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Behavior and mental health situation of students during the second lockdown of the Covid-19 pandemic in Rennes, France

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Abstract

Introduction: To curb the spread of the Covid-19 pandemic in France, health recommendations were set by Santé publique France. Students of higher education institutions, generally considered at lower risk of contracting a severe form of Covid-19, had to comply with the health recommendations to minimize the virus's transmission.

The mental health of students is another issue of concern during the pandemic. Higher education students may be prone to mental health for different reasons, such as financial instability and loneliness during the lockdown.

Objectives: The study's primary goal was to assess students' compliance to the adoption of sanitary recommendations ((physical distance <1m, mask-wearing, limitation of number of people in gathering, restriction on kissing and hugging as well alcohol-based hand sanitizers usage) and assess the impact of the second lockdown on mental health among students of higher education (RBS, EHESP, SciPo) in Rennes, France.

Method: The study used the second wave of the COVER prospective cohort study. Questions related to student's behavior in response to sanitary health recommendations were asked. Besides, symptoms of anxiety, depression, and psychological distress were assessed using standard questionnaires.

Result: Out of the five recommendations, in terms of absolute compliance, restriction on hugging and kissing was the most respected recommendation, while physical distancing was the least. Overall compliance result shows that 22% of the students respected all the five recommendations always in all ten places assessed. The prevalence of mental health indicators were 22.7%, 39.6%, and 61.9% for symptoms of depression, anxiety, and psychological distress, respectively. Finally, there was no significant association between mental health indicators and compliance.

Conclusion: There was absolute compliance by about one-fifth of the study participants. The study's result also indicates a high prevalence of self-reported symptoms of depression, anxiety, and psychological distress during the lockdown. The study suggested that the student's mental health is alarming stage.

Keywords: compliance, Covid-19, sanitary health recommendations, students, depression, anxiety, psychological distress

Abstract (French)

Introduction : Pour freiner la propagation de la pandémie de Covid-19 en France, certaines recommandations sanitaires ont été fixées par Santé publique France. Les étudiants des établissements d'enseignement supérieur, généralement considérés comme moins à risque de contracter une forme sévère de Covid-19, devaient se conformer aux recommandations sanitaires pour minimiser la transmission du virus.

La santé mentale des élèves est un autre sujet de préoccupation pendant la pandémie. Les étudiants de l'enseignement supérieur peuvent être sujets à des problèmes de santé mentale pour différentes raisons, telles que l'instabilité financière et la solitude pendant le confinement.

Objectifs : L'objectif principal de l'étude était d'évaluer la conformité des élèves à l'adoption des recommandations sanitaires (distance physique <1m, port du masque, limitation du nombre de personnes en rassemblement, restriction des baisers et des câlins ainsi que l'utilisation de désinfectants pour les mains à base d'alcool) et d'évaluer l'impact du deuxième confinement sur la santé mentale des élèves (RBS, EHESP, SciPo) de Rennes en France.

Méthode : L'étude a utilisé la deuxième vague de l'étude de cohorte prospective COVER. Des questions ont été posées sur leur comportement en réponse aux recommandations sanitaires. En outre, les symptômes d'anxiété, de dépression et de détresse psychologique ont été évalués à l'aide de questionnaires standard.

Résultat : Sur les cinq recommandations, en termes de conformité absolue, la restriction sur les câlins et les baisers était la recommandation la plus respectée, tandis que la distanciation physique était la moins respectée. Le résultat global d'adhésion montre que 22% des étudiants ont respecté toutes les demandes, toujours dans les dix endroits évalués. Les prévalences des indicateurs de santé mentale étaient respectivement de 22,7 %, 39,6 % et 61,9 % pour les symptômes de dépression, d'anxiété et de détresse psychologique. Enfin, il n'y avait pas d'association significative entre les indicateurs de santé mentale et la conformité.

Conclusion : Environ un cinquième des participants à l'étude se sont conformés totalement. Les résultats de l'étude indiquent également une forte prévalence de symptômes autodéclarés de dépression, d'anxiété et de détresse psychologique pendant le confinement. L'étude suggère que la santé mentale des étudiants en enseignement supérieur à Rennes avait atteint un seuil alarmant lors du second confinement.

Mots-clés : conformité, Covid-19, recommandations sanitaires, étudiants, dépression, anxiété, détresse psychologique.

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DEDICATION

In memory of Late. Gaim, my uncle, my mentor, thanks for always believing in me, I wish you lived longer to see this milestone.

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Acronyms

aOR	Adjusted Odds Ratio
BMI	Body Mass Index
CI	Confidence Interval
COVER	CoronaVirus chez les Etudiants de Rennes
COVID-19	Coronavirus disease of 2019
EHESP	École des hautes études en santé publique
GDPR	General Data Protection Regulation
HAD	Hospital Anxiety and Depression Scale
IQR	Inter Quartile Range
MHI-5	Mental Health Inventory-5
OECD	Organization for Economic Co-operation and Development
OR	Odds Ratio
OSSS	Oslo Social Support Scale
PCR	Polymerase Chain Reaction
RSB	Rennes School of Business
SARS	Severe Acute Respiratory Syndrome
SciPo	Institute of Political Studies (Rennes campus)
UCLA	University of California, Los Angeles Loneliness Scale
CI	Confidence Interval
GDPR	General Data Protection Regulation

1. Introduction

1.1 Opening section

It has been more than a year since Covid-19 hit the world. It has claimed a life of 3,236,104 deaths worldwide and more than a hundred thousand deaths in France.^{1,2} The disease can range from asymptomatic to severe respiratory distress that can result in death.

On top of the morbidity and mortality caused directly by the pandemic, it has also generated additional impacts; the OECD report on June 20, 2020, states that "the crises are unprecedented and it has caused beyond the short-term health and economic shocks, the long-term effects on human capital, productivity and behavior may long-lasting."³

On March 11, 2020, the WHO declared covid-19 as pandemic⁴, and since then, the WHO has set general recommendations on how to fight back the virus.⁵ Different countries have been implementing recommendations to curb the spread of the virus.

The French government has made efforts to mitigate the spread of the virus at a regional and national level. Some of the recommendations were wearing a mask, physical distancing, lockdown, curfew. As the recommendations came into play, almost all daily routines have changed.⁶ Moreover, in France, three lockdowns have been in place since the start of the pandemic.

Although everyone is at risk of contracting the virus, people older than 65 years of age, those with chronic diseases and high BMI, are at higher risk of contracting a severe form of the infection. On the other hand, young, healthy adults are generally at a lower risk of getting the severe form of the virus; thus, they are at a lower risk of dying from it.⁷ However, regardless of the vulnerability, everyone is required to follow the recommendations.

This chapter encompasses a background followed by the research problem, aims of the research, and the significance of the study, followed by literature review, methodology, result, discussion. Finally, closes by conclusion and recommendations.

1.2 Background

Young adults who are generally at lower risk of getting a severe form of Covid-19 are not immune.⁸

In addition, because they tend to have a vast social network and participate in various social events, they can spread the virus rapidly.⁹ Therefore, including younger adults to abide by the recommendation reduce the rampant spread of the virus.

However, there have been some complaints that younger adults are not strictly adhering to the recommendation given by health authorities to curb the spread of the virus.¹⁰

Higher education institutions, where thousands of younger adults gather, were reported as a cluster of infections in different parts of France.¹¹ A report from the regional health Agency in Bretagne on May 10, 2021, states that 146 Covid-19 clusters were identified. Almost half of the clusters were in the Ille-et-Vilaine department. In addition, out of the ten reported clusters in higher education in that region, six were in the department of Ille-et-Vilaine.¹² Rennes, the capital of Brittany, is found in this department. It is home to many students. They are estimated to be 60,000, which is around 30% of the total population.¹³

In many instances, universities were closed in response to the emerging clusters. And most students were required to continue their studies from a distance (virtual). Hence, the student population had to adapt to the new learning method that includes working for long hours in front of the screen, less or no physical interaction with other students. On top of that, most of the students were facing financial problems and increased housing fees¹⁴. These situations may put students at risk of mental health problems.

In the last assessment, "Condition de vie 2016" of the Observatoire national de la Vie Etudiante, only 15.9% of the students reported that they did not have any psychological problems such as insomnia, loneliness, burnout, stress, and depression.¹⁵

The rate of suicidal thoughts, severe distress, high level of perceived stress, severe depression, and high level of anxiety during the Pandemic in France is alarming. On top of that, Females were more susceptible to mental health problems.¹⁶

Finally, in the context of the pandemic, behaving according to given health recommendations is an important tool for the prevention and mitigation of the virus. At the same time, mental health remains an equally important concern as a possible impact of the pandemic.

1.3 Research problem

In the absence of vaccination against Covid-19, the only means to contain the spread of the virus was compliance with the adoption of the sanitary recommendation. With some exceptions, generally, because of their age group, higher education students are at lower risk of getting the severe form of the disease. Despite that, to decrease transmission from asymptomatic individuals (primarily young age group), they were required to follow the same recommendation as to the general population.

Besides, in addition to the pressure from the workload of their studies, they may have challenges related to financing, psychological pressure from lockdown and loneliness, and the uncertain future that the pandemic may bring.

Hence, it is a timely question to ask how students respond to the sanitary recommendations during the pandemic to protect themselves and the general population. Hand in hand, it is also essential to assess the mental health of the students in the context of the pandemic. Moreover, it is relevant to observe a pattern between behavior and mental health of students, so we can understand how students' situation (behavior and mental health) has been during the pandemic. More specifically, how are Students in Rennes behaving in response to the sanitary recommendations? Is their mental wellbeing affected during the second lockdown? And what are the factors that are associated with mental health and compliance? How does their overall related situation look like during the pandemic?

1.4 Scope and Objectives of the Study

The study's main objective is to assess students' compliance to the adoption of sanitary measures and the impact of the second lockdown on mental health among the students in Rennes, France. The study mainly captures wave two of the COVER prospective study.

The specific objectives of the study include:

- To assess the behavior of students in respect of preventive measures against the pandemic.
- To assess the associated factors that are associated with compliance of students to the adoption of protective measures.
- To assess the mental health/wellbeing of students during the pandemic
- To determine the factors associated with each for the mental health outcomes among students.
- To assess the association between mental health and compliance among the students.

1.5 Significance and justification

As it is vital to tackle the death and severe conditions of Covid-19 infection, it is also equally important to pay attention to the student population, who can be at lower risk of Covid-19 but at greater risk of suffering from the impacts of the pandemic.

It is essential to understand the dynamics of their behavior and compliance towards adopting the public health measures and understand what related their behavior, because that plays an important role in curbing the pandemic.

Students could be at a greater risk of mental health problems even during ordinary times because of the workload, financial instability, extended time in front of the screen. On top of this, the Covid-19 situation has demanded students to stay at home, at times alone, change the mode of learning, some forced to stop working, which can result in financial problems. These factors may affect student wellbeing.

Therefore, understanding the situation of students during the pandemic should be a significant and timely concern for research. With the evidence gained from this research, the situation can be addressed, and effective intervention can be recommended. The result of the study will also give a better understanding of the situation of students during the pandemic. The information can help to prepare to communicate with young adults in preventing, mitigating the spread of future pandemics while their mental wellbeing is protected.

Finally, a pandemic can be controlled with a better understanding of behavior and protect the most vulnerable, primarily the senior adults. In addition, by reducing the pandemic, we mitigate its impacts on the general population, focusing on higher education students. Therefore, the study is one means to communicate, understand, and save generations.

2. Literature review

This research paper relates to several studies which were conducted in response to the Covid-19 Pandemic. Behavior analysis and mental health are not new research areas that emerged with the pandemic; however, the reviewed articles were only Covid-19 related in order to remain focused.

Behavioral approach, compliance to sanitary measures, in this context, was the only means to prevent and mitigate the spread of the pandemic, especially when there was no available pharmaceutical solution.

At the start of the pandemic, a study conducted among 1000 general population from four states in the US; New York, Texas, Florida, and California; roughly 250 from each state, shows that 88% of respondents reported engaging in self-protective behaviors (wearing mask, handwashing, increased social distancing, reducing unnecessary outing) in response to the Covid-19 Pandemic.¹⁷ The study also showed that males were significantly less likely (23%) to follow social distancing guidelines. In addition, those who had a strong belief in the effectiveness of recommended preventive measures showed a stronger adherence to those measures. However, the existence of preexisting health conditions did not increase the commitment to self-protective behaviors.

Self-reported compliance to an endorsed four recommendations such as curfew, non-essential shop closure, avoidance of handshake, and physical distancing was as high as 89% in a nationally representative survey (n=3456) conducted in Italy, mid-March of 2020.¹⁸In addition, women and healthier individuals were found to be more compliant. Surprisingly, even those who do not have trust the government reported that they were in adherence. However, younger adults were less compliant with handwashing and distance measures. The result of the study indicates that individuals with poor health were complying low with the lockdown. Yet, the authors presume that this could be (with high variation) due to hospital and pharmacy visits. Additionally, the authors anticipated there can be a change of compliance over time.

A survey was conducted among the general population of France (n= 10,013) in March 2020 to assess the adoption of preventive measures such as physical distancing (>1 m), frequent hand washing and hand disinfectant usage, restriction on kissing and hugging, limitation of gathering, coughing with a flexed elbow, one-time tissue paper usage, staying at home as much as possible.

The study showed that, on average more than five out of seven recommendations were respected. Furthermore, some differences were observed; people with lower literacy levels, men, those who always work outside of their homes, younger people, and people who did not have a relative with symptoms of Covid-19 took fewer preventive measures. The authors also mentioned that the number of systematically adopted measures had decreased during the lockdown. Cognitive and affective determinants explain the systematic adoption of measures. Perceived ability to adopt measures, subjective norms, and perceived severity of the diseases were among the main ways to describe the systemic adoption of measures.¹⁹

A research conducted among young adults in Zurich (n=737), Switzerland, states that compliance rates of recommendations related to the pandemic were high during the initial wave of the pandemic. They were slightly higher with social distancing in comparison to hygiene measures. In addition, a similar result to the study mentioned earlier¹⁹ was reported regarding male participants, who were less likely to comply with hygiene-related and distance measures. Moreover, participants who have a higher perception of risk of getting infected by the virus, who sought information, have trust in authority, and have higher moral obligation were most likely to comply with adopted recommendations.²⁰

Similarly, a study conducted in Jordan among university students (n=2.083) at the beginning of the pandemic shows that females, older medical students, and postgraduate students showed higher scores towards low-risk practices of Covid-19 such as hygiene and distancing restriction than their counterparts. Female students scored a significantly higher (85%) low-risk practice

towards Covid-19, while males students scored 82.2% ($P < 0.05$). Moreover, students who lived in high-standard living arrangements, villas, scored higher 86.0% compared to those who live in apartments 66.5% ($P < 0.05$). Besides, students of life sciences such as medicine and agricultural studies scored higher than students from engineering studies.²¹

In May 2021, twelve behaviors such as personal protective equipment, physical distance, hand washing and disinfection, and exposure to COVID-19 were studied in Portugal among 262 university students. Thirteen items were used in this study, such as personal protective equipment, physical distance, hand washing, disinfection, and exposure to COVID-19) and the response was on a Likert scale of five. The response scores were added to make up the highest score, the best practice. Students' responses showed that they were dominantly engaged in preventive behaviors, with an average, 5.81(SD=2.61); the analysis by sex shows that females were practicing more preventive behaviors ($M = 6.01$, $SD=2.59$) than males ($M=5.09$, $SD=2.60$). Female students had higher risk perception and higher knowledge compared to male students. In addition, Ph.D. students showed lower adherence to preventive measures than bachelor's and master's students. In addition, a significant weak correlation was found between preventive behaviors and knowledge ($r = 0.241$, $p < 0.01$). However, the fact that Ph.D. students showed lower adherence to the preventive measures can translate that behaving in a certain way can be explained by additional factors other than knowledge. Those may include attitude and perception; a significant positive correlation was found between perception of risk and preventive behaviors. ($r = 0.130$, $p < 0.05$) as well as Attitude and preventive behaviors (0.398 , $p < 0.01$).²²

Furthermore, most young participants from the study done in Italy, expressed increased boredom, frequent disagreement with family members, and loneliness was reported by the older age group and people with existing health problems during the lockdown.¹⁸ Frequent conflict, boredom, and loneliness can affect the mental health of an individual. With the fear of the disease, a quick shift in routines, and many uncertainties that may have resulted from the pandemic, there could be an increase in mental illness prevalence. The young age group, particularly students of higher education, are assumed to have an increased risk of mental health problems during the pandemic. The following studies review the mental health among students of higher education institutions.

Higher education students from 62 countries participated in an international survey ($n=30,383$) conducted to assess the overall situation of students during the pandemic, which showed that negative emotions were felt by many of the students, including boredom, anxiety, frustration, anger, hopelessness, and shame. The first three emotions were felt by 45.2%, 39.8%, and

39.1% of respondents, while the other negative emotions were reported by less than 26% of the students descending respectively. ²³

A study conducted to assess the effects of Covid-19 on college students in the US (n=195), using a PSS-10 standard questionnaire to assess perceived stress. In addition, students were asked if their own and their peers' stress and anxiety has increased during the pandemic. The result showed that 71% indicated that their anxiety and stress has increased during the pandemic, while 20% and 9% mentioned that it remained the same and decreased, respectively. Moreover, depressed thoughts were reported by 44% of the students. For those who responded to an increase in stress, anxiety, depression, further questions were asked using available mental health counseling services. Besides, questions to assess symptoms of depression were used. In addition, it was reported that students who did not write anxiety were most likely to be substance and alcohol users. Additionally, Sleep disruption was common among most students (86%), with one-third categorized as severe sleep disruption. The increased cost of living, house expenses, and medical expenses were among what worried the students. Half of the students (49.8%) reported difficulty securing food two weeks before the survey. Moreover, students who faced financial stressors were identified among the highest predictors of anxiety and depression. Female students were 1.5 more likely to develop symptoms of depression compared to male counterparts, regardless of the age difference. Hand in hand, Financial problems were among the common problems students faced during the pandemic. A student expressed his financial situation as "Being fired from my job gives me plenty of ...free time but causes many panic attacks. financially we've been struggling a lot". ²⁴ Similarly, in a cross-sectional study conducted in two private colleges in the Davao del Sur province of the Philippines, most of the students reported having anxiety for the duration of the lockdown, and 332/530 (64.4%) were worried about food. ²⁵

University students (n= 946) in the UK's health were found to have been negatively impacted during the pandemic reported a study conducted on their mental health and Movement Behavior. The research used Warwick-Edinburgh Mental Well-being Scale (WEMWBS), Cohen's Perceived Stress Scale (PSS), both validated in a UK students' population. In addition, this research showed that sedentary behavior and perceived stress have increased among university students. However, the reduction in mental health and increased perceived stress were not related to changes in physical activities. Still, there was a weaker association between perceived stress and a decrease in physical activity. Yet the authors notified that the deterioration of student's mental health should not entirely be taken as an impact of Covid-19,

for there are other stressors such as academic workload and exam pressure, especially exam time.²⁶

A representative longitudinal study of youth in Norway showed that in spring 2020, that used HSCL-10, preliminary Pandemic anxiety scale (developed by British Co-Space), UCLA standard questionnaires indicated an increase in depression and anxiety. Moreover, those individuals who were deemed to be more vulnerable before the outbreak, based on previous studies, were found to have a higher number of mental health complaints than before the pandemic.²⁷

Active Minds, a non-profit in the US which promotes mental health awareness and education for young adults, conducted a nationwide survey in the US, on 2,086 college students, in April 2020. The data from this survey shows that (80%) of college students experienced a negative impact on their mental health-related to Covid-19, and (20%) reported a significant worsening in their mental health. The most highly informed has implications on mental health caused by Covid-19 were stress or anxiety, disappointment or sadness, and loneliness, with (91%, 81%, and 80%) of the respondents respectively reporting these.²⁸

According to Wathelet et al., during the pandemic, while in quarantine, students in France reported a prevalence rate of self-reported severe symptoms of distress IES-R, (22.4%), depression BDI-13, (16.1%), anxiety STAI Y-2, (27.5%), and perceived stress PSS-10, (24.7%). Moreover, Students from the second to the fifth year of university had a higher risk of perceived stress and anxiety. Students who lost their job (income) were at higher risk of reporting at least one mental health than those who did not. At least one mental health problem was reported by students who have a history of mental health illness; not living with their family was also related to reporting at least one mental health problem.¹⁶

Hand in hand, research conducted among student and non-student groups in Bordeaux used PHQ-9, GAD standard questionnaire to assess symptoms of depression and anxiety. It revealed that students were more frequently associated with perceived stress (aOR=1.70, 95%CI 1.26;2.29) symptoms of depression ((aOR)=1.58; 95%CI 1.17;2.14), symptoms of anxiety (aOR=1.51; 95%CI 1.10;2.07. Being in lockdown alone was associated with mental health problems only among students. However, a history of psychiatric illness was a common risk factor of mental health among students and non-student groups (approximately 23%).²⁹

To our knowledge, there was no study conducted on compliance to health recommendation in the context of covid-19 among students of higher institutions in France. Hence, it is a timely question to ask how students of higher education in Rennes, France responded to the health recommendation set by health authorities to curb the pandemic and as well as it is essential to know how the student's mental health is during the pandemic. Moreover, it is of interest to

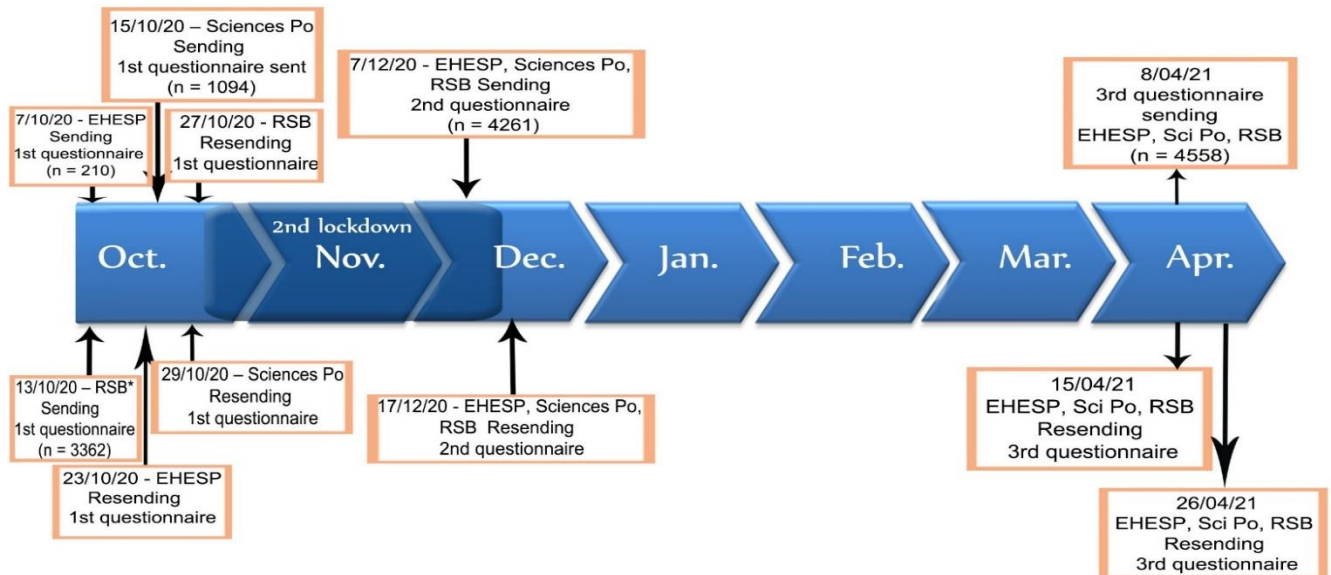
investigate factors associated with the study population's compliance and mental health status as well as assess for an association between mental health and behavior.

3. Methodology

3.1 Study design and data collection

COVER (COronaVirus chez les Etudiants de Rennes) is an open, prospective cohort study consisting of three waves of questionnaires sent from October 2020 to May 2021 (Fig.1). The participants of the study were students from Rennes school of business (RSB), French school of Public Health (EHESP), and Science Po Rennes (Sci-Po).

The questionnaires were distributed using the online Lime-Survey platform. All the students who volunteered to participate in the study were part of the study. Some students participated in the three waves, while others participated in one or two of the waves. The study will only focus on the second questionnaire sent in December 2020 to 4261 students in the present thesis. In addition, wave two did not include international students because the questionnaire was only in French.



*RSB: Rennes School of Business

Fig.1 Timeline of COVER questionnaires distribution

3.2 Measurement and variables

3.2.1 Demography variables and precariousness variables

The study contains demographic variables such as sex, age, place of residence, if a student works or not, financial status before the second lockdown if the student holds a scholarship,

university, level of study. In addition, variables such as financial status, availability of enough food during the second lockdown were used as indicators of precariousness.

In addition, variables such as sport, financial status, hunger, risk of a severe form of Covid-19, perceived health, means of transport, TousAntiCovid-19 application usage, PCR test, contact by health insurance, symptoms of Covid-19 were among the variables used.

3.2.2 Variables related to behavior

Behavioral questions were asked in the wave two questionnaires. These questions include if a student was in ten outings, namely indoor bars before and after midnight, outdoor bars, indoor and outdoor restaurants, private evenings, student associations, commercials (shops), walking, and festive gatherings (weddings, concerts) fifteen days before the day of completing the questionnaire. In addition, for each outing, students were asked how frequently (never, sometimes, often, and never) they followed recommendations given by French health authorities. The five recommendations that were assessed in this research were mask-wearing, physical distancing (>1 m), hand disinfectant usage, restriction on kissing and hugging, and the number of people with whom the student hangs out.

Their responses were coded from 0-3, always, often, sometimes, and never respectively.

First, the values of answers for each recommendation, such as mask, were summed. Then an aggregated score was created by summing all the scores from the five recommendations.

To measure the proportion of absolute compliance among students, a definition of complete compliance was set at a cut point of zero which means always comply with for each recommendation. Then, a comparison was made across the five recommendations. (Absolute mask score).

On top of that, a combined score of absolute compliance was computed from a combined score of all the five recommendations, meaning always complying with all the recommendations in all the outings. And a proportion of students who were compliant was measured.

Secondly, the combined compliance score was divided into two: high and low compliance based on the median. A score equal to or less than the median was categorized as high compliance, and the scores above the median as low compliance.

In addition, for sensitivity analysis purposes, another definition for compliance was set using quartiles of the compliance score. A score equal to or less than the first quartile was defined as high compliance and the rest as low compliance.

3.2.3. Variables related to mental health

The mental health of students was assessed using psychometric questionnaires validated in French. To define the symptoms of depression and anxiety, the HAD³⁰ questionnaire was used. There were 14 items, seven for depression and anxiety. For each dimension, scores for each item were added, and the cutoff was 11. Suffering from symptoms of depression was defined as $HAD \geq 11$ for the items related to depression. Likewise, suffering from symptoms of anxiety was described as $HAD \geq 11$ for the items related to anxiety. Mental Health Inventory Five items (MHI-5)³¹ was used to identify symptoms of psychological distress. From a score of 100, ≤ 52 was categorized as suffering from symptoms of psychological distress. Social isolation was measured using the three items of OSSS³², categorized in three categories: 3-8 "weak," 9-11 "moderate," and 12-14 "strong" social support.

A feeling of loneliness was measured with items from UCLA questionnaire version three³³, and students were categorized into three. A score strictly greater than 5 indicates feelings of loneliness whereas less than five or equal (≤ 5) otherwise. Measures of MHI-5 and HAD questions report students' respective situations four weeks before the response day. In addition, a history of a previous psychiatric follow-up (longer than six months) was assessed. However, the rest of the questions do not indicate temporality between measures of social ties and mental health indicators.

3.3. Data analysis

Data were analyzed using STATA version 16.0³⁴ and R studio version 4.0.4³⁵. During the analysis, only students who entirely completed the questionnaire and who were 18 years of age and above were included for analysis. Descriptive statistics were computed using the demography data as well as indicators of precariousness and information related to health.

A proportion of absolute compliance was computed across the five recommendations, and they were compared to see the most and least adhered recommendation.

In addition, proportion of overall absolute compliance (binary) was measured among students and was compared across sex.

The binary compliance score (median cutoff), the descriptive analysis was used to assess compliance across demography variables, and logistic regression was used to identify associated factors low compliance. Variables were selected $p \leq 0.20$ at univariate analysis. Moreover, a similar analysis to the previously created compliance variables was conducted for sensitivity analysis.

For mental health variables, the proportion was used to describe proportion symptoms, as well as symptoms of mental health indicators across sex was estimated. In addition, stepwise logistic regression was used to understand the underlying associated factors of mental health. In addition, variables were included at $p \leq 0.25$ in univariate analysis and exclude at $p \geq 0.05$. Furthermore, a chi-2 was computed to explore association between compliance and mental health indicators as well social ties indicators.

Hosmer-Lemeshow test was used to evaluate the goodness of fit of logistic regression models. Throughout the analysis, $p < 0.05$ was used as the level of significance.

3.4. Ethical consideration

Consent was obtained from the students at the beginning of each questionnaire concerning GDPR (General Data Protection Regulation). Besides, all responses were anonymized during data collection.

4. Results

4.1. Description

4.1.1. Sample characteristics

During the second wave, out of 4261 students who were requested to participate, 18.4% participated in the study. Only the 784 students who completed the questionnaire fully were considered for analysis. In addition, students who identified themselves as non-binary sex ($n=8$) and students from five universities other than RSB, EHESP, SciPo ($n=16$, females) were excluded because they carried very few participants. Finally, 766 students were analyzed. Out of the participants of the wave two questionnaires, 482 (62.9%) had also participated in wave one.

The median and (IQR) was 21(20-23) years. Female participation was higher (68.2%), while males were 31.8%. More than half of the participants are from Rennes school of business (57.6%). Students who hold a scholarship were 27.4%, and 14.4% of the students work beside their studies, while 3.7% were 'En alternance.' Before the lockdown, students who replied that they are financially comfortable and okay were 28.5% and 41.6%, respectively, while 8.3% answered they hardly get and 14.4% said they need to be careful. Most of the participants lived alone in a house (41.6%) and 8.6% in a student residence. And 21.9% lived in a shared flat while 17.4% lived with a family. (Table 1)

Table 1. Description of demographic variables

Variables	Values (N=766)
Age (in years) Med IQR	21 (20-23)
Sex	
Female	522 (68.2%)
Male	244 (31.8%)
University	
Rennes school of business	441 (57.6%)
EHESP	65 (8.5%)
SciPo	260 (33.9%)
Year of study	
Bachelor Year 1	102 (13.3%)
Bachelor Year 2	115 (15.0%)
Bachelor Year 3	141 (18.4%)
Masters Year 1	205 (26.8%)
Masters Year 2	203 (26.5%)
Scholarship holder	
Yes	210 (27.4%)
No	556 (72.6%)
Work (part-time)	
No	628 (82.0%)
Yes	110 (14.4%)
“En alternance”	28 (3.7%)
Financial status (before lockdown)	
Comfortable	218 (28.5%)
Okay	319 (41.6%)
Fine, but need to be careful	152 (19.8%)
Hardly get there	64 (8.4%)
Do not wish to respond	13 (1.7 %)
Place of residence	
Alone(house)	319 (41.6%)
Flat share	223 (29.1%)
Student residence	66 (8.6%)
Family	133 (17.4%)
Home stay acc	6 (0.8%)
Other	19 (2.5%)

*acc: accommodation

4.1.3 Indicators of precariousness during the second lockdown

The financial status of students was assessed before and during the lockdown. During the lockdown, the financial status of students was slightly different from before the lockdown ($p < 0.001$). Additionally, students were asked if they had enough food; 94.9% responded they were able to get enough food during the second lockdown. Students' ability to get enough food during the second lockdown was not different from before the lockdown ($p < 0.001$) (Table 3).

Table 2. Precariousness indicator variable(N=766)

Variables	Values
Financial status	
Comfortable	238 (31.07%)
Okay	290 (37.86%)
Fair, needs attention	159 (20.76%)
Hardly get there	66 (8.62%)
Do not wish to resp	13 (1.7%)
Food availability	
Yes	727 (94.91%)
No	21 (2.7%)
Do not wish to respond	18 (2.3%)

4.1.4 health-related variables

Concerning health-related information, 36.8% reported having very good perceived health, 43.6% good, 13.6% quite good, and only 6.01% reported having bad health perception. Besides, 6.3% said being at risk of a severe form of Covid-19 infection. In addition, 9.5% had symptoms of Covid-19. The TousAntiCovid-19 application was downloaded by 34.6% of the students. Most of the students, 61.2%, reported that they did not take the PCR test, whereas 32.1% got negative test results and 6.1 % got a positive result at least once.

(Table 2)

Table 3. Health related variables (N=766)

Variables	Values
Perceived health	
Very good	282 (36.8%)
Good	334 (43.6 %)
Quite good	104 (13.6 %)
Bad	46 (6.0%)
Risk Severe Covid-19	
Yes	48 (6.3%)
No	702 (91.6%)
Do not wish to respond	16 (2.1%)
Sympt of Covid-19	
Yes	73 (9.5%)
No	693 (90.5%)
TousAntiCovid-19	
Variables	Values
Yes	265 (34.6%)
No	501 (65.4%)

Variables	Values
Test	
Not tested	469 (61.2 %)
All negative	246 (32.1%)
≥1 positive	47 (6.1%)
Yes, waiting for result	4 (0.5 %)

4.2 Behavior

4.2.1 Behavioral (Compliance) analysis

The mean of the combined score was 3.3, with a standard deviation of 3.8. The median and IQR were 3 and [1;4] respective.

Absolute compliance, meaning always adhering to a health recommendation (e.g., mask) in all the ten settings, was assessed for each recommendation. Students showed absolute compliance for mask 413(53.9%), distance 279(36.4%), hand disinfectant 378(59.3%), restriction on kissing and hugging 604(78.8%), number of people in gathering 526 (68.7%) of absolute compliance. Restriction on kissing and hugging was the most complied recommendation while respecting physical distance (>1m) was the least followed recommendation by the participants.

A correlation metric was conducted, and a moderate to low correlation was observed between the scores of recommendations.

On a combined score for all the five recommendations, students who always complied with all the recommendations were 20.2%. In addition, there was no significant difference in compliance among female and male students ($p=0.372$).

In addition, as it was explained in the previous methods, a binary compliance variable was created by using the median as a cutoff. Scores below and equal to the median were categorized as high compliance and scores above the median as low compliance.

There was no significant association between sex, age, TousAntiCovid-19, scholarship, perceived risk of a severe form of Covid-19, perceived health, financial status before the lockdown, place of residence, and compliance at bivariate analysis.

On the other hand, there was a significant positive association between universities EHESP (aOR= 0.42(95% CI (0.21;0.83)), SciPo (aOR=0.53(95% CI (0.36;0.79))), test (PCR) (aOR=5.54 (95% CI (2.82;10.89))) and compliance. Regression output is presented in Table 4.

Compliance	Odds Ratio	p-value	95% interval	Conf.
University				
RSB (reference)	1.00	NA	NA	
EHESP	0.42	0.012	(0.21; 0.83)	
SciPo	0.53	0.002	(0.36; 0.79)	
Work				
No (reference)	1.00	NA	NA	
Yes	1.05	0.839	(0.67; 1.64)	
En alternance	2.50	0.030	(1.09; 5.71)	
Level of education				
Bachelor1 (reference)	1.00	NA	NA	
Bachelor 2	1.53	0.193	(0.81; 2.90)	
Bachelor 3	1.90	0.040	(1.03; 3.52)	
Master1	1.80	0.045	(1.01; 3.22)	
Master2	1.31	0.383	(0.71; 2.42)	
Financial-status before (lock down)				
Comfortable (reference)	1.00	NA	NA	
Okay	1.15	0.476	(0.78; 1.69)	
fair, needs attention	0.79	0.334	(0.49; 1.28)	
hardly get there	0.65	0.192	(0.34; 1.24)	
Do not wish to resp	2.44	0.130	(0.77; 7.74)	
Test				
No test (reference)	1.00	NA	NA	
All negative	1.04	0.847	(0.73; 1.48)	
≥1 positive	5.54	0.001	(2.82; 10.89)	
Yes, waiting for result	2.80	0.32	(0.37; 21.31)	

4.2.2 Sensitivity analysis

In the sensitivity analysis, quartiles were used to categorize combined compliance scores in two. High compliance was defined as equal or less than the first quartile (1Q; ≤ 1). Highly compliant students comprise 31.46%, and there was no difference between male and female students regarding compliance ($p=0.76$).

Having a positive test result at least once was positively associated with compliance (aOR= 10.95 (95% CI (2.61;46.04))).

Concurrently, both the models for predicting low compliance indicate that having a positive Covid-19 test result more than once contributes to low compliance. The regression model for sensitivity analysis is presented in Table 5.

Table 5. Sensitivity analysis: Factors associated with low compliance (N=766)

Compliance	Odds Ratio	p-value	95% interval	Conf.
Work				
No (reference)	1.00	NA	NA	
Yes	1.33	0.25	(0.82; 2.17)	
En alternance	2.05	0.173	(0.73; 5.72)	
University				
RSB (reference)	1.00	NA	NA	
EHESP	0.62	0.111	(0.34; 1.12)	
SciPo	0.80	0.259	(0.54; 1.18)	
Year of study				
Bachelor 1 (reference)	1.00	NA	NA	
Bachelor 2	1.71	0.083	(0.93; 3.12)	
Compliance				
Bachelor 3	1.04	0.897	(0.58; 1.87)	
Master1	1.23	0.461	(0.71; 2.11)	
Master2	1.26	0.424	(0.71; 2.24)	
Place of residence				
Alone (house) (reference)	1.00	NA	NA	
Flat share	1.27	0.235	(0.86; 1.89)	
Student residence	0.75	0.322	(0.43; 1.32)	
Family	1.15	0.567	(0.72; 1.82)	
Home stay acc	0.85	0.859	(0.15; 4.90)	
Test (reference)				
No test	1.00	NA	NA	
All negative	1.10	0.601	(0.78;1.54)	
≥1 positive	10.95	0.001	(2.61;46.04)	
Yes, waiting for result	1.55	0.707	(0.37;15.35)	
Other	0.77	0.597	(0.29; 2.05)	

4.3 Mental health

4.3.1 Prevalence of Mental Health and Social ties indicators

The prevalence of mental health of depression, anxiety, and psychological distress during the lockdown were 22.7%, 39.6%, and 61.9%, respectively. Females have higher self-reported anxiety 44.8%, than their male counterparts 28.3% ($p < 0.001$).

Feeling loneliness was reported by more than half of students, 52.0%. Female students reported a slightly higher feeling of loneliness 54.6%, than male students 46.3% ($p = 0.032$).

Symptoms of psychological distress were higher among females, 66.7%, than in males, which was 51.2% ($p < 0.001$). Students who had psychiatric follow-up six months and before were 10.8%, and 13.2% of female students reported having a psychiatrist follow up our visit, which is more than double of male students ($p = 0.002$). (Table 6.)

Table 6. Mental health and social ties indicators

Mental Health indicators	All (n= 766)	Females (N=522)	Males (n=244)	p-value
Depression	174 (22.7 %)	116 (22.2%)	58(23.8%)	0.634
Anxiety	303 (39.6%)	234 (44.8%)	69 (28.3%)	<0.001
Psychological distress	474 (61.9 %)	349 (66.86%)	125 (51.2%)	<0.001
Loneliness	398 (60.0 %)	285 (54.6%)	113 (46.3%)	0.032
Mental Health indicators	All (n= 766)	Females (N=522)	Males (n=244)	p-value
Social support				0.220
Poor Social support	169 (22.1%)	106(20.3%)	63 (25.8%)	
Moderate Social support	388 (50.6 %)	272(52.1%)	116 (47.5%)	
Strong Social support	209 (27.3 %)	144 (27.6%)	65 (26.6%)	
History of psychiatric follow-up	83 (10.8%)	69 (13.2%)	14 (5.7%)	0.002

P-value (χ^2 test) indicates the prevalence of symptoms of mental health and social ties indicators across sex.

4.3.2 Factors associated with self-reported symptoms of depression

Self-reported symptom of depression was positively associated with bad perceived health (aOR= 11.22 (95% CI (4.92 ;25.60)), sleep problems during lockdown ((aOR= 1.77 (95% CI (1.13;2.78))).

In addition, there was a significant negative association between self-reported symptoms of depression and strong social support ((aOR= 0.47 (95% CI ((0.25; 0.80))), playing sport during

the lockdown, at home ((aOR= 0.59(95% CI (0.36; 0.98)), outdoors ((aOR= 0.55 (95% CI (0.29; 1.05)) and both ((aOR= 0.56 (95% CI (0.32; 0.99)). (Table.7)

Depression	Odds Ratio	p-value	95%Conf. interval
Perceived health			
Very good (reference)	1.00	NA	NA
Good	1.01	0.996	(0.63; 1.59)
Quite good	1.08	0.802	(0.59 ;1.97)
Bad	11.22	0.001	(4.92;25.60)
Depression			
Sleep problem (lockdown)			
No (reference)	1.00	NA	NA
Yes	1.77	0.013	(1.13;2.78)
Social support			
Poor (reference)	1.00	NA	NA
Moderate	0.64	0.050	(0.41; 1.00)
Strong	0.45	0.007	(0.25; 0.80)
Sport during lockdown			
No (reference)	1.00	NA	NA
Yes, at home	0.59	0.041	(0.36; 0.98)
Yes, outdoors	0.55	0.070	(0.29; 1.05)
Yes, at home & outdoors	0.56	0.047	(0.32; 0.99)
Risk of Severe Covid-19			
No (reference)	1.00	NA	NA
Yes	1.63	0.195	(0.78; 3.39)
Do not wish to respond	4.71	0.007	(1.52;14.59)
Sedative during lockdown			
No (reference)	1.00	NA	NA
Yes	2.01	0.004	(1.24;3.25)
Loneliness			
No (reference)	1.00	NA	NA
Yes	2.92	0.001	(1.87; 4.55)

4.3.3 Factors associated with self-reported symptoms of anxiety

There was a more likelihood of having reported anxiety and loneliness ((aOR= 2.53 (95% CI (0.36; 0.77)), quite good health perception ((aOR= 1.72 (95% CI (1.02;2.91))), bad health perception ((aOR= 4.50(95% CI (1.98; 10.18))). In addition, a significant positive association was assessed between students of SciPo ((aOR= 1.93 (95% CI (1.32; 2.82))). Students who reported their financial status during the lockdown as fair need attention ((aOR= 1.89 (95% CI

(1.16; 3.09)) and hardly get there ((aOR= 3.41(95% CI (1.74; 6.68)). Finally, those who had sleep problems during the second lockdown were more likely to report symptoms of anxiety compared to those who did not have sleep problems during the lockdown ((aOR= 2.15 (95% CI (1.49; 3.10))) (Table 8). Presents multiple logistic regression output for factors associated with self-reported anxiety.

Table 8. Factors associated with self-reported symptoms of anxiety

Anxiety	Odds Ratio	p-value	95% interval	Conf.
Sex				
Female (reference)	1.00	NA	NA	
Male	0.53	0.001	(0.36; 0.77)	
Loneliness				
No (reference)	1.00	NA	NA	
Yes	2.58	0.001	(1.82; 3.65)	
History of psychiatric follow-up				
No (reference)	1.00	NA	NA	
Yes	1.72	0.050	(0.99; 2.98)	
Perceived health				
Very good (reference)	1.00	NA	NA	
Good	1.28	0.210	(0.87; 1.88)	
Anxiety				
Quite good	1.72	0.040	(1.02; 2.91)	
Bad	4.50	0.001	(1.98; 10.18)	
University				
RSB (reference)	1.00	NA	NA	
EHESP	0.53	0.06	(0.27; 1.02)	
SciPo	1.93	0.001	(1.32; 2.82)	
Financial status during lockdown				
Comfortable (reference)	1.00	NA	NA	
Okay	1.01	0.98	(0.65; 1.52)	
Fair, needs attention	1.89	0.010	(1.16; 3.09)	
hardly get there	3.41	0.001	(1.74; 6.68)	
Do not wish to respond	2.42	0.160	(0.70; 8.43)	
Sedative during lockdown				
No (reference)	1.00	NA	NA	
Yes	1.82	0.01	(1.13; 2.94)	
Sleep problem (lockdown)				
No (reference)	1.00	NA	NA	
Yes	2.15	0.001	(1.49; 3.10)	

4.3.4 Factors associated with self-reported symptoms of psychological distress

Symptoms of psychological distress were the most reported from the mental health indicators. It was positively associated with loneliness ((aOR= 5.68 (95% CI (0.37; 0.82))), sedative drugs intake during the lockdown ((aOR= 6.75 (95% CI (3.01; 15.15))), sleeping problem during the lockdown ((aOR= 2.54 (95% CI (1.74; 3.69))). In addition, the students from SciPo were more likely to report symptoms of psychiatric distress compared to the students from RSB ((aOR= 1.69 (95% CI (1.07; 2.68))) and second-year bachelor (Bachelor 2) were more likely to report symptoms of psychological distress ((aOR= 1.98 (95% CI (0.95; 4.14))) compared to the first-year students (Bachelor1).

Besides, there was a positive significant association between good health perception ((aOR= 1.54 (95% CI (1.03; 2.30))), quite good health perception ((aOR= 2.18 (95% CI (1.18; 4.05))), as well as bad health perception ((aOR= 13.57 (95% CI (2.77; 66.54)))) and reported symptoms of psychological distress.

Finally, having all the test results ((aOR= 0.58 (95% CI (0.39; 0.87))) and taking test and waiting for response (((aOR=0.05 (95% C ((0.00; 0.61)))) was significantly associated with decreased likelihood of reported symptoms of psychiatric distress. Full logistic regression is presented in Table 9.

Table 9. Factors associated with self-reported symptoms of psychological distress

Psychological distress	Odds Ratio	p-value	95% Conf. interval
Sex			
Female (reference)	1.00	NA	NA
Male	0.55	0.003	(0.37 ;0.82)
Loneliness			
No (reference)	1.00	NA	NA
Yes	5.68	0.001	(3.88; 8.31)
Sedative during lockdown			
No (reference)	1.00	NA	NA
Yes	6.75	0.001	(3.01; 15.15)
Sleep problem during lockdown			
No (reference)	1.00	NA	NA
Yes	2.54	0.001	(1.74; 3.69)
Test			
No test (reference)	1.00	NA	NA
All negative	0.58	0.009	(0.39; 0.87)
≥1 positive	1.54	0.303	(0.68; 3.49)
Yes, yet result	0.05	0.020	(0.00; 0.61)
University			
RSB (reference)	1.00	NA	NA
EHESP	0.92	0.811	(0.47; 1.80)

Psychological distress	Odds Ratio	p-value	95% Conf. interval
SciPo	1.69	0.024	(1.07; 2.68)
Level of study			
Bachelor 1(reference)	1.00	NA	NA
Bachelor 2	1.98	0.070	(0.95; 4.14)
Bachelor 3	2.02	0.052	(0.99; 4.09)
Master1	1.64	0.129	(0.87; 3.12)
Master2	0.95	0.872	(0.49; 1.82)
Financial status during lockdown			
Comfortable	1.00	NA	NA
Okay (reference)	1.02	0.920	(0.66; 1.60)
Fair, needs attention	1.69	0.061	(0.98; 2.93)
hardly get there	1.58	0.258	(0.71; 3.51)
Do not wish to respond	0.71	0.620	(0.18; 2.79)
Perceived health			
Very good (reference)	1.00	NA	NA
Good	1.54	0.033	(1.03; 2.30)
Quite good	2.18	0.013	(1.18; 4.05)
Bad	13.57	0.001	(2.77; 66.54)

4.4 Relationship between self-reported mental health, social ties indicators and compliance

Finally, chi2 square was computed to assess an association between mental health indicators and compliance. There was no significant association between compliance and mental health indicators; depression (p= 0.27), Anxiety (p=0.55), psychological distress (p=0.45), loneliness (p=0.26), social support (p=0.78), History of psychiatric illness (p= 0.56).

5. Discussion

In response to the Covid-19 pandemic, countries have implemented sanitary recommendations of different levels of intensities. Yet, the recommendations are only practical with people's participation. Considering, health belief model³⁶, compliance to health recommendations in this study can be explained in terms of perceived susceptibility, perceived severity, perceived beliefs, and demography variables.

During the initial phase of the pandemic, the young age group was repeatedly blamed for not following the recommendations giving by health authorities. As a result, the WHO director called for higher compliance among younger age group⁸.

While this remains coherent in research studies conducted among the general population^{18,19} higher education students from the US, Europe, Jordan showed a good level of compliance.

In our study, the proportion of students who had always complied in all the settings (i.e. an absolute compliance) was 22.%. It is compared to the preliminary result from wave one of our study, i.e., 12.6%. The increase of approximately 10% could be due to an improved perception of the disease's severity.

Interestingly, there was no difference in absolute compliance among male and female students in our research, which is different from the findings of the reviewed articles. Students and general French population, females had higher compliance than males.^{19,21,22}

The result from the regression models with a (cut point of median) revealed that students from health-related school, EHESP were highly compliant compared to business school students from Rennes School of Business (RSB), which was consistent with a study conducted among university students in Jordan²¹ that medical students had higher compliance compared to other fields such as engineering.²¹ This can be because of a higher level of knowledge related to the pandemic as it directly related to the area of health sciences. Unlike the result from a survey conducted among universities in Portugal²², the study's finding showed no association between the level of education and compliance.

Having a positive test at least more than once was positively associated with low compliance compared to those who did not take a test. It could be due to those who did not take the test, which might have strictly followed the rules and might not have tested.

“En alternance” students showed a positive association with low compliance. However, this can be due to the small number of participants in that group compared to others, making the result appear significantly associated. There was a similar observation with the risk of a severe form of Covid-19 (do not want to respond) and bad health perception. While the result might be significant, we think that the odds ratio estimation is inflated.

Except for a study conducted in Italy among the general population¹⁸, all the reviewed articles revealed that preexisting health situations, bad/low perceived health, and high perception of risk were related to higher compliance^{17,19,20}. However, the result of our study did not show a significant association between perceived health, perceived risk, and compliance.

Furthermore, in our study, compliance was not significantly associated with the type of housing the students live in. In contrast, in a survey conducted in Jordan²¹, living arrangements were associated with compliance; students who live in villas had a higher degree of compliance than those living in other housing arrangements.²¹

In our study, socio-demographic variables except for the universities students attend, there was no significant association with compliance, which contradicts the result from a study conducted in France among the general population³⁷, which states some demographic factors were related

to compliance. This could be due to the similarity of social-demographic characteristics of our participants.

The unavailability of a standard questionnaire to assess compliance in the Covid-19 context might vary on how compliance was measured in research studies. It may raise a concern when results from different research papers were compared.

Besides, it is essential to note that the definition of compliance was different across different society. Again, despite Covid-19 being a global threat, countries' sanitary recommendations varied across the globe. Governance, socio-cultural context, an ideology of society as liberals and conservative, individualism and communitarian, the structure of society, society beliefs and norms, trust in government may have contributed to the difference on how people define and respond to health recommendations³⁸.

In our research, measuring absolute compliance was also considered, meaning to define compliance as complete obedience to all recommendations in all the ten sked outings. Yet, the practicality is low, for instance, with physical distancing. As discussed at the beginning of the discussion, one-fifth of the students reported being compliant. However, the author anticipated a possibility for self-desirability bias. However, it should not imply that maximum compliance is unattainable. Therefore, a median cutoff (high compliance \leq median) was taken as an alternative for the purpose of logistic regression, to see the associated factors with compliance. The possibility of different cutoff points to define as high and low compliance, led us to investigate associated factors at different cutoffs.

For that reason, in this study, sensitivity analysis was performed. Scores equal or less than the first quartile was taken as high compliance. This way, high compliance was defined in a stricter sense. The difference in cutoff resulted in a reduction of the proportion of high compliance by half. Despite that, a subtle difference in predicting contributing factors was observed. In our study, the median was taken as a cutoff to account for outliers and because the distribution was not normal.

Interestingly, all the logistic regression models, including the model for absolute compliance, predicted a strong positive association between having a positive test result at least once and low/er compliance.

Finally, the recommendation from Santé publique France regarding the number of people in a private gathering was a maximum of six. But in the questionnaire of the research, it was set to less than five. With this recommendation, the definition of high compliance in this study was stricter than the recommendation set by health authorities in France.

Concerning students' mental health, It is worrisome to see the mental health situation of higher education students was at stake globally during the pandemic.²³ In line with all the reviewed

articles, anxiety and depression were among the commonly reported mental health problems.^{24,25} In addition, this study showed that symptoms of psychological distress was the most reported mental health problem compared to symptoms of anxiety and depression. Furthermore, the study investigates that females were more prone to anxiety than males; this concurs with other studies.^{16,24} Yet a more comprehensive list of mental health problems should be analysed before concluding females are more prone to mental health than male counterparts. In line with other studies, an important finding of this research was the high prevalence of mental health problems among the young population, including higher education students.²⁷ because students, in general, are exposed to pressure from exams and performance at school.

It is possible that a history of psychiatric follow-up could have modified the mental health problems during the second lockdown. On the other hand, a study conducted in Bordeaux concluded that history of psychiatric illness did not seem to modify mental health outcomes between student and non-student.

A number of factors were positively associated with mental health outcomes in our study, to mention some, feelings of loneliness, poor social support, taking sedatives, sleeping problem. these findings were also found in the report done among US colleges and among French students in Bordeaux.^{27,29} Feelings of loneliness, although it can differ from one to another, could be anticipated in lockdown, especially when a student lives away from his friends and families, besides, as courses were mostly from distance, in ability to physical interact with classmates and other academic might explain it. However, it is difficult to conclude feelings of loneliness, poor social support, sleep problems and sedative drug usage was had contributed to mental health outcomes.

In our study, compared to the students who used sedatives before the second lockdown was 54, and the result increased by eight students during the lockdown. Sleep problems might come from different things; one reason we thought is relevant to the pandemic and which was shown in a study³⁹ is that increase in the amount of time spent in front of the screen(computers) as most of the schoolwork have changed from in-person to online classes and its effect on sleep disruption as well as depression.

The findings from our research indicated that anxiety was positively associated with financial instability. Our study also shows that the change in the financial status of students was not significant before and after the pandemic. This shows that the financial problem that led to mental health might not be created or shown during the second lockdown. Nevertheless, similar findings were observed in other related studies.^{16,24} And another important point to raise was the

ability of students to get enough food; while the term enough food remains subjective, the majority of our participants responded that they were able to get enough food (94.9 %). On the other hand, half of the students (49.8%) in a survey conducted in the US²⁴ and (64.4%) of students studies in the Philippines²⁵ mentioned that they had difficulty securing food. The fact that students in Rennes, France did not experience problems getting enough food and perhaps that extends in the financial indifferences before and after the lockdown could be explained by the different interventions done by associations aimed to help students with food, subsidizing meal from 3.30 euros to 1 euro by the Crous student restaurants and in-kind and monetary support from different French governmental institutions^{40,41}.

Lastly, perceived stress was mentioned as contributing factor in a number of the reviewed articles^{16,26,29}. While perceived stress was not included in our study, perceived health (bad health perception) was positively associated with psychological distress.

The study's finding, along with the reviewed articles, indicates that mental health of students of higher education has become a global challenge during the pandemic.

Furthermore, our study showed no significant association between depression, anxiety, psychological distress, loneliness, social support, and compliance.

Strength and limitation of the study

The study was conducted through an online survey tool. The amount of screen time students has these days, commonly known as "zoom fatigue," might have affected the participation rate. Conversely, the fact that it was online and was anonymous has additional strength, especially with mental health questions. We believe it has created a comfortable environment and encouraged the respondents to give genuine answers.

On the other hand, the respondents were students who volunteered to participate. This may create a self-selection bias. Furthermore, it is also possible that there was a social desirability bias in responding to the behavior-related questions.

It is possible that compliance and mental health status change over time. A longitudinal analysis is best to capture this information. Due to time constraints, it was not possible to do a longitudinal analysis. With additional time and increased participation of students in the three waves, a longitudinal analysis could better explain students' behavior and mental health evolution.

Different standard questionnaires to assess mental health indicators were used in the literature to what we had in our study. This might have affected the comparability of our results with the research papers reviewed.

Finally, with the scope of the study, i. e, exploratory study, potential confounders, interactions, and mediators were not assessed; therefore, with deeper analysis, there is a possible room for the errors mentioned above.

6. Conclusion

The study concludes one-fifth of the students were always compliant with all the recommendations. Students who got a positive result at least once were at higher likely hood of being low compliant. On the other hand, in general, the student's mental health condition was at an alarming stage during the second lockdown, and the impact of the second lockdown on the students' mental health was hefty. In addition, female students are at a greater chance of having symptoms of anxiety and psychological distress. Finally, there was no significant association between mental health status and compliance of students of higher education among the study population.

7. Recommendations

Based on the findings of the study, several recommendations can be given at different levels.

The recommendations include:

- Higher education institutions should keep attention to the mental health status of their students and make mental health services more accessible, expansion of services to virtual hotlines, increase awareness of mental health among students. And special consideration should be given to female students' mental health.
- A communication strategy that targets university students and young adults should be considered to foster compliance in the covid context.
- Further research should be encouraged on the behavior and mental health of students.

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