneliness	0.8	0.1	<.001	1.7	2.28	3.0	0.45	0.7	0.2	<.001	1.5	1.98	2.7	0.38
	Hours slept	-0.2	0.1	.011	0.7	0.80	1.0	-0.12	-0.3	0.1	.001	0.6	0.74	0.9	-0.17
	Treatment (0 = no; 1 = yes)	-0.8	0.3	.011	0.2	0.44	0.8	-0.45	-1.3	0.3	<.001	0.1	0.26	0.5	-0.74
	Partnership (0 = no; 1 = yes)	0.4	0.2	.110	0.9	1.47	2.4	0.21	0.8	0.3	.004	1.3	2.22	3.8	0.44
	Intercept	-0.4	1.3	.731					-2.3	1.5	.115				
	Model characteristics	Model PHQ-9: Chi ² (18) = 557.0, <i>p</i> < .001 <i>R</i> ² = .46 (Cox-Snell), .52 (Nagelkerke)							Model GAD-7: Chi ² (18) = 385.3, <i>p</i> < .001 <i>R</i> ² = .35 (Cox-Snell), .42 (Nagelkerke)						

partnership was a significant factor ($p = .002$, $OR = 1.86$) as well. Not enough financial resources, hours slept, and psychological/psychiatric treatment were non-significant factors.

However, in terms of the *severe worrying* category, not enough financial resources ($p = .014$, $OR = 2.14$), hours slept ($p = .001$, $OR = 0.74$), and psychological/psychiatric treatment ($p < .001$, $OR = 0.26$) were also found to be significant characteristics, in addition to the other factors (higher effect sizes) previously mentioned, making all factors significant in the model. The regression model explained a large part of the variance (42%).

Partnerships During the Corona Pandemic (Question 4)

Table 5 shows the data collected on partnership. On average the students reported that they have been in 1.9 ($SD = 1.6$; Range: 0-12) committed partnerships. Slightly more than half (51.8%) of the students were in a committed, 4.3% were in a loose, and 2.3% were in an open partnership at the time of the survey. Furthermore, 15.2% had never had a committed partnership and 26.4% were currently in no partnership. Of the students in some form of partnership, 25.1% indicated that the partnership had improved and 22.3% indicated that it had worsened during corona. While 10.7% were very unhappy to unhappy in their current partnership, the majority was happy to very happy (89.3%). Most students (61.5%) had sex in their partnership one to three times or more per week and 70% of the participants were satisfied with the frequency of sex in their partnership.

Sexual Behavior During the Corona Pandemic (Question 5)

The students reported that they have had 5.1 ($SD = 9.0$; Range: 0-120) sex partners and 1.9 One-Night-Stands ($SD = 6.7$; Range: 0-100), while 18.9% reported that they have had zero sex partners at the time of the survey. Sixty-four percent of them have had unprotected sex and 40.9% are unhappy with their current sex life. Of the students in partnerships, 26.8% reported that they are having less sex (much less: 10.8%) and 20.8% that they are having more sex during corona, whereas single students reported less sexual behavior (31%; much less: 21.5%) more

Table 5

Descriptive Data of Students' Partnerships and Sex Life

Partnership data	<i>n</i> (%)	Sex data	<i>n</i> (%)
Number of partnerships		Number of sex partners	
0	185 (20.0%)	0	173 (18.9%)
1-3	633 (68.5%)	1-3	393 (43.0%)
4-5	85 (9.2%)	4-5	121 (13.2%)
> 5	21 (2.3%)	> 5	227 (24.8%)
Change in partnership during corona (<i>n</i> = 534)		Change in sex life during corona (all students)	
Much worse	15 (2.8%)	Much less	139 (15.2%)
A little worse	104 (19.5%)	A little less	122 (13.3%)
No change	281 (52.6%)	No change	517 (56.4%)
A little better	103 (19.3%)	A little more	81 (8.8%)
Much better	31 (5.8%)	Much more	57 (6.2%)
Happiness with partnership (<i>n</i> = 536)		Happiness with sexuality	
Very unhappy	8 (1.5%)	Very unhappy	64 (7.0%)
Unhappy-somewhat unhappy	49 (9.2%)	Unhappy-somewhat unhappy	309 (33.9%)
Happy-somewhat happy	338 (63.0%)	Happy-somewhat happy	431 (47.3%)
Very happy	141 (26.3%)	Very happy	108 (11.8%)
Frequency of sex in partnerships (<i>n</i> = 532)		Number of One-Night-Stands	
Never	21 (3.9%)	0	563 (62.1%)
Less than 1 time per month	42 (7.9%)	1-3	240 (26.5%)
1-3 times per month	142 (26.7%)	4-5	41 (4.5%)
1-3 times per week	327 (61.5%)	> 5	63 (6.9%)
Sex life during corona in partnerships (<i>n</i> = 539)		Sex life during corona in single students (<i>n</i> = 377)	
Much less	58 (10.8%)	Much less	81 (21.5%)
A little less	86 (16.0%)	A little less	36 (9.5%)
No change	283 (52.5%)	No change	234 (62.1%)
A little more	65 (12.1%)	A little more	16 (4.2%)
Much more	47 (8.7%)	Much more	10 (2.7%)

frequently and more sexual behavior less frequently (6.9%). The two groups differed significantly in their distributions ($\chi^2 = 55.7, p < .001$).

Discussion

The corona pandemic has changed the lives of students around the world [19]. Since March 2020, with the onset of the corona pandemic and the resulting containment measures, life has changed drastically for many students at universities. While many studies focus on younger children, adults, or the elderly, studies on young adults are hardly available in Germany. For this reason, this study reports data after the third wave focusing on mental health, partnerships, and sexual behavior during the pandemic.

Descriptive analysis of the data shows that students are generally moderately satisfied with their lives, although 38.5% show rather poor general health. This stands in contrast to the longitudinal study of Voltmer et al. [13] reporting that 77% of the students rated their health as (very) good in June 2020. During corona, about one in ten students suffered severe financial losses, and both the impairment and the burden can be considered severe. Two thirds of the students are not or only moderately worried about their professional future. So those concerns don't seem to be at the forefront of many students' minds right now. Around 15% of students received psychological and/or psychiatric treatment at the time of the survey. This is slightly more than what would be expected. For example, Kohls et al. [5] reported that 8% of the investigated students were currently under treatment. One explanation for this could be that some students have decided to seek help during the pandemic because of greater stress. Furthermore, we did not distinguish between offers by professionals or universities (e.g., counseling centers). A WHO survey from Auerbach et al. [20] reported 12-month prevalence of 31.4% (Germany: 36.2%) for college students, however only a small proportion of these receives treatment.

Finally, loneliness plays a major role for students during the pandemic, with around one third stating that they feel lonely on more than half of the days.

In May 2020, 42% of students in a survey at the Technische Universität Braunschweig reported feeling irritated in terms of their mood (depressed) [21]. We expected mental health to appear worse after the third wave compared to the available data from Germany due to the lasting drastic changes (Question 1).

Comparison With Data From Germany Before the Pandemic.

The comparison of our findings with data from Germany before the pandemic shows a strong difference in students' mental health. For German students Zhou et al. [6] reported mean scores of 6.8 ($SD = 4.8$) for the PHQ-9 and 6.2 ($SD = 4.3$) for the GAD-7 in 2016. Students in this sample reported significantly higher mean values for the PHQ-9 of 11.0 ($SD = 5.7$) and for the GAD-7 of 8.2 ($SD = 4.9$). Furthermore, Wörfel et al. [7] reported that 14.2% of the German students showed clinically relevant depressive and 16.3% anxiety symptoms, while 8.4% experienced both. The rates we found in this present investigation are also significantly above these values. Our data show that 56.4% were above the cut-off value for clinically relevant depressive mood problems, 35.7% for worrying and one third (33.4%) was above both cut-off values simultaneously.

Comparison With Data From Germany After the First Wave.

While Kohls et al. [5] reported a mean score of 8.7 ($SD = 5.5$) for the PHQ-9 and Karing [12] of 7.1 ($SD = 4.9$) for the GAD-7 after the first lockdown in 2020, our mean scores seem to be significantly higher for mood problems (PHQ-9: $M = 11.0$; $SD = 5.7$) and slightly higher for worrying symptoms (GAD-7: $M = 8.2$, $SD = 4.9$) after the third wave.

Additionally, Karing [12] found in her study that 22% of the students showed moderate and 14% severe depressive symptoms (anxiety symptoms: moderate: 19%; severe: 9%). Severe depressive symptoms (29%) were reported significantly more frequently in our sample, while frequencies with respect to moderate depressive mood problems (28%) and anxiety symptoms were only slightly more frequent (moderate: 24%; severe: 12%).

It can be concluded that the mental health of the students studied here was worse compared to the pre-pandemic data and also compared to the first wave data, especially concerning mood problems. In our sample, women were significantly more burdened than men and also suffered more severe symptoms.

We expected that students who started university during the pandemic should have more mental health problems than students who have been at a university longer (Question 2). This was only the case for mood problems, whereas there were no differences for worrying. However, it should be noted that the found effect is very small.

The third step was to identify risk profiles, i.e., characteristics which are associated with poorer mental health during the pandemic (Question 3). The female gender, higher study stress, not enough financial resources, higher strain due to corona and more loneliness were associated with worrying and mood problems. In contrast, higher life satisfaction, more sleep, and psychological treatment were associated with a better mental health status.

A current partnership did not play a role in the depression models but was related to more worrying, contrary to our expectations. One explanation for this finding could be that the participants were also more concerned about their partners due to the pandemic (e.g., "Could he infect me?"; "Will we have enough money?"; "Can we manage the crisis together?") increasing stress and worrying

The models for moderate symptoms differed slightly from those for severe symptoms in such a way that gender did not play a role for moderate mood problems and financial resources as well as psychological/psychiatric treatment did not play a role for moderate worrying. Sleep did not play a role for either.

Loneliness and higher perceived stress were associated with mental health in the study of Kohls et al. [5] as well. Karing [12] reported that stress by the pandemic, worries about the financial situation and about study were risk factors for depressive and anxiety symptoms in her hierarchical regression model being in congruence with our findings. However, she reported no significant effect of gender in her final model, which stands in contrast to our findings.

When considering these outcomes, it is important to note that it is normal to react with mood problems or worrying during crises [e.g., [22], [23], [24]]. For this reason, an increase of such symptoms is to be expected during a pandemic. Since the PHQ-9 and GAD-7 are only screening instruments, no conclusions can be made about whether these symptoms could be indicators for mental disorders. Whether there is a real increase in mental disorders should be investigated in future studies and cannot be deduced from these observational findings.

Of the students, 58.4% were in some form of partnership (51.8% in a committed partnership), whereas 15.2% stated that they had not yet had been in a partnership. That about half of the students live in a committed partnership was also reported in 2016 by the German Social Survey [25]. Thus,

there does not seem to be a big change regarding partnerships during corona. On average, each student (mean age: 24 years) had already had two partnerships. The majority of students were satisfied with their partnership and the frequency of sex they had with their partner.

We expected that one part of the partnerships could become worse and another part could become better during corona (Question 4). The data support this assumption, with about a quarter of the students stating that the relationship has become worse or had improved during the pandemic. This is congruent with the Chinese study by Li et al. [15], which found that 31% of the 15–35-year-olds reported a deterioration in their partnership in May 2020.

On average, students have had five sex partners and two One-Night-Stands, with the majority not engaging in the latter. Forty percent of the students were not happy with their sex life in general at the time of our survey. Around every fifth student has had zero sex partners, which is a little higher than expected compared to Böhm et al. [16] reporting that 91% of the students between the age of 20-30 have had sexual intercourse.

Regarding sexual behavior we expected that single students' sex life decreased due to social constraints, while students in relationships should exhibit more sexual behavior (Question 5). In fact, students in partnerships were more likely to report that they have had more sex during the pandemic. Single students, on the other hand, reported having much less sex. The reason for this is probably that as part of the lockdowns in Germany, social contact with new people was reduced to a minimum, so that dating was severely restricted and only possible online.

Strengths and Limitations

On the one hand, strengths of the study include the number of 928 students that could be analyzed. The data describe the current situation of students' mental health, partnerships, and sexual behavior during the pandemic, which have hardly been explored in Germany so far.

On the other hand, the following limitations should be considered. First, there is a bias in the sample due to an excess of women. However, most of the studies used for comparison also had an excess of women, making the studies somewhat comparable ([5-7], [12]). Studies found hints that women could be more affected by the pandemic than men (e.g., [11], [26-27]). Furthermore, it should be noted that slightly more students than expected received treatment for mental health issues in our sample, which also limits the generalizability. Second, the results on partnership (there were 89% happy couples) should be viewed with caution since variance is missing. Third, the data are from a cross-sectional survey and can only be compared descriptively with the results of other studies and no assumptions about developments over time or causality can be made.

Conclusion

The vast majority of all students are still happy with their current relationship. While half of the students noted no change in their relationship, a quarter each reported improvement or deterioration. However, many students are unhappy with the expression of their sexuality overall. While every third single student had less sex, in every fifth partnership it came to more sex during the pandemic.

Many of the students reported that they are feeling lonely. Loneliness is a problem that can affect people across the lifespan and has clinical relevance (e.g., [28]). Due to online university classes, a computer with internet is now available to almost every student in Germany. These could be used for online meetings or game nights by the students to do something against their loneliness. Universities could help students network with each other or give students opportunities for online events. For students whose mental health is considerably impaired during the pandemic, short videos or web pages with links to self-help offers (e.g., relaxation exercises, dealing with stress, anxiety, or depressive symptoms) could help them cope.

Interestingly, women seem to suffer more than men. This tendency is already observable in adolescents in Germany. In a longitudinal study [29], male (7%) adolescents reported lower clinically relevant pre-pandemic depression scores than females (13%) in 2018/2019. This difference was even higher during the pandemic (spring 2020): Among males it doubled (15%) and among female adolescents it even roughly tripled (35%). Female adolescents were three times more likely to develop depressive symptoms. Future studies should attempt to explore the reasons for these gender differences.

Finally, it can be concluded that a part of students perceived irritations in their psychosocial situation and mental state during corona and are currently dealing with a lot of mental stress. Some students could likely benefit from mental health support and offers for activities, whereby information and interventions should be given with respect to the single case and not to all by the watering can principle.

Declarations

Ethics approval and consent to participate.

The research project received ethical approval by the ethics committee of the Technische Universität Braunschweig (BA_2021-14). All methods were performed in accordance with the Declaration of Helsinki and the relevant BioMed Central guidelines and regulations.

Consent for publication.

Not applicable.

Availability of data and materials.

The data being analyzed during the current study can be requested from Max Supke (m.supke@tu-braunschweig.de) and are available for further research on reasonable requests. The questionnaires used can be found in the corresponding references.

Competing interests.

The authors have no relevant financial or non-financial interests to disclose.

Funding.

The Open Access Publication of Technische Universität Braunschweig supports us with funds for the open access publication of this manuscript within the framework of Project Deal.

Authors' contributions.

MS wrote 50% of the manuscript and performed 80% of the data analysis. KH 10% manuscript; KK 10% manuscript; BM 10% manuscript, and WS 20% manuscript/analysis. All authors have read and approved the final manuscript and ensure that this is the case.

Acknowledgements.

We thank the students for their participation in our study and the positive feedback on our research project.

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