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Depressive symptoms in higher education students during the COVID-19 pandemic: the role of containment measures

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Background: Students are a vulnerable group for the indirect impact of the COVID-19 pandemic, particularly their mental health. This paper examined the cross-national variation in students' depressive symptoms and whether this can be related to the various protective measures implemented in response to the initial stage of the COVID-19 outbreak. **Methods:** Student data stem from the COVID-19 International Student Well-being Study, covering 26 countries during the first wave of the COVID-19 pandemic. Country-level data on government responses to the COVID-19 pandemic were retrieved from the Oxford COVID-19 Tracker. Multilevel analyses were performed to estimate the impact of the containment and economic support measures on students' depressive symptoms ($n = 78\ 312$). **Results:** School and workplace closures, and stay-at-home restrictions were positively related to students' depressive symptoms during the COVID-19 pandemic, while none of the economic support measures significantly related to depressive symptoms. Countries' scores on the index of these containment measures explained 1.5% of the cross-national variation in students' depressive symptoms (5.3%). This containment index's effect was stable, even when controlling for the economic support index, students' characteristics, and countries' epidemiological context and economic conditions. **Conclusions:** Our findings raise concerns about the potential adverse effects of existing containment measures (especially the closure of schools and workplaces and stay-at-home restrictions) on students' mental health.

Introduction

Higher education is a transitional period in a young adult's life that entails a range of potential stressors, including moving out of the family home, making new friends, a high study burden, holding a job while studying to become financially independent.[1] There is ample evidence indicating that these stressors render students vulnerable to developing mental health problems, such as depression and anxiety. A review reported a mean prevalence rate of depression among university students of 30.6%,[2] identifying depression as one of the most common health problems in higher-education students.[3]

This vulnerability may have increased during the COVID-19 pandemic, as students were confronted with a range of containment measures.[4] Most countries initially implemented general containment measures to reduce the spread of the virus. These included the partial or total closure of schools, universities and workplaces, the cancellation of public events and restrictions on social gatherings, stay-at-home requirements, restrictions on internal movement within countries, and international travel. Most countries adopted a mix of these policies.[5] However, they differed in timing and calibration of specific responses and the intensity with which the various policies were deployed—from compulsory quarantines to voluntary lockdowns and social distancing measures.[6]

These containment measures resulted in significant changes in students' social lives.[7,8] The school closures and stay-at-home requirements directly impacted students' day structures, minimized physical proximity, and face-to-face encounters with friends and peers while many students moved back to their parental home.[7,8] The containment measures were also translated at the level of the higher education institution (HEI) and, thus, changed how higher education itself was organized: a conversion from face-to-face lectures to online classes, the partial or total cancellation of internships, laboratory attachments, fieldwork and the adaptation of assessment methods to COVID-19 protective measures.[8,9] The general containment measures and in particular, the workplace closures may have

caused financial difficulties by shutting down certain economic sectors. As a result, student jobs, which enabled students to pay for education or accommodation, were cancelled. At the same time, they may have impacted the income of students' parents, decreasing their ability to provide financial support.

In order to mitigate the economic effects resulting from these containment measures, many countries implemented economic support measures, including income protection and debt or contract relief measures for households.[5] While in some countries, these measures were reserved for formal sectors, in other countries, transfers were also made to informal sector workers, including student jobs. Therefore, they could have minimized students' financial worries as well. As a result, we may expect that both the governmental containment measures and these economic support measures may have impacted students' mental well-being.

Recent evidence indeed points to elevated levels of depressive symptoms in higher education students during the first wave of the COVID-19 pandemic, as well as to cross-national variation therein.[8,10] However, there are, to date, no studies on how the variation in containment and economic support measures relates to cross-national variation in depressive symptoms among students. The current paper fills this gap in the literature by (i) describing the cross-national variation in depressive symptoms in students in the participating countries during the first wave of the COVID-19 pandemic and (ii) examining which containment and economic measures explain these cross-national differences in depressive symptoms.

Methods

Data

Data stem from the COVID-19 International Student Well-being Study (C19 ISWS), which collected information on student well-being during the first wave of the COVID-19 pandemic in 133 HEIs in 26 countries. The C19 ISWS applied a stratified convenience sampling design. In a first step, HEIs were selected within countries, covering Western, Central-Eastern, Eastern, Northern and Southern European countries and including some additional high- and upper-middle-income countries (Canada, Israel, South Africa, Turkey and the USA). Data collection took place between 27 April and 7 July 2020, with two-thirds of HEIs collecting the data within the first month of the initial launch. Within each HEI, the survey was active for at least 2 weeks, but a selection of HEIs prolonged this period. Respondents were recruited through direct emailing and social media and were asked to fill out an online survey. Participants were eligible if they were enrolled in a higher education program, aged 17 years or above and provided informed consent. More details about the study procedures can be found in the study protocol.[11]

For this study, a subsample of the data was used to cover each participating country during a period with relatively stable policy measures. The basic rule for this selection was restricting our data to the first weeks (at least 2 weeks) following the survey implementation until the week wherein the government measures were changed (see Supplementary files S1 and S2 for details about the subsample selection).

Measures

Dependent measure

Depressive symptoms: An eight-item version of the Center for Epidemiologic Studies-Depression Scale (CES-D 8) was used to measure the frequency and severity of depressive symptoms.[12] Scale scores were assessed using a non-weighted summed rating and ranged from 0 to 24, with higher scores indicating a higher frequency and severity of depressive symptoms. The reliability and the validity of the inventory were confirmed across a wide selection of European countries.[13] In the C19 ISWS sample, the country-specific Cronbach's alphas ranged between 0.85 and 0.90.[11]

Independent measures

Data on policy interventions were obtained from the Oxford COVID-19 Government Response Tracker (OxCGRT).[14] The OxCGRT is very adequate for cross-country analyses and includes containment measures as well as economic support measures.[15] It closely resembles the data of the CoronaNet project.[16] The containment measures included (a) closures of schools and universities; (b) closures of workplaces; (c) cancellation of public events, (d) restrictions on social gatherings; (e) public transport closures, (f) stay-at-home regulations, (g) restrictions on internal movements (within a country); and (h) restriction on international traveling. The economic support measures included (i) income protection measures and (j) debt or contract relief measures for households (see Supplementary file S3 for details concerning the operationalization).

In addition, two indexes were constructed (using an additive approach) with the most relevant policy measures regarding our research objectives and target population: the *containment index* consists of school (a) and workplace closures (b) and stay-at-home regulations (f) and the *economic support index* of income protection (i) and debt or contract relief (j). For all countries, the measurement scores of the Oxford data were at the national level, except for the USA and Canada. There we have opted for the regional measures corresponding to the participating HEI region: New Jersey and Quebec (also available in the Oxford data).[14]

Control variables

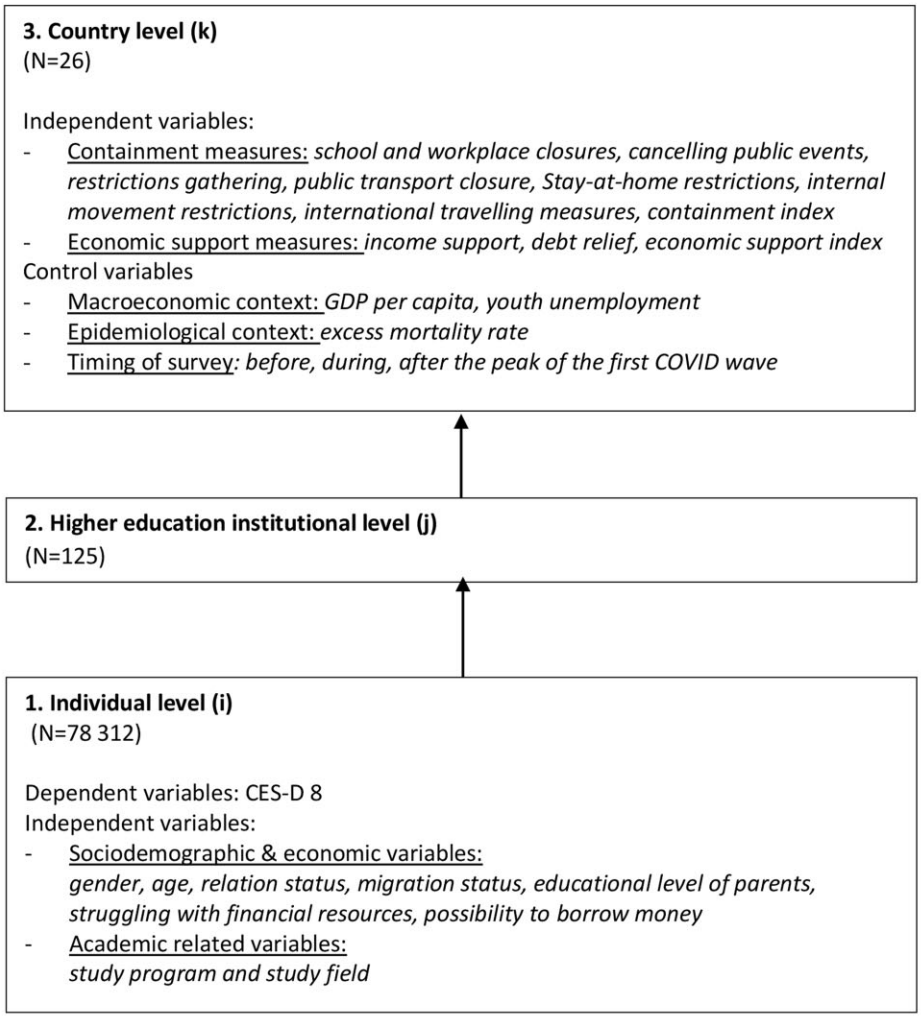
At the individual level, we controlled *for gender, age, relationship status, migrant background, the highest level of education attained by either parent, if students had sufficient financial resources to cover their monthly costs and whether they could easily borrow an equivalent of 500 euros within 2 days (adjusted to the local currency)*. The latter is recoded into four categories: (i) zero persons, (ii) one to two persons, (iii) three to four persons and (iv) five or more persons (reference category). *Student program* distinguished between first-year bachelor, not first-year bachelor, master, doctoral program or another program. *Study field* was operationalized according to the ISCED study field categorization.[17]

To control for countries' macroeconomic conditions, *GPD per capita* (in 2019[18]) and *youth unemployment rate* (the number of unemployed 15–24 year-olds as a percentage of the youth labor force in 2019[19]) were included. To take countries' epidemiological context into account, we controlled for the country's level of *excess mortality during the selected survey period* (p-score; own calculations based on data from Eurostat[20] or national or regional statistics bureaus) and *the timing of the survey* in relation to the peak (defined by the highest level of excess mortality) of the first COVID-19 wave (before, during, after the peak).

Statistical analyses

First, countries' average levels of depressive symptoms and of the containment and economic support measures are described. Significant country differences were identified through a one-way analysis of variance and *post hoc* Bonferroni test. Two-tailed Pearson's correlations (r) assessed the strength of the associations between the various government measures.

Thereafter, a hierarchical three-level model was constructed with individual-level variables and control variables at the country-level, as the students were clustered in HEIs ($n = 125$), which were again clustered in countries ($n = 26$) (figure 1). First, the government measurements were tested one by one, controlling for countries' epidemiological and economic conditions. The measurements were tested in separate models as most of them were correlated



Multilevel regression formula:

$CES\text{-}D\ 8_{ijk} \sim N(XB,\Omega)$

$CES\text{-}D\ 8_{ijk} = \beta_{0ijk}cons + \beta_1 X1_{ijk} \ldots \beta_{23} X23_{ijk} + \beta_{24} containment\_measure_k + + \beta_{25} excess\_mortality\_rate_k + \beta_{26} before\_peak_k + \beta_{27} during\_peak_k + \beta_{28} Youth\_unemployment_k + \beta_{29} GDP\_per\_capita/1000_k$

$\beta_{0ijk} = \beta_0 + v_{0k} + u_{0jk} + e_{0ijk}$ error term

Variances

$[v_{0k}] \sim N(0, \Omega_v) : \Omega_v = [\sigma^2_{v0}]$ k = country level

$[u_{0jk}] \sim N(0, \Omega_u) : \Omega_u = [\sigma^2_{u0}]$ j = higher education institutional level

$[e_{0ijk}] \sim N(0, \Omega_e) : \Omega_e = [\sigma^2_{e0}]$ I = individual level

Figure 1 Presentation of the three-level model, with the number of units and the variables per level

with each other—reflecting countries' general policy action toward the COVID-19 pandemic and the pandemic's strength—and because the number of higher-level units (countries) was limited. In the second part, we re-estimated the models, including simultaneously the containment and economic support index. In both parts, a stepwise procedure was followed: Model 1 included the individual-level variables to assess the variation in depressive symptoms at the country level, taking the composition of the student population in terms of sociodemographic, economic, and academic characteristics into account (Supplementary file S6, table E). Model 2 estimated the effect of the governmental measures controlling for these individual-level variables, and thereafter (Model 3), we controlled for the countries' epidemiological and economic conditions (tables 1 and 2).

We conducted sensitivity analyses to examine the extent to which the results would hold, if we used other proxies for addressing countries' economic and epidemiological conditions, and if we used a subsample excluding the survey weeks where countries' containment or economic measures were changing. The impact of influential countries on the results was also estimated by deleting every country once from the analysis.[21] In addition, a logistic analysis was performed with the depression scale dichotomized (cut-off = 9/24).[22,23] The results of these analyses (see Supplementary files S7–S11) confirm the robustness of our findings.

Data preparation and descriptive statistics were done in SPSS® version 26, and the multilevel analyses were performed in MLwiN Version 3.05.

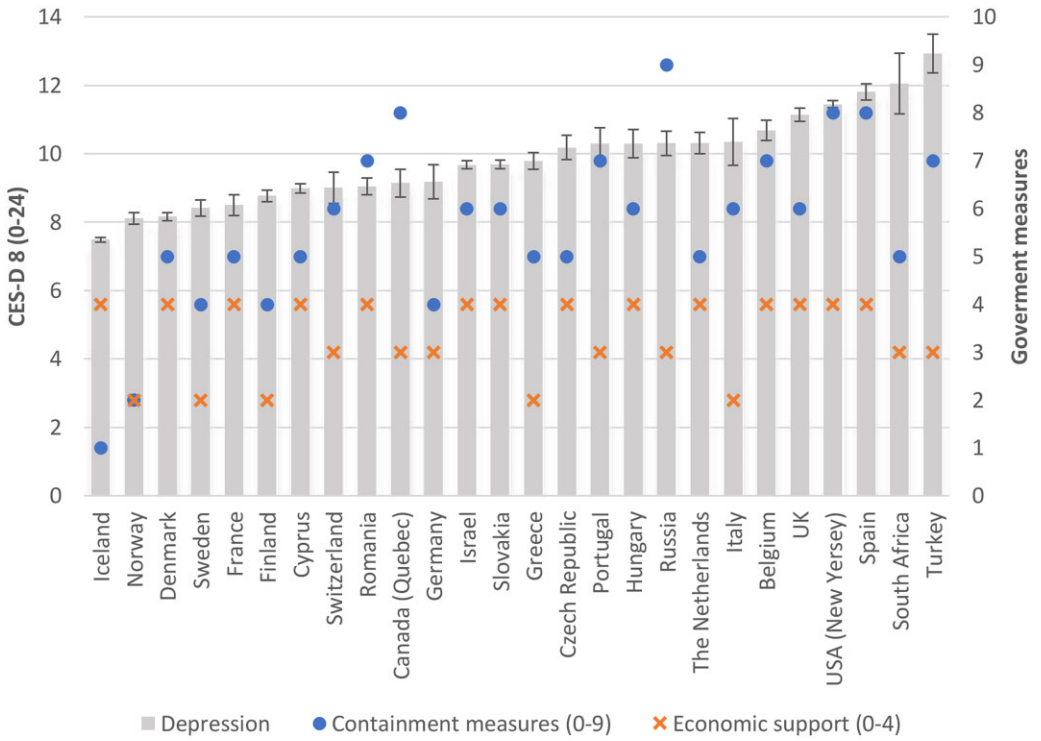


Figure 2 Depressive symptoms and scores on the containment and economic support index per country

Results

As figure 2 shows, the mean levels of depressive symptoms ranged from 7.5 in Iceland to 12.9 in Turkey and differed significantly between the majority of countries. The lowest levels of depressive symptoms were reported in the Nordic countries, Switzerland and France, while the highest mean levels in Turkey, South Africa, Spain, the UK and the USA.

Concerning the COVID-19 protective measures (see Supplementary file S4, table B, and Supplementary file S5, table C, for the corresponding figures), Russia (scored 9/9 on the containment index), Quebec, Spain, and New Jersey (scored 8/9), Belgium, Romania, Portugal, and Turkey (scored 7/9) had very strict containment measures during their survey period in contrast to Iceland (scored 1/9), and Norway (scored 1/9). The correlations between the three containment measures were moderate to high (ranging from 0.570 to 0.627, $P < 0.010$). In addition, all countries had some economic support measures implemented, with 14 countries having the maximum score on the index: which is the combination of replacing more than 50% of lost salary and a broad debt and contract relief. Greece, Italy, Finland and Norway had the most limited economic support measures (scored 2/4). However, the correlation between the two economic measures was relatively weak ($r = 0.204$, $P < 0.001$).

The containment index was strongly related to the severity of the COVID-19 pandemic, measured by the excess mortality rate ($r = 0.564$, $P < 0.01$), and to countries' average level on the depression scale ($r = 0.6$, $P < 0.001$), while the economic support index was not significantly related to the depression scale and the epidemiological indicators. The correlation between the two indexes was not significant.

Turning to our multilevel results, the cross-country variance in depressive symptoms was significant but limited in scope, as only 5.3% of the variance of depressive symptoms between countries was explained by differences between countries derived from the variance decomposition of the null model of the multilevel analysis (Supplementary file S6, table E). This variance was reduced to 4.5% after taking the composition of the student population into account (M1).

School closures, workplace closures and stay-at-home restrictions were significantly related to students' depressive symptoms (table 1, M2), also after adding the epidemiological and macroeconomic factors to the models (M3). In countries with stricter and broader implementations of these measures, higher levels of depressive symptoms were found. The implementation of these containment measures was responsible for more than 1% of the variance of depressive symptoms at the country level (M2). The other containment measures and the two economic support measures were not significantly related to students' depressive symptoms.

$$\text{CES-D } 8_{ijk} \sim N(XB,\Omega)$$

$$\text{CES-D } 8_{ijk} = \beta_{0ijk}\text{cons} + \beta_1 X1_{ijk} \ldots \beta_{23} X23_{ijk} + \beta_{24}\text{containment\_measure}_k + + \beta_{25}\text{excess\_mortality\_rate}_k + \beta_{26}\text{before\_peak}_k + \beta_{27}\text{during\_peak}_k + \beta_{28}\text{Youth\_unemployment}_k + \beta_{29}\text{GDP\_per\_capita}/1000_k$$

$$\beta_{0ijk} = \beta_0 + v_{0k} + u_{0jk} + e_{0ijk} \quad \text{error term}$$

Variances

$[v_{0k}] \sim N(0, \Omega_v)$: $\Omega_v = [\sigma^2_{v0}]$ k = country level

$[u_{0jk}] \sim N(0, \Omega_u)$: $\Omega_u = [\sigma^2_{u0}]$ j = higher education institutional level

$[e_{0ijk}] \sim N(0, \Omega_e)$: $\Omega_e = [\sigma^2_{e0}]$ i = individual level.

In table 2, an index of the three selected containment measures and the two economic support measures were simultaneously estimated. Results show that higher containment measure scores related to more depressive symptoms, while the economic support index had no significant effect on depressive symptoms. This effect remained significant when taking the epidemiological and macroeconomic factors into account and reduced the variance in depressive symptoms at the country level by ~1.5%.

Discussion

This multi-country study is the first in the literature to examine whether the cross-national variation in the level of depressive

Table 1. Multilevel results (part 1): containment and economic support measures separately regressed on depressive symptoms

	Model 2[a]						
	β	**SE**	**95% CI**	***P***	R^{2} [b]	σ^{2}_{v0}[c]	**SE**
Containment measures							
a School closure	0.955	0.275	0.416 to 1.495	0.001***	3.036	0.727	0.250
b Workplace closure	0.798	0.297	0.216 to 1.380	0.007**	3.552	0.855	0.283
c Canceling public events	0.616	0.513	−0.389 to 1.620	0.230	4.259	1.033	0.336
d Restrictions gathering	−0.114	0.179	−0.465 to 0.237	0.524	4.413	1.072	0.346
e Public transport closure	0.550	0.395	−0.224 to 1.323	0.164	4.180	1.013	0.326
f Stay-at-home restrictions	0.711	0.275	0.172 to 1.249	0.010**	3.536	0.851	0.284
g Internal movement restrictions	0.381	0.303	−0.212 to 0.975	0.208	4.236	1.027	0.334
h International travelling measures	0.072	0.270	−0.458 to 0.602	0.790	4.499	1.094	0.352
Economic support measures							
i Income support	−0.385	0.555	−1.473 to 0.703	0.488	4.445	1.080	0.346
j Debt and contract relief	0.522	0.302	−0.070 to 1.114	0.084	4.010	0.970	0.317
	Model 3[d]						
Containment measures							
a School closure	0.871	0.288	0.306 to 1.437	0.003**	2.438	0.580	0.206
b Workplace closure	1.040	0.306	0.441 to 1.639	0.001***	2.195	0.521	0.190
c Canceling public events	0.208	0.501	−0.773 to 1.189	0.677	3.331	0.799	0.270
d Restrictions gathering	0.020	0.196	−0.365 to 0.405	0.920	3.359	0.806	0.270
e Public transport closure	0.187	0.433	−0.661 to 1.035	0.666	3.339	0.802	0.269
f Stay-at-home restrictions	0.880	0.384	0.127 to 1.634	0.022*	2.703	0.645	0.225
g Internal movement restrictions	0.222	0.341	−0.446 to 0.890	0.515	3.283	0.788	0.266
h International travelling measures	−0.176	0.276	−0.717 to 0.366	0.525	3.331	0.799	0.270
Economic support measures							
i Income support	0.660	0.669	−0.650 to 1.970	0.324	3.190	0.765	0.260
j Debt and contract relief	0.487	0.311	−0.121 to 1.096	0.117	3.012	0.721	0.247

Notes:
*: $P < 0.050$.
**: $P < 0.010$.
***: $P < 0.001$; *n* country = 26; *n* HEI = 125; *n* students = 78 312.
a: $M2_{a–j}$: inclusion of the individual control variables (gender. age. migration and relation status. financial situation. ability to borrow money. parental education. study program and field).
b: R^{2}: $[\sigma^{2}_{v0}/(\sigma^{2}_{v0} + \sigma^{2}_{u0} + \sigma^{2}_{e0})] * 100$.
c: $M2–3_{a–j}$: variance at higher education institutional level $M2_{a–j}$: 0.36 (0.07); and at individual level 22.86 (0.12).
d: $M3_{a–j}$: inclusion of the individual control variables and countries' epidemiological (excessive mortality and timing of the survey in relation to the peak of the first COVID-19 wave) and economic conditions (youth unemployment rate and GDP per capita (/1000).

symptoms among students is related to the various protective measures implemented by the governments in response to the first COVID-19 outbreak. Our research shows that the containment measures played a particularly important role. We found that in countries with strict measures regarding school closures, workplace closures and stay-at-home restrictions, mean levels of depressive symptoms in students were higher as well. These measures had a significant impact on students' day-to-day lives by changing social contacts, leisure time activities including sports, student jobs, day structure and methods of education.[7] This finding is in line with research in the general population, which found that school and university closings, followed by quarantine and social distancing, were perceived as having the most substantial effect on daily life, particularly at the beginning of the pandemic.[24] Other containment measures, such as the cancellation of public events, restrictions on social gatherings, internal movements and international traveling, and public transport, appeared to have no effect on students' well-being at the time. These measures probably are less directly related to students' daily lives and social interactions, or their impact will only be visible after a longer period by increasing symptoms of entrapment among students.

Young adults' student days are characterized as a life stage of experimentation and identity development, for which social interactions, new adventures, experiences and spontaneous activities are crucial. Because of these containment measures, students may have felt that they missed out on a large part of their student days and that their social life was limited or replaced by virtual interactions on social media, which was not beneficial for their mental health.[8,25] At the same time, students were confronted with an increased level of stress because of new study methods (online classes, remote studying), increased study-related workload, changed living situations (e.g. moving back to the parental home), loss of student jobs, financial worries and uncertainty about the employment possibilities when graduating.[10] These unintended effects of containment measures may have led to increased levels of depressive symptoms. Further research is recommended to investigate the underlying pathways that explain the effect of these measures on students' mental health.

Our results suggest that the economic support measures did not mitigate the negative effect of the COVID-19 pandemic on students' depressive symptoms. Either these measures did not go far enough in protecting students from the secondary effects of the pandemic, or the index used did not allow us to adequately examine how these measures protected vulnerable student populations. These measures may also have had a more delayed effect than the tangible stay-at-home restrictions, school and workplace closures and may be more directly relevant for the active working population in the affected sectors whose finances worsened as a result of the lockdown.[26] The broader economic impact of the pandemic and the role of the associated economic support measures will probably only become visible in the long run, and particularly in countries with a pronounced imbalance between the costs of higher education and the capacity of students to shoulder increasing debt burdens.[27]

Table 2 Multilevel results (part 2): the containment and economic support index simultaneously regressed on depressive symptoms

	Model 3[a]			
Country-level variables	β	**SE**	**95% CI**	***P***
Containment index	0.410	0.125	0.165 to 0.655	0.001***
Economic support index	0.323	0.233	−0.134 to 0.78	0.166
Excess mortality rate[b]	−2.393	1.512	−5.357 to 0.572	0.114
Timing survey (ref. after peak)				
Before peak	−0.216	0.527	−1.248 to 0.817	0.682
During peak	−0.403	0.489	−1.362 to 0.555	0.409
Youth unemployment rate[b]	0.031	0.020	−0.008 to 0.07	0.117
GDP per capita (/1000)[b]	−0.127	0.186	−0.492 to 0.237	0.494
Variance				
Country-level [σ^2_{v0}]	0.373	0.152		
HEI-level[c] [σ^2_{u0}]	0.408	0.08		
Individual-level [σ^2_{e0}]	23.622	0.119		
R^2 (%)[d]	1.529			
−2 Log Likelihood	470119.448			

Notes:
*: $P < 0.050$.
**: $P < 0.010$.
***: $P < 0.001$; *n* country = 26; *n* HEI = 125; *n* students = 78 312.
a: Inclusion of the individual control variables and countries' epidemiological context and macroeconomic conditions.
b: Grand mean-centered.
c: Higher education institution.
d: $[\sigma^2_{v0}/(\sigma^2_{v0} + \sigma^2_{u0} + \sigma^2_{e0})] * 100$.

While containment measures were implemented to attenuate the strength of the pandemic, these measures appear also to have an impact on student mental well-being. The severity of the pandemic itself (measured by a few proxies such as excess of mortality) seems to not be related to student mental well-being. What the effect of the pandemic's severity would be in the absence of these measures remains, of course, unclear and is beyond the scope of this paper. However, within the current context, it appears that mainly the secondary effects of the pandemic affected the lives of students. For this population which perceived the severity of the consequences of an infection for themselves as rather minor,[28] these measures were probably considered as too drastic and may have caused a lot of stress among students. The lack of a direct effect of the severity of the pandemic was also established for other outcomes, such as anxiety, protective health behaviors and supportive attitudes towards containment measures.[29,30]

Some limitations of this work should be addressed. First, the C19 ISWS made use of a convenience sample, both in terms of the selection of students, HEIs and countries. Sample sizes were small in some countries, or data were collected within only one HEI within certain countries. As a result, the C19 ISWS could be not representative of the entire student population. In addition, selection bias cannot be excluded, as it may be likely that students who experienced stress due to the COVID-19 pandemic were more likely to respond to our invitation to participate in the study, and students with a more disadvantaged socioeconomic background or limited access to the internet are generally less likely to participate in surveys. Second, because depressive symptoms were not assessed prior to the COVID-19 pandemic, we were unable to disentangle causal paths between depressive symptoms and containment measures, nor were we able to examine the degree to which depressive symptoms changed.

To conclude, school and workplace closures and stay-at-home restrictions were positively related to students' depressive symptoms during the first wave of the COVID-19 pandemic. Not the severity of the COVID-19 pandemic, but the protective measures taken by the government helped to explain cross-national variation in students' depressive symptoms. The mitigation of these secondary effects of the COVID-19 pandemic should, therefore, be a priority within the student population,[31] especially in a context where the situation is unduly prolonged. Our findings highlight the importance of seeking strategies to mitigate the adverse effects of the existing containment measures on students' mental health.

Ethics approval

Ethical approval was obtained individually in all participating HEIs, and the multi-country research design was approved by the Ethics Committee for the Social Sciences and Humanities of the University of Antwerp, Belgium (reference number: SHW_20_38).

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Data availability

The rough data and analytical sample underlying this article are available in the public domain: https://zenodo.org/search?page=1&size=20&q=C19%20ISWS.

Key points

- Country differences in the level of depression among higher education students during the first wave of the COVID-19 pandemic can be partly ascribed to the variation in countries' responses to the pandemic.
- School closures and workplace closures as containment measures were significantly related to higher depression levels among students.
- In countries with strict stay-at-home restrictions, the average depression level among students was higher.
- None of the economic support measures was significantly related to depressive symptoms among students.
- The index of these three containment measures had a stable impact on depression, also after taking students' characteristics, as well as, countries' epidemiological context, economic conditions and support measures into account.

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