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L'Encéphale 48 (2022) 607–614

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# Self-reported mental health symptoms, quality of life and coping strategies in French health sciences students during the early stage of the COVID-19 pandemic: An online survey

## *Santé mentale, qualité de vie et stratégies de coping des étudiants en santé français au début de la pandémie COVID-19 : une enquête en ligne*

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ARTICLE INFO

*Article history:*
Received 25 May 2021
Accepted 20 September 2021
Available online 24 September 2021

*Keywords:*
Mental health
Health sciences students
COVID-19
Coping strategies
Quality of life
Pandemic

ABSTRACT

*Introduction.* – Health sciences students usually report high rates of mental health problems. The COVID-19 pandemic context may have serious psychological impacts in this at-risk population. We aimed to assess the self-reported mental health status, health-related quality of life and coping strategies of health sciences students during the early stage of the pandemic.
*Method.* – An online 128-item questionnaire sent to 17,673 health sciences students from the Claude Bernard University Lyon 1 in April 2020 assessed: a) sociodemographic characteristics, b) conditions of lockdown, c) depressive (*Beck Depression Inventory- Short Form*, BDI-SF), anxiety (*State-Trait Anxiety Inventory-A,* STAI-A) and traumatic symptoms (*Impact of Event Scale -Revised*, IES-R), d) health-related quality of life (SF12) and e) coping strategies (*Brief Coping Orientation to Problems Experienced*, Brief COPE).
*Results.* – The participation rate was 9.9% ($n = 1{,}765$). A total of 19.5% of participants reported an IES-R > 33, 11.6% depressive symptoms, 58.1% anxiety symptoms, and 4.4% suicidal ideation. Their mental health-related quality of life was significantly poorer than for physical health. Female gender, COVID-like symptoms, social isolation due to the lockdown, pandemic-related financial restraint and exams-related stress were significantly associated with poorer self-reported mental health conditions. Volunteering in the healthcare system was significantly associated with lower mental health scores. Coping strategies were mostly oriented toward avoidance and positive appraisal.
*Conclusion.* – French health sciences students exhibited high levels of self-reported mental health problems and a poor mental health-related quality of life during the early stage of the COVID-19 pandemic. Specific risk factors related to the pandemic partly explain the observed prevalence.
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*Mots clés :*
Santé mentale
Étudiants en santé
Covid-19

RÉSUMÉ

*Objectifs.* – Les étudiants en santé présentent habituellement des taux élevés de problèmes en santé mentale. La pandémie Covid-19 et le confinement pourraient avoir des conséquences délétères sur la santé mentale dans cette population à risque. Notre étude visait à évaluer l'état de santé mentale, la qualité de vie et les stratégies de coping auto-reportées des étudiants en santé pendant les premières semaines de la pandémie Covid-19.

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https://doi.org/10.1016/j.encep.2021.09.002
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Stratégies de coping
Qualité de vie
Pandémie

*Méthode.* – Un questionnaire en ligne de 128 items a été envoyé en avril 2020 à 17 673 étudiants en santé de l'Université Claude Bernard Lyon 1 pour évaluer: a) les caractéristiques sociodémographiques, b) les conditions de confinement, c) les symptômes dépressifs (*Beck Depression Inventory- Short Form*, BDI-SF), anxieux (*State-Trait Anxiety Inventory-A*, STAI-A) et traumatique (*Impact of Event Scale -Revised*, IES-R), d) les stratégies de coping (*Brief Coping Orientation to Problems Experienced,* Brief COPE) et la qualité de vie liée à la santé (SF12).
*Résultats.* – Le taux de participation a été de 9,9 % ($n$ = 1765). Un total de 19,5 % des participants rapportaient un score supérieur à 33 à l'IES-R, 11,6 % des symptômes dépressifs, 52,6 % des symptômes anxieux et 4,4 % des idées suicidaires. La qualité de vie liée à la santé mentale était moins bonne que celle liée à la santé physique. Le sexe féminin, les symptômes évocateurs du Covid, l'isolement social du au confinement, les soucis financiers liés à la pandémie et le stress des examens étaient significativement associés à une moins bonne santé mentale. Le volontariat dans le système de santé était associé à une meilleure santé mentale. Les stratégies de coping les plus utilisées étaient l'évitement et la pensée positive.
*Conclusion.* – Les étudiants en santé présentaient des taux élevés de problèmes en santé mentale auto-reportées et une qualité de vie liée à la santé mentale altérée au début de la pandémie Covid-19. Des facteurs de risqué spécifiques liés à la pandémie expliquent en partie les résultats observés.
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## 1. Introduction

On February 2020, the first cases of infection by the SARS-CoV-2 (COVID-19) were observed in France [1]. The number of cases exponentially increased, and, on March, the French government ordered a lockdown to limit the spread of the virus [2]. As in other countries, the pandemic and the lockdown measures raised questions about their impact on the mental health of the general population [2–5]. Several studies performed in the early stages of the pandemics [6–10] reported a significant impact of the COVID-19 pandemic on the mental health of the general population and of healthcare workers. College students were identified as a particularly vulnerable population during the pandemics [8,11].

In the same time, health sciences students (HSS) are known to usually report poor mental health conditions. Indeed, numerous surveys on medical, nursing, pharmacy, midwifery, dental or physiotherapy students reported high prevalence of depressive symptoms [12–15], anxiety symptoms [16–19], stress [20,21] or suicidal ideation [22,23]. The liability toward mental health observed in HSS may be explained by the stress of demanding curricula, the duration of education or the exposure to challenging clinical experiences [19,20,24].

In the context of the pandemic, HSS are facing specific stress factors, including volunteering or being requisitioned to strengthen the healthcare system, the exposure to patients infected by COVID-19, the economic restraint or the uncertainty regarding their exams, curricula, requisition or clinical rotations [25–28]. Notably, the paradoxical dual role of HSS during the pandemic was highlighted, as a potentially part form of the healthcare workforce and, conversely, possibly considered as non-essential in current clinical delivery [25–28]. However, their current implication in the healthcare system during the COVID-19 pandemic may vary across years of study, disciplines and students, so that the coping strategies used to face the situation may differ between groups and individuals [20,29–31].

A significant impact on the mental health of HSS may be expected during the COVID-19 pandemic. The aim of our study was thus to assess the self-reported mental health, quality of life and coping strategies of French HSS during the early stage of the COVID-19 pandemic.

## 2. Methods

### 2.1. Participants

The CESAMES study is an online survey which included HSS (*i.e.,* medical, nursing, pharmacy, dental, midwifery, physiotherapy and speech therapy students) from the Claude Bernard Lyon 1 University (CBLU), located in Lyon, France. The study received ethical approval from the Ethics Committee of the Hospices Civils de Lyon. The total number of HSS enrolled in CBLU is 17,673. Most of them are medical students ($n$ = 9,584; 54.2%), nursing students ($n$ = 4,418; 24.9%) and pharmacy students ($n$ = 1,633; 9.2%). Most health sciences students from the CBLU are female (70.7%). Their mean age is 24.8 and 87.8% are single. A total of 16.3% receive a scholarship to fund their education.

### 2.2. Survey

The reporting of the CESAMES survey follows the CHERRIES statement for online surveys [32]. An online 128-item survey based on a literature review of psychological impact of quarantine and pandemics [33] and literature reviews of mental health in health sciences students [14,19,22] was built. The questionnaire comprised the three following parts:

- sociodemographic characteristics;
- conditions of lockdown;
- evaluation of mental health symptoms, coping strategies and health-related quality of life.

The online survey used a secure software driven by the CBLU and was sent to all HSS of the CBLU through their email. Purposive snowball sampling was used. A link to the online survey was distributed via CBLU students' social networks (Facebook, Twitter) and mailing lists of HSS' associations. The students anonymously answered the survey online. Data were collected between April 6$^{th}$ and April 13$^{th}$, 2020. Due to the short inclusion period, a 10% survey response rate was expected in our study (expected number of participants = 1,768). This sample size ensures a 2% margin of error for estimates with a 95% confidence level.

### 2.3. Collected data

#### 2.3.1. Sociodemographic characteristics and conditions of lockdown

The sociodemographic characteristics included age, gender, familial and marital status, discipline and financial situation regarding education.

The conditions of lockdown included the location during lockdown, the proximal environment (number of people, relationship), daily activities and habits (sleep, food, physical activity, exams

reviewing, access to digital material). The impact of the lockdown on the financial situation of respondents was also assessed. Students were also questioned about their personal or professional exposure to COVID-19, their requisition or volunteering to strengthen the healthcare system.

#### 2.3.2. Self-reported mental health symptoms

Four types of self-reported mental health symptoms were assessed: traumatic symptoms, depressive and anxiety symptoms, and suicidal ideation.

Depressive symptoms were assessed with the *Beck Depression Inventory scale short form* (BDI-SF), developed from the *Beck depression Inventory* [34]. The BDI-SF is a 13-item Likert scale with scores for each item ranging from 0 to 3, yielding a total score from 0 to 39. Current suicidal ideation, in active (score > 1) and passive (score = 1) form, were assessed through the item 7 of the BDI-SF [35].

Anxiety symptoms were assessed through the STAI-A, a 20-item scale developed based on Spielberger et al. [36] original "State-Trait Anxiety Inventory" (STAI), used for the measurement of levels of state-anxiety. This instrument is commonly used in the context of health [37]. STAI-A is 20-item Likert scale with scores ranging from 0 (*not at all*) to 4 (*very much*), yielding a total score between 0 and 60. According to previous studies, a cutoff of 41 was retained to ascertain the presence of anxiety symptoms.

Traumatic symptoms were assessed through the French version of the *Impact of Event Scale-Revised* (IES-R) [38–40]. The IES-R is a 22-item self-report questionnaire assessing intrusion, avoidance and hyperarousal symptoms in the previous seven days before completion. Each item is rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely), for a total score of 88. According to previous literature, we retained a cut-off score of 24/88 to indicate a significant psychological impact reaction [41] and a cut-off of 34/88 for moderate or severe psychological impact [8,42].

The SF-12 is one of the most widely used instruments for assessing self-reported health-related quality of life [43]. Originally developed from the Medical Outcomes Study 36-item Short-Form Health Survey SF-36 [44], the SF-12 covers physical health-related quality of life (PH-QoL) and mental health-related quality of life (MH-QoL). This instrument evaluates the 12 items using a 5-point Likert scale coded between 1 to 5 (total score from 12 to 60). Higher scores indicate a good quality of life.

#### 2.3.3. Coping strategies

The coping strategies used by participants to face the situation were assessed through the French version of the *Brief Coping Orientation to Problems Experienced* (Brief COPE) [45]. The Brief COPE is a 28-item scale that assesses 14 different coping strategies divided into four main coping profiles: avoidance (10 items), social support (8 items), positive thinking (6 items) and problem solving (4 items)[46]. The French version of the Brief COPE showed good internal (Cronbach's alpha ranging from 0.71 to 0.82) and external validity [46]. We observed a good internal validity for our data ($\alpha = .78$).

### 2.4. Statistical analyses

Data manipulation and analyzes were performed using the IBM SPSS 25 software. Qualitative variables were summarized using numbers and percentages, and quantitative variables were calculated using means and standard deviations (SD). All scales used have a good intern validity (Cronbach's alpha ranging from 0.77 to 0.91). We first described characteristics of respondents and mean ± standard deviation (SD) score for each mental health outcome: IES-R, BDI-SF, STAI-A and MH-QoL, after having checked for normality. We then explored factors associated with each mental health outcome as dependent variables, expressed as total scores. Univariate analyses were conducted depending on the nature of the factor using Pearson's correlation test for continuous variables (e.g., financial restraint, exams-related stress and age), Student t-test for binary variables (*e.g.,* COVID-19-like symptoms, social isolation, gender, volunteering and being requisitioned and financial restraint), and using ANOVA for categorical variables or non-parametric (Kurskal-Wallis test depending on Levene's test significance) *(e.g.,* discipline with IES-R score, age). We conducted stepwise multivariate linear regressions to assess the significance and the weight of independent variables in the explanation of the score for each mental health outcome (IES-R, BDI-SF, STAI-A and MH-QoL scores). Independent variables included in each model were variables found to be associated with at least one of the 4 mental health outcomes in univariate analysis (*e.g.,* exams-related stress, financial restraint, age, gender, COVID-19-like symptoms, volunteering, and social isolation and discipline). A threshold alpha of 0.05 was considered statistically significant; all tests were two-sided.

## 3. Results

### 3.1. Participants

A total of 1,765 students completed the questionnaire (participation rate = 9.9%). The characteristics of participants are given in Table 1. The mean age was 21.8 and the majority of respondents were medical and nursing students. The sample comprised a great majority of female students. Most of the participants were single and had no child. A minority (23.4%; $n = 412$) financed their education without any help from their family through a loan, a job or a scholarship.

### 3.2. Conditions of lockdown

The overall conditions of lockdown of respondents are given in Table 1. Most of the respondents were in a house, with their family. Only 10.9% of respondents were living alone and 6.6% stayed in their studio or residence. Regarding financial resources, a minority reported experiencing financial restraint due to the pandemic and continued their job during the lockdown. Regarding their involvement in the healthcare system, a large minority volunteered, and a small minority was requisitioned. A very small minority had no daily access to digital material or reported their digital material to be bad or very bad quality ($n = 72$; 4.2%). The majority (58.5%; $n = 1{,}033$) spent more than five hours daily working for their education, while 13.4% ($n = 236$) spent more than two hours per day informing themselves about the pandemic.

### 3.3. Physical health and health behaviors

A total of 21.8% ($n = 384$) of the respondents were exposed to people with COVID-19 and 14.8% ($n = 261$) reported COVID-19-like symptoms, of which 46.4% (121/261) received a screening test. The test was positive for 17 of them. Most of the respondents had less than one hour of physical activity per day ($n = 1451$; 82.2%). A total of 46.1% ($n = 814$) reported an impaired quality of sleep, of which 15.2% ($n = 124$) reported it to be very bad. Regarding the quality of diet, 17.0% ($n = 300$) reported it to be impaired.

### 3.4. Self-reported mental health symptoms

The mean IES-R score was 21.3 (SD = 13.8). A total of 35.6% reported an IES-R score > 24 and 19.5% showed an IES-R > 33. The mean BDI-SF score was 6.09 (SD= 5.21). A total of 11.6% of participants reported BDI-SF > 13. The mean STAI-A score was 43.6 (SD = 12.7). A total of 58.1% of participants reported an STAI-A ≥ 41.

**Table 1**
Sociodemographic characteristics of participants and conditions during lockdown.

| Variables* | | Variables* | | Variables* | |
|---|---|---|---|---|---|
| **Gender** | | **Type of accommodation during the lockdown** | | **Daily access to digital material** | |
| Female | 1433 (81.8) | House | 876 (49.6) | Yes | 1668 (94.6) |
| Male | 318 (18.2) | Flat | 737 (41.8) | No | 96 (3.4) |
| **Age (mean + SD)** | 21.8 (4.17) | Studio | 60 (3.4) | **Financial restraint due to the lockdown** | |
| **Discipline** | | Residence | 57 (3.2) | High level | 144 (8.2) |
| Medicine | 902 (51.4) | Other | 35 (2.0) | Low level | 408 (23.2) |
| Nursing | 376 (21.4) | **Alone during the lockdown** | | No restraint | 1209 (68.6) |
| Pharmacy | 191 (10.9) | Yes | 193 (10.9) | **Job during lockdown** | |
| Dental | 77 (4.4) | No | 1571 (89.1) | Yes | 404 (23.1) |
| Rehabilitation** | 144 (8.3) | **Number of other people living with the participants during the lockdown** | | No | 1345 (76.9) |
| Midwifery | 65 (3.7) | 1 | 324 (20.5) | **Volunteering** | |
| **Marital status** | | 2 | 324 (20.5) | Yes | 715 (40.6) |
| Single | 1404 (79.9) | 3 | 434 (27.4) | No | 1046 (59.4) |
| In a relationship | 314 (17.9) | 4 | 286 (18.1) | **Requisitioned** | |
| Married | 34 (1.9) | 5 and more | 214 (13.5) | Yes | 269 (15.3) |
| Divorced | 6 (0.3) | **Social environment** | | No | 1491 (84.7) |
| **Children** | | Family only | 1331 (84.2) | **Financing of education***** | |
| Yes | 60 (3.4) | Friends only | 55 (3.5) | Parental or familial funding | 1352 (76.6) |
| No | 1704 (96.6) | Flatmates only | 43 (2.7) | Scholarship | 387 (21.9) |
| | | | | Job | 288 (16.3) |
| | | | | Loan | 102 (5.8) |

* Except for age, results are given in samples (with percentages between parentheses).
** Includes physiotherapy, speech and motor rehabilitation students.
*** The total percentage overreaches 100% as several sources of funding are possible. The cumulative number of participant may underreach 1765 for some variables due to missing responses for several items of the questionnaire.

A total of 4.42% respondents reported current suicidal ideation. Only a minority of them ($n = 6$) exhibited active suicidal ideation.

### 3.5. Health-related quality of life

The mean SF-12 score was 3.72 (SD = 0.5). The mean scores were 3.91 (SD = 0.39) for PH-QoL and 3.38 (SD = 0.73) for MH-QoL. MH-QoL was significantly lower than PH-QoL ($t = 29.77$; ddl = 1764; $P < 0.0001$).

### 3.6. Factors associated with self-reported mental health symptoms

In the univariate analysis (Table 2), female gender, COVID-like symptoms, financial restraint and stress related to final exams were significantly associated with higher scores in IES-R, BDI-SF and STAI-A scales. Social isolation due to the lockdown, younger age and exposure to people infected by the COVID-19 was significantly associated with higher BDI score but not with higher IES-R or STAI-A scores. Social isolation was associated with higher prevalence of suicidal ideation ($P < .05$). Volunteering to strengthen the healthcare system was found to be significantly associated with lower scores in IES-R, BDI and STAI-A. No significant association was found for being requisitioned.

In the multivariate linear regression (Table 3), exams-related stress, pandemic-related financial restraint, social isolation and volunteering explained a substantial proportion of the variance for the four scales (IES-R, SF-BDI, STAI-A and MHQoL). Gender was predictive for IES-R, STAI-A and MH-QoL. COVID-19-like symptoms were predictive for IES-R and MH-QoL and age was predictive for BDI-SF. 20.8% to 28.1% of the variance were explained by the predictive models for each scale.

### 3.7. Coping strategies

Avoidance and positive appraisal were the most frequent strategies used by the participants (Table 4). Avoidance was significantly but weakly associated with higher scores at the BDI-SF, STAI-A and MH-QoL. Positive appraisal, support-seeking and problem-solving were significantly but weakly associated with higher IES-R scores. Female gender and exhibiting COVID-19-like symptoms were significantly associated with higher use of support-seeking, problem-solving and positive appraisal.

## 4. Discussion

### 4.1. Summary of results

First, we found a high prevalence of self-reported mental health problems measured during the early stage of the COVID-19 pandemic in HSS. Second, poorer self-reported mental health and mental health-related quality of life were found to be significantly associated with exams-related stress, female gender, pandemic-related financial restraint, social isolation due to the lockdown and COVID-19-like symptoms. Third, volunteering to strengthen the healthcare system was found to be associated with better self-reported mental health conditions, while being requisitioned was not found to be associated with mental health or health-related quality of life. Finally, coping strategies used by the participants were mostly oriented toward avoidance and positive appraisal.

### 4.2. Interpretation of results

HSS are known to usually exhibit poor self-reported mental conditions and the effects of the COVID-19 pandemic on their mental health status remains to be better understood. Our results are consistent with other studies performed in the early stage of the pandemic. In a recent meta-analysis, Lasheras et al. [47] for

**Table 2**
Mean scores for IES-R, BDI-SF, STAI-A and SF-12 (MH-QoL) depending on associated variables.

| Variables | *n* | IES-R | | | BDI-SF | | | STAI-A | | | SF-12 (MH-QoL) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Mean | SD | *P* | Mean | SD | *P* | Mean | SD | *P* | Mean | SD | *P* |
| **Gender** | | | | *<.001* | | | *<.01* | | | *<.001* | | | *P<.001* |
| *Male* | *318* | 17.05 | 13.47 | | 5.31 | 4.85 | | 39.53 | 12.25 | | 3.54 | .73 | |
| *Female* | *1,433* | 22.28 | 13.73 | | 6.26 | 5.27 | | 44.47 | 12.68 | | 3.34 | .73 | |
| **Age** | | | | *<.001* | | | *<.001* | | | *<.001* | | | *<.001* |
| *≤19* | *465* | 23.94 | 14.15 | | 7.41 | 5.67 | | 45.6 | 12.69 | | 3.23 | .78 | |
| *Between 20 and 21* | *517* | 21.06 | 13.78 | | 5.82 | 5.17 | | 42.95 | 13.09 | | 3.42 | .74 | |
| *Between 22 and 23* | *469* | 20.19 | 13.38 | | 5.65 | 5.12 | | 42.06 | 12.34 | | 3.47 | .69 | |
| *>24* | *314* | 19.50 | 13.56 | | 5.25 | 4.28 | | 43.95 | 12.53 | | 3.39 | .69 | |
| **Discipline** | | | | *NS* | | | *<.001* | | | *<.05* | | | *<.01* |
| *Medical* | *902* | 20.94 | 14.25 | *NS* | 6.37 | 5.47 | | 43.06 | 13.02 | *<.05* | 3.34 | .75 | |
| *Nursing* | *376* | 20.31 | 13.46 | *NS* | 5.12 | 4.61 | | 43.07 | 11.74 | *<.05* | 3.53 | .69 | |
| *Pharmacy* | *191* | 24.22 | 13.73 | *NS* | 7.31 | 5.67 | | 46.87 | 13.39 | *<.05* | 3.26 | .79 | |
| *Dental* | *77* | 21.67 | 13.04 | *NS* | 5.72 | 4.64 | | 42.90 | 13.98 | *<.05* | 3.36 | .77 | |
| *Midwifery* | *65* | 22.10 | 14.09 | *NS* | 6.26 | 5.15 | | 43.89 | 12.61 | *<.05* | 3.42 | .70 | |
| *Rehabilitation*[*] | *144* | 21.58 | 12.07 | *NS* | 5.43 | 4.23 | | 44.12 | 11.86 | *<.05* | 3.42 | .62 | |
| **Financial restraint** | | | | *<.001* | | | *<.001* | | | *<.001* | | | *<.001* |
| *No* | *1,207* | 19.04 | 12.75 | | 5.36 | 4.70 | | 41.59 | 12.31 | | 3.48 | .69 | |
| *Yes* | *558* | 26.23 | 14.73 | | 7.67 | 5.86 | | 47.91 | 12.62 | | 3.17 | .77 | |
| **Volunteering** | | | | *<.001* | | | *<.001* | | | *<.001* | | | *<.001* |
| *No* | *1,046* | 22.74 | 13.92 | | 6.62 | 5.49 | | 44.91 | 12.90 | | 3.30 | .73 | |
| *Yes* | *715* | 19.17 | 13.38 | | 5.28 | 4.65 | | 41.57 | 12.26 | | 3.50 | .72 | |
| **Social isolation** | | | | *NS* | | | *<.05* | | | *NS* | | | *NS* |
| *No* | *1,570* | 21.21 | 13.75 | | 6.00 | 5.20 | | 43.45 | 12.82 | | 3.38 | .74 | |
| *Yes* | *194* | 22.17 | 14.39 | | 6.84 | 5.23 | | 44.75 | 12.16 | | 3.33 | .71 | |
| **Stressed by exams** | | | | *<.001* | | | *<.001* | | | *<.001* | | | *<.001* |
| *A little* | *488* | 14.59 | 10.85 | | 3.84 | 3.89 | | 36.26 | 10.35 | | 3.74 | .61 | |
| *Moderately* | *540* | 19.58 | 12.04 | | 4.92 | 4.02 | | 41.11 | 10.94 | | 3.51 | .61 | |
| *A lot* | *499* | 24.22 | 12.82 | | 7.20 | 4.81 | | 47.75 | 11.21 | | 3.18 | .72 | |
| *Excessively* | *238* | 32.93 | 15.84 | | 11.02 | 6.70 | | 55.51 | 12.22 | | 2.76 | .74 | |
| **COVID-19-like symptoms** | | | | *<.01* | | | *<.01* | | | *<.05* | | | *<.01* |
| *No* | *1,532* | 20.91 | 13.61 | | 5.92 | 5.12 | | 43.35 | 12.65 | | 3.40 | .73 | |
| *Yes* | *231* | 24.01 | 14.92 | | 7.26 | 5.64 | | 45.17 | 13.33 | | 3.25 | .74 | |

BDI-SF: Beck Depression Inventory short form; IES-R: Impact of Event Scale - Revised; STAI-A: State-Trait Anxiety Inventory–A; MH-QoL: Mental health-related quality of life; SD: standard deviation.
[*] Includes physiotherapy, speech and motor rehabilitation students.

**Table 3**
Multivariate analysis assessing the role of variables associated with IES-R, BDI-SF, STAI-A and SF-12 (MH-QoL).

| | **IES-R** | | **BDI-SF** | | **STAI-A** | | **SF-12 (MH-QoL)** | |
|---|---|---|---|---|---|---|---|---|
| | $R^2$ = .221 | | $R^2$ = .217 | | $R^2$ = .281 | | $R^2$ = .208 | |
| **Variables** | β | 95% CI | β | 95% CI | β | 95% CI | β | 95% CI |
| **Stress due to exams** | .36*** | 4.33 – 5.52 | .387*** | 1.77 – 2.22 | .457*** | 5.23 – 6.28 | −.393*** | −0.32 – −0.25 |
| **Financial restraint** | .151*** | 3.21 – 5.76 | .112*** | 0.78 – 1.17 | .117*** | 2.08 – 4.34 | −.097*** | −0.22 – −0.09 |
| **Gender** | .111*** | 2.48 - 5.49 | NS | – | .114*** | 2.44 - 5.11 | −.073** | −0.22 – −0.06 |
| **Age** | −.065** | −1.43 – −0.26 | −.103*** | −0.73 – −0.30 | NS | – | NS | – |
| **Volunteering** | −.062** | −2.98 – −0.53 | −.049* | −0.99 – −0.06 | −.072*** | −2.94 – −0.83 | .084*** | 0.06 - 0.19 |
| **Social isolation** | .056** | 0.62 - 4.35 | .083*** | 0.68 – 2.09 | .065** | 1.02 – 4.30 | −.05* | −0.22 – −0.02 |
| **COVID symptoms** | .049* | 0.28 - 3.72 | .067** | 0.39 – 1.69 | NS | – | −.043* | −0.19 - 0 |
| **Discipline** | NS | – | NS | – | NS | – | NS | – |

BDI-SF: Beck Depression Inventory short form; IES-R: Impact of Event Scale - Revised; STAI-A: State-Trait Anxiety Inventory–A; MH-QoL: Mental health-related quality of life; $R^2$: $R^2$ adjusted; β: Beta standardized.
*$P<0.05$; **$P<0.01$;***$P<0.001$; NS: not significant.

example reported a prevalence of 28% for anxiety in medical students during the early stage of the COVID-19 pandemic. In their meta-analysis, Pappa et al. [48] reported a prevalence of 23.2% of anxiety and 22.8% of depression in healthcare workers during the pandemic. Compared to previous studies on the mental health of HSS, higher levels of self-reported mental health symptoms than in the usual context are reported. In a survey on American first-year HSS performed in 2017 and 2018, Hoying et al. [49] for example found prevalence rates of 14.2% for depressive symptoms. Wu et al. [50] reported a total mean IES-R score of 9.86 after a snowstorm disaster in Chinese medical students in 2011. Consistent with the literature, our result may thus indicate the deterioration of mental health of HSS during the current pandemic. However, these results have to be interpreted with caution as they may be subject to several biases, such as selection bias. HSS with poorer mental health conditions may indeed have been more prone than other students to participate in our survey. Moreover, the scales used to assess the self-reported mental health symptoms varies across studies and may induce interpretation biases.

Regarding the risk factors associated with poorer mental health, our results are also consistent with previous studies on mental health during the COVID-19 pandemic [8,9,51]. Rajkumar [51] reported that female gender, social isolation and COVID-19 infection were associated with poorer mental health in the general population. We also found that COVID-19-like symptoms were associated with poorer mental health. However, most of the HSS who reported symptoms were tested and showed no biological evidence of the COVID-19 infection. Thus, the impact of COVID-19

**Table 4**
Mean scores for coping strategies depending on associated variables.

| Variables | *n* | Avoidance | *P* | Positive appraisal | *P* | Support seeking | *P* | Problem-solving | *P* |
|---|---|---|---|---|---|---|---|---|---|
| **Total** | *1,765* | 2.23 (0.41) | | 2.13 (0.47) | | 1.85 (0.37) | | 1.83 (0.47) | |
| **Gender** | | | *NS* | | *<.05* | | *<.001* | | *<.001* |
| *Female* | *1,433* | 2.24 (0.42) | | 2.15 (0.48) | | 1.88 (0.37) | | 1.85 (0.48) | |
| *Male* | *318* | 2.22 (0.40) | | 2.08 (0.45) | | 1.74 (0.35) | | 1.74 (0.45) | |
| **Age** | | | *NS* | | *NS* | | *<.05* | | *NS* |
| *≤ 19* | *465* | 2.22 (0.43) | | 2.13 (0 .46) | | 1.81 (0.37) | | 1.87 (0.49) | |
| *Between 20 and 21* | *517* | 2.21 (0.40) | | 2.09 (0.46) | | 1.84 (0.36) | | 1.79 (0.48) | |
| *Between 22 and 23* | *469* | 2.24 (0.40) | | 2.16 (0.50) | | 1.89 (0.38) | | 1.81 (0.47) | |
| *≥ 24* | *314* | 2.26 (0.41) | | 2.16 (0.48) | | 1.87 (0.36) | | 1.84 (0.46) | |
| **Discipline** | | | *<.001* | | *<.001* | | *<.05* | | *<.001* |
| *Medical* | *902* | 2.28 (0.41) | | 2.20 (0.46) | | 1.86 (0.37) | | 1.88 (0.47) | |
| *Nursing* | *376* | 2.12 (0.42) | | 2.0 (0.51) | | 1.82 (0.40) | | 1.73 (0.49) | |
| *Pharmacy* | *191* | 2.16 (0.40) | | 2.10 (0.46) | | 1.80 (0.35) | | 1.79 (0.46) | |
| *Dental* | *77* | 2.30 (0.39) | | 2.16 (0.49) | | 1.89 (0.37) | | 1.82 (0.45) | |
| *Midwifery* | *65* | 2.25 (0.34) | | 2.20 (0.46) | | 1.86 (0.33) | | 1.82 (0.45) | |
| *Rehabilitation** | *144* | 2.27 (0.35) | | 2.07 (0.40) | | 1.93 (0.36) | | 1.78 (0.44) | |
| **Financial restraint** | | | *<.001* | | *NS* | | *NS* | | *NS* |
| *No* | *1,207* | 2.26 (0.41) | | 2.13 (0.48) | | 1.84 (0.36) | | 1.81 (0.47) | |
| *Yes* | *558* | 2.18 (0.41) | | 2.15 (0.46) | | 1.86 (0.38) | | 1.86 (0.48) | |
| **Volunteering** | | | *NS* | | *NS* | | *NS* | | *NS* |
| *No* | *1,046* | 2.23 (0.40) | | 2.13 (0.47) | | 1.86 (0.36) | | 1.84 (0.46) | |
| *Yes* | *715* | 2.24 (0.43) | | 2.14 (0.48) | | 1.84 (0.38) | | 1.80 (0.49) | |
| **Social isolation** | | | *NS* | | *<.001* | | *<.05* | | *<.01* |
| *No* | *1,570* | 2.23 (0.41) | | 2.12 (0.48) | | 1.84 (0.37) | | 1.81 (0.47) | |
| *Yes* | *194* | 2.25 (0.43) | | 2.25 (0.43) | | 1.91 (0.36) | | 1.92 (0.48) | |
| **Stressed by exams** | | | *<.001* | | *NS* | | *NS* | | *<.01* |
| *A little* | *488* | 2.30 (0.40) | | 2.11 (0.50) | | 1.83 (0.35) | | 1.78 (0.45) | |
| *Moderately* | *540* | 2.26 (0.40) | | 2.11 (0.47) | | 1.85 (0.37) | | 1.80 (0.46) | |
| *A lot* | *499* | 2.20 (0.40) | | 2.15 (0.46) | | 1.86 (0.37) | | 1.84 (0.48) | |
| *Excessively* | *238* | 2.10 (0.45) | | 2.18 (0.44) | | 1.86 (0.39) | | 1.92 (0.52) | |
| **COVID-19-like symptoms** | | | *NS* | | *<.05* | | *<.05* | | *<.05* |
| *No* | *1,532* | 2.23 (0.41) | | 2.12 (0.47) | | 1.84 (0.37) | | 1.82 (0.47) | |
| *Yes* | *231* | 2.28 (0.40) | | 2.19 (0.47) | | 1.91 (0.34) | | 1.90 (0.46) | |

*Rehabilitation includes physiotherapy, speech and motor rehabilitation students.

infection on mental health may mostly be mediated by psychosocial factors. The fear of the infection was notably found to be a trigger for mental health problems during previous infectious outbreaks [52–58] and during the current pandemic [59]. As found in previous studies [59,60], the social isolation induced by quarantine measures may also foster mental health problems and suicidal ideation.

Our results may also highlight the existence of putative specific risk factors in HSS during the pandemic. Being requisitioned was not found to be a risk factor for poorer mental health, while volunteering was found to be associated with better mental health status. Inconsistent with our primary hypothesis, our results suggest that being in frontline to fight against the COVID-19 pandemic may have represented a protective factor for healthcare workers regarding mental health. No other study directly evaluated the role of requisition or volunteering on mental health of HSS or healthcare workers during the COVID-19 outbreak but Tan et al. [7] reported that non-medical healthcare workers showed higher prevalence of anxiety than frontline nurses and two Chinese studies [61,62] reported better mental health in medical students compared to non-medical students during the pandemic. Those who were in frontline may have beneficiated of increased accessibility to formal and informal psychological support, to social connectedness with other HSS and healthcare workers but also to more first-hand medical information on the pandemic. This hypothesis would be consistent with positive association between social support and better self-reported mental health status, while avoidance was associated with poorer mental health. It is also notable that the cross-sectional design of our study does not allow us to know the direction of the association, so that this result may indicate that HSS with better mental health may have be more prone to volunteer during the early stage of the pandemic. Previous studies for example showed that students with a high level of burnout are less willing to engage as volunteers in the care for the underserved or in social accountability projects [63].

As reported in previous studies [64,65], stress related to their exams and financial stress were found to be important risk factors associated with higher levels of psychological impact, depressive and anxiety symptoms. The uncertainty driven by the COVID-19 pandemic may foster the impact of these stressors on HSS. Regarding coping strategies, Chew et al. [66] reported that problem-solving and seeking social support are often used during emerging infectious disease outbreaks. Inconsistently, the students from our sample reported more avoidance and positive appraisal. This may indicate that the lockdown measures hamper the ability to use efficient coping strategies to cope with the situation. Indeed, avoidant coping strategies have previously been found to mediate the link between negative events and anxiety symptoms in adults [67] and adolescents [68,69].

### 4.3. Limitations

Our study has several limitations. First, our sample may not be representative of the CBLU health sciences students. Notably, the rate of female respondents and emerging adults in our sample was higher than in the sample of CBLU HSS. However, to avoid time-effects of the lockdown on our results we had to collect the responses in a short period of time, so that although several reminders were done, we could not reach a higher participation rate. Second, the cross-sectional design of our study limits the ability to make causal inference. The absence of control group does not allow us to compare HSS with other college students. Third, the monocentric design of our study limits the generalizability of our conclusion. However, the CBLU is one of the largest Universities in France. Finally, the scales used in our study may also induce

putative biases. Indeed, the online completion may have induced errors in the way students responded to the items of the scales. However, due to the lockdown measures it was not possible to propose a face-to-face recruitment. Moreover, the internal validity was found to be good or very good (Cronbach's alpha ranging from 0.77 to 0.94) for each of the scales used.

## 5. Conclusion

We performed a large survey on the impact of the COVID-19 pandemic and lockdown measures on health sciences students. Our results indicate that health sciences students reported high levels of mental health symptoms during the early stage of the COVID-19 pandemic. We also found that risk factors related to the COVID-19 pandemic, such as the infection by the virus, financial restraint or social isolation induced by the lockdown measures, significantly deteriorate the self-reported mental health of HSS.

## Disclosure of interest

The authors declare that they have no competing interest.

## Acknowledgement

The authors wish to thank the students and teachers of the University Claude Bernard Lyon 1.

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