



Short communication

Depressive symptoms and suicidal ideation among university students before and after the COVID-19 pandemic

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ABSTRACT

Background: The COVID-19 pandemic and lockdown have had negative effects on students' mental health. However, little information is available regarding the frequencies of depressive symptoms and suicidal ideation during the post-pandemic period. We aimed to determine the effect of the COVID-19 pandemic on depressive symptoms and suicidal ideation among French university students.

Methods: In this comparative study, 4463 students were recruited during the pre-COVID-19 pandemic period (2013–2020) and 1768 students, during the post-COVID-19 pandemic period (2022–2023). Standardized frequencies of depressive symptoms and suicidal ideation were compared between the two time periods. Changes in the level of depressive symptoms and suicidal ideation between the pre- and post-pandemic periods, were then analyzed using interrupted time series analysis.

Results: Compared to participants from the pre-pandemic sample, participants from the post-pandemic sample had higher standardized rates of depressive symptoms (40.6 % vs 25.6 %) and suicidal ideation (29.3 % vs 21.1 %). Segmented logistic regression showed an about 50 % increased risk of depressive symptoms (aOR, 1.47; 95 % CI, 1.01–2.13) and a 100 % increased risk of suicidal ideation (aOR, 2.00; 95 % CI, 1.33–3.00) in the post-pandemic period. Before the pandemic, there was no significant time-trend for depressive symptoms (aOR, 1.002; 95 % CI, 0.999–1.006) and suicidal thoughts (0.999–1.006; aOR, 0.999; 95 % CI, 0.995–1.002).

Limitations: Potential biases related to self-selection of participants in the study and information bias. History of depression and suicide attempt were self-reported.

Conclusions: These findings reveal an alarming deterioration of students' mental health in the post-pandemic period compared to the pre-pandemic era.

1. Introduction

Although some studies showed that suicidal risk was stable or diminished during the pandemic (Appleby et al., 2021; López Steinmetz et al., 2021), other studies highlighted an increase in mental health problems and suicidality in different populations and age groups (Ettman et al., 2020; Viner et al., 2022; Giannouli and Giannoulis, 2023). However, there are few recent data in the literature on the post-pandemic period, even for at-risk groups (Wang et al., 2022), e.g., university students. Before the COVID-19 pandemic, university students were known to exhibit a high prevalence of mental health problems, including depressive symptoms and suicidal ideation, in most countries (Auerbach et al., 2018), including France (Macalli et al., 2020). Several

factors serve as an explanation as to why university students are such a vulnerable group to mental health disorders: academic stress, separation and individuation from their family, first onset of mental health or substance use problems. This pre-existing vulnerability was exacerbated by the COVID-19 pandemic and the associated lockdowns (Arsandaux et al., 2021; Wathelet et al., 2020). Thus, a previous study showed that students were more likely to have high scores of depressive symptoms and anxiety more frequently than non-students during the lockdown (Macalli et al., 2021). Furthermore, a study conducted among 664 university students in Germany showed that the rate of students suffering from suicidal ideation was twice as high in 2020 than in previous years from 2016 to 2019 (Brailovskaia et al., 2021). However, to our knowledge, few studies have assessed university students' mental

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0165-0327/© 2024 Elsevier B.V. All rights are reserved, including those for text and data mining, AI training, and similar technologies.

health situation during the current post-pandemic period in comparison to the pre-pandemic period. In the present study, we applied an interrupted time series (ITS) approach to determine the effect of the COVID-19 pandemic on depressive symptoms and suicidal ideation among French university students.

2. Methods

2.1. Study design and sample

We conducted a comparative analysis using baseline data from two studies of French student volunteers: i-Share and Prisme, which both focused on students' health and its determinants. These studies used similar recruitment methods (social networks, mailings, meetings at stands and in lecture halls, and a peer-to-peer approach), eligibility criteria (officially registered at a university or higher education institute, at least 18 years of age, and provided informed consent for participation), data collection method (online questionnaires), and measures of mental health parameters. In i-Share, students were enrolled from 2013 to 2020, mainly at Bordeaux University, but also at other French universities. Students enrolled in the i-Share cohort after March 17, 2020 (date of first lockdown in France) were not included in the current study. In Prisme, participants were recruited from September 2022 to February 2023 at Bordeaux university only. To optimize comparability of samples, we restricted the i-Share sample to students from Bordeaux university (pre-COVID-19 pandemic sample, $N = 4463$). This sample was compared to the Prisme sample (post-COVID-19 pandemic sample, $N = 1768$). Regulatory approvals were obtained for both studies. No compensation was paid for participation in either study.

2.2. Measures

Depressive symptoms were measured using the French version of the 9-item Patient Health Questionnaire (PHQ-9), the most commonly used tool for screening for depression (Levis et al., 2019). We used a validated cut-off of 10 to define the presence of depressive symptoms (Kroenke et al., 2001). Suicidal ideation was measured using the following question: "In the past 12 months, have you ever had suicidal thoughts?" In our analyses, we considered the following variables: COVID-19 pandemic period (pre- and post-pandemic), age, gender, university campus (to inform on study fields), scholarship (allocated on social and economic criteria), year of study, perceived stress (measured by the Perceived stress scale-4), and history of depression and suicide attempt.

2.3. Statistical analysis

We first compared the pre-pandemic and post-pandemic samples in terms of mental health and socio-demographic characteristics. To obtain more precise estimates of mental health variables, by accounting for the structural differences of the samples, we re-estimated these variables after standardizing the post-pandemic sample structure based on the pre-pandemic sample. To this end, we used the raking ratio method with three margin variables—namely, gender, age, and university campus (macro SAS CALMAR).

As interrupted time series (ITS) is a study design for evaluating results of population-level health interventions or events, we performed a time series on depressive symptoms and suicidal ideation to study underlying trend "interrupted" by an intervention at a known point in time i.e. the COVID-19 pandemic. We have modeled the odds of each outcome i.e. depressive symptoms and suicidal ideation over time, using segmented logistic regressions to estimate: 1) their immediate post-pandemic level change; 2) their trend before the pandemic; and 3) their change in the trend after the pandemic. Models were adjusted for confounding factors (scholarship, history of depression (for depressive symptoms), or suicide attempt (for suicidal ideation)). Then, to represent the evolution of depressive symptoms and suicidal ideation over

time (in months from M1 = February 2013 to M121 = February 2023), we have modeled the predicted probabilities in unadjusted segmented logistic regressions.

3. Results

Participants in the pre-pandemic sample were slightly older (mean age, 20.4 years; $SD = 2.6$; $N = 4463$) than participants in the post-pandemic sample (mean age, 19.9 years; $SD = 2.7$; $N = 1768$) (Table 1). The two samples had similar gender distribution (77.9 % women in the pre-pandemic, and 80.8 % in the post-pandemic sample), and socio-economic status measured by scholarship (41.8 % in the pre-pandemic, and 45.1 % in the post-pandemic sample). Compared to participants in the pre-pandemic sample, participants in the post-pandemic sample had higher rates of depressive symptoms (43.3 % vs. 25.6 %) and suicidal ideation (30.6 % vs 21.1 %). Other mental health parameters (high perceived stress, and history of depression and suicide attempt) were also higher in the post-pandemic sample than in the pre-pandemic sample (Table 1).

After standardizing the post-pandemic sample based on the pre-pandemic sample's distributions of gender, age, and university campus, we found that the estimated prevalence rates of depressive symptoms (40.6 %) and suicidal ideation (29.3 %) in the post-pandemic sample were lower than before standardization, but these estimates remained higher than those in the pre-pandemic sample (Table 1).

A comparison of socio-demographic characteristics according mental health outcomes in each sample showed that students who reported depressive symptoms and suicidal ideation were more likely to be female, entering the university (first year study) and scholarship students, whatever the period. They were also more likely to present high perceived stress and history of depression or suicide attempt than those who declared no depressive symptoms nor suicidal ideation (Supplementary material Table 1).

Interrupted time series analyses revealed a change in the level of depressive symptoms (Fig. 1-A) and suicidal ideation (Fig. 1-B) in the post-pandemic period. In the multivariate segmented logistic regression (Table 2), before the pandemic, we observed no trend in depressive

Table 1
Comparison of key variables between pre- and post-COVID-19 samples.

Characteristic, N (%)	Pre-pandemic sample (N = 4663)	Post-pandemic sample (N = 1768)	Standardized post-pandemic sample (N = 4663)
Female	3634 (77.9)	1429 (80.8)	3634 (77.9)
Age, mean (SD)	20.4 (2.6)	19.9 (2.7)	20.4 (2.9)
University campus			
Bordeaux	3650 (78.3)	922 (52.1)	3650 (78.3)
Bordeaux-Montaigne	769 (16.5)	525 (29.7)	769 (16.5)
Other or unknown	244 (5.2)	321 (18.2)	244 (5.2)
First year of study ^a	1785 (38.6)	694 (39.3)	1524 (32.7)
Scholarship ^b	1948 (41.8)	798 (45.1)	2101 (45.1)
High perceived stress ^c	1893 (40.6)	1033 (58.5)	2555 (54.9)
Past history of depression ^d	489 (10.5)	327 (18.5)	873 (18.7)
Past history of suicide attempt ^e	254 (5.5)	206 (11.7)	514 (11.0)
Depressive symptoms	1194 (25.6)	765 (43.3)	1891 (40.6)
Suicidal ideation	982 (21.1)	541 (30.6)	1366 (29.3)

^a Missing data for 38 participants in the pre-epidemic sample.

^b Missing data for 4 participants in the pre-epidemic sample.

^c Missing data for 2 participants in the post-epidemic sample, and 5 in the standardized post-epidemic; Score ≥ 8 used to define high perceived stress, using the PSS-4 scale.

^d Missing data for 1 participant in the post-epidemic sample, and 3 in the standardized post-epidemic sample.

^e Missing data for 76 participants in the pre-epidemic sample.

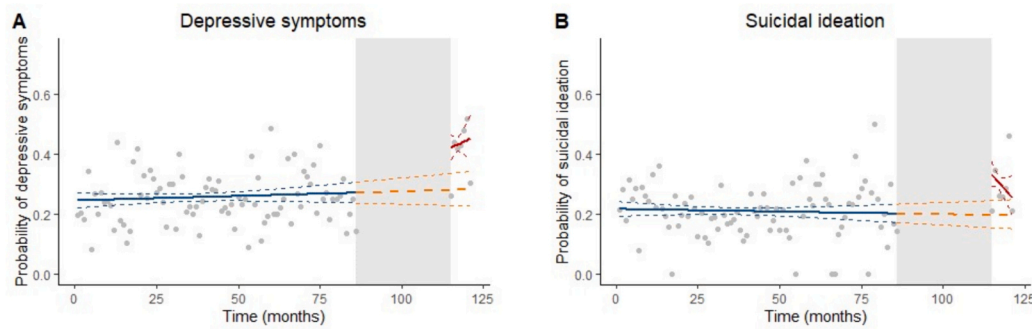


Fig. 1. Depressive symptoms and suicidal ideation predicted probabilities over time (2013–2023). Grey points represent the proportion of the outcome (depressive symptoms or suicidal ideation) by months. Blue lines and red lines are the predicted probabilities and their 95 % CI pre- and post-pandemic. Orange dashed line is the counterfactual scenario, i.e., predicted probabilities if there was no pandemic. Shaded area is the pandemic period. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Table 2
Segmented logistic regression of the effect of the COVID-19 pandemic on depressive symptoms and suicidal ideation among university students.

	Depressive symptoms			Suicidal ideation		
	OR (95%CI) (n = 6431)	aOR ^a (95%CI) (n = 6431)	aOR ^b (95%CI) (n = 6426)	OR (95%CI) (n = 6431)	aOR ^a (95%CI) (n = 6431)	aOR ^b (95%CI) (n = 6351)
Immediate post-pandemic level change	1.85 (1.29–2.64)	1.68 (1.17–2.42)	1.47 (1.01–2.13)	2.16 (1.47–3.18)	2.10 (1.42–3.10)	2.00 (1.33–3.00)
Pre-pandemic trend	1.002 (0.998–1.005)	1.002 (0.998–1.005)	1.002 (0.999–1.006)	0.999 (0.995–1.002)	0.999 (0.995–1.002)	0.999 (0.995–1.002)
Change in post-pandemic trend	1.02 (0.95–1.10)	1.01 (0.94–1.09)	1.02 (0.95–1.10)	0.94 (0.87–1.02)	0.93 (0.86–1.01)	0.93 (0.86–1.02)
Gender						
Male	Ref	Ref	Ref	Ref	Ref	Ref
Female		1.81 (1.57–2.10)	1.72 (1.48–2.00)		0.98 (0.85–1.13)	0.92 (0.80–1.07)
Age		0.94 (0.92–0.96)	0.92 (0.90–0.95)		0.99 (0.97–1.02)	0.98 (0.96–1.01)
University campus						
Bordeaux	Ref	Ref	Ref	Ref	Ref	Ref
Bordeaux-Montaigne		1.53 (1.34–1.75)	1.38 (1.20–1.58)		1.74 (1.51–2.00)	1.56 (1.34–1.80)
Other or unknown		1.06 (0.87–1.29)	1.07 (0.87–1.31)		0.95 (0.77–1.18)	1.02 (0.81–1.27)
Scholarship			1.20 (1.07–1.34)			1.12 (0.99–1.27)
History of depression			2.97 (2.53–3.47)			
History of suicide attempt						5.22 (4.27–6.40)

Abbreviation: OR, odds ratio; aOR, adjusted odds ratio; 95 % CI, confidence interval 95 %.

^a Adjusted for gender, age and university campus.

^b Adjusted for gender, age, university campus, scholarship, and history of depression (for depressive symptoms) or suicide attempt (for suicidal ideation).

symptoms (aOR, 1.002; 95 % CI, 0.999–1.006) and suicidal ideation (aOR, 0.999; 95 % CI, 0.995–1.002) and no change in the trend in the post-pandemic period compared to the pre-era (depressive symptoms: aOR, 1.02; 95 % CI, 0.95–1.10; suicidal ideation: aOR, 0.93; 95 % CI, 0.86–1.02). From the first month of the post-era, participants had an approximately 50 % increased risk of depressive symptoms (aOR, 1.47; 95 % CI, 1.01–2.13) and a 100 % increased risk of suicidal ideation (aOR, 2.00; 95 % CI, 1.33–3.00), compared to participants from the pre-pandemic sample. Female gender (aOR, 1.72; 95 % CI, 1.48–2.00), university campus of Bordeaux Montaigne i.e. humanities and social sciences section (in reference to Bordeaux campus, i.e. sciences and health section; aOR, 1.38; 95 % CI, 1.20–1.58), scholarship (aOR, 1.20; 95 % CI, 1.07–1.34), and history of depression (aOR, 2.97; 95 % CI, 2.53–3.47) were associated at any given time to a higher probability to report depressive symptoms. Students who reported suicidal ideation were also more likely to declare history of suicide attempt (aOR, 5.22;

95 % CI, 4.27–6.40).

4. Discussion

The present results showed that compared to participants from the pre-pandemic sample, those in the post-pandemic sample had higher rates of depressive symptoms and suicidal ideation.

Previous studies have shown that young adults, including students, were strongly exposed to depressive disorders during the COVID-19 pandemic (Bliddal et al., 2023; COVID-19 Mental Disorders Collaborators, 2021; Léon et al., 2023). For instance, a study conducted among 884 college students in Northern Ireland and Republic of Ireland from 2019 to 2020 found a large increase in depression by over 10 % (McLafferty et al., 2021). Our findings suggest that this increased frequency of depressive disorders is persisting after the pandemic, rather than returning to normal. A similar observation was reported after the

SARS pandemic in 2002, with some studies reporting long-term psychiatric implications (Lee et al., 2007).

As student mental health has steadily declined over the past decade, it may be hypothesized that the higher prevalence of depressive symptoms and suicidal ideation in 2022–2023 may be part of an ongoing trend. However, our results showed no significant trend in depressive symptoms and suicidal ideation before the pandemic but a change in the level of depressive symptoms and suicidal ideation in the post-pandemic period.

The literature includes only sparse and inconsistent findings of whether the aggravation of mental health problems during the COVID-19 pandemic also manifested as changes in suicidality. Some studies have shown no change in suicidal ideation at the beginning of the pandemic (Knudsen et al., 2021; Pirkis et al., 2021) or after the lockdown (Danielsen et al., 2023), while others have found an increase of suicidal ideation (Huang et al., 2022). In a study conducted among 4693 Canadian university students, Jones et al. observed an initial drop of suicidal ideation followed by an increasing trend, suggesting the possibility of delayed impact (Jones et al., 2023). Likewise, a large study conducted among 44,898 university students found that the prevalence of suicidal ideation increased between the first lockdown (10.6 %) in France and August 2021, 15 months later (13.8 %) (Wathelet et al., 2022). In this study, in line with our findings, female, students with financial difficulties or psychiatric history, were at risk of mental health problems. Despite the limited data available in the post-Covid period, our results are consistent with literature suggesting the possibility of a worrying long-term impact of the pandemic (Chen et al., 2023; Cheng et al., 2023). A recent study conducted among 6798 students in Spain (most participants were females 73.2 %), between February and March 2022 found similar results with 46.5 % symptoms of severe or moderately severe depression (using the same scale PHQ-9 and the same cut-off) (Pérez et al., 2023). The authors concluded that perception of these symptoms did not change after returning to face-to-face university classes in the post-COVID19 era. A large study conducted among 722,488 students in Finland between 2015 and 2023 concluded that the proportion of participants with generalized anxiety, depression, and social anxiety symptoms increased from pre-COVID-19 levels to 2021 and remained at these higher levels in 2023 (Kiviruusu et al., 2024). Likewise, a study conducted among college students in China revealed that the proportion of suicidal thoughts increased from 7.7 to 14.8 % after full removal of COVID-19 restrictions (Chen et al., 2024), while another study showed that many students returning to further and higher education after Covid-19 restrictions experienced reduced mental health and wellbeing (Liverpool et al., 2023).

The aggravation of students' mental health problems during the post-pandemic period may have various causes, including the economic crisis and persistent anxiety about global warming in this population. If global warming was already considered a massive problem long before COVID-19, in the beginning of the pandemic, the media devoted much attention to climate disaster, and these events also coincided with the global youth-led climate strikes (Nacu-Schmidt et al., 2020). Nevertheless, we think that an exacerbation of this magnitude is partly attributable to the COVID-19 pandemic and the lockdowns, which have been traumatic in this population, as they dramatically limited interactions with teachers and peers for several months (Macalli et al., 2021). The pandemic has importantly changed the functioning of universities and learning processes that may have altered individuals' behaviors and emotions (Aguayo-Estremera et al., 2022) and social relationships (BuiZZa et al., 2023). The WHO revealed that, faced with extended university closures, young people have been left vulnerable to social isolation which can lead to anxiety, uncertainty, loneliness and behavioral problems (WHO, 2022) (Nitschke et al., 2021). We can assume that the reconstruction and recovery of certain social and personal skills may take time and lead to some mental exhaustion (Magorokosho et al., 2024). In addition, the COVID epidemic may have promoted poor health behaviors or dysfunctional routines that could have a long-term negative impact on

students' mental health (Dewa et al., 2024; Zhang et al., 2023). In addition, mental health services, already inadequate before the epidemic, may have been overburdened, resulting in ineffective or delayed treatment.

5. Strengths and limitations

Main strengths of this study included the relatively large samples of students (pre-pandemic $N = 4663$; post-pandemic $N = 1768$) recruited from the same university, using similar recruitment methods, and using the same validated tools to evaluate mental health. Notably, both studies would have been similarly affected by self-selection bias, which is inherent to community-based studies. In particular, there is an over-representation of women in both cohorts, compared to the 56 % of female students in France. We found no statistical differences in the frequency of suicidal behavior between men and women in either cohort. Nevertheless, this bias limits the generalizability of our results to the entire student population. Likewise, we can assume that students who were more aware of depression or suicidal ideation had a greater predisposition to participate to health studies, that could lead to a high prevalence of mental health disorders. However, both studies would have been similarly affected by this bias. Another potential limitation is the possibility that media coverage of the impact of the pandemic on mental health may have led to an over-reporting of mental disorders in the post-pandemic period. This over-reporting could reflect actual mental distress. However, this increase may also be related to under-reporting of mental disorders in the pre-pandemic period, related to stigmatization when mental disorders were less present in the media. In this study, suicidal ideation was measured with one item that could lead to misclassification bias (Millner et al., 2015). However, there are several ways of measuring suicidal thoughts and none has a consensus. Furthermore, the use of a single item to assess suicidal thoughts remains a common approach in cohort studies in the general population (Mars et al., 2019; Scardera et al., 2020), particularly if the data come from cohorts that are not specific to the study of suicidal behaviors, which is the case in the present study.

6. Conclusions

The present findings reveal an alarming deterioration of students' mental health in the post-pandemic period compared to in the pre-pandemic period. These results need replication in other settings and other countries, but they nevertheless suggest that it is crucial to continue monitoring students' mental health, to strengthen communication on this topic, and to reinforce university mental healthcare systems.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jad.2024.09.093>.

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CRedit authorship contribution statement

Mélissa Macalli: Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Conceptualization. **Laura Castel:** Writing – review & editing, Validation, Formal analysis. **Hélène Jacqmin-Gadda:** Writing – review & editing, Validation, Methodology. **Charline Galesne:** Formal analysis. **Marie Tournier:** Writing – review & editing, Validation. **Cédric Galéra:** Writing – review & editing, Validation. **Edwige Pereira:** Writing – review & editing, Supervision, Methodology, Data curation, Conceptualization. **Christophe Tzourio:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

None.

Data sharing statement

In accordance with the General Data Protection Regulation (GDPR), the data sets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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