

The effects of Covid-19 induced lockdowns on students' mental health: a Systematic Literature Review

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ABSTRACT: *This Systematic Review analyses the impact of Covid-19 induced lockdowns on the mental health status of young students aged between 18 to 25 years old. We analyzed a total of 30 empirical papers following a targeted word search through Web of Science, PubMed, and Scopus. We found a general consensus on a positive relation between the two variables. Future research should focus on longitudinal designs to capture the temporal effect associated to prolonged restrictions and forced isolation and its potential drawbacks on individuals' mental health status.*

Introduction

Since its outbreak, Covid-19 has caused several disruptions in different aspects of human life. Losses in terms of deaths were huge, the level of commercial trade, and the main economic indicators have all fallen. Moreover, a large proportion of the world population has been forced to stay at home during lockdown periods.

This fact has caused the necessary and unprecedented shift from *in presence* to *remote* modalities of work for a significant number of working categories. Education was also included, and students were largely the most affected group. At the same time, among the population, students were also the most fragile and insecure and they were the ones who most needed social relationships.

An important literature has been produced after quarantine and lockdown periods. Authors investigated levels of stress, anxiety, depression, sleep disorders, mental health, and their variation during the period of forced isolation. This review shall explore the effective strength of the correlation between lockdowns and this large list of disorders that are strongly associated to the role of mental health. Significant results will be reported and discussed in the sections that follow.

Methods

Studies were included if they examined the following points:

1. Only records that presented a quantitative approach or an empirical analysis
2. Only records with a focus on 18-25 years old students
3. Only records related to the impact on students' mental health and relevant treatments

While looking at the impacts of Covid-19 induced lockdowns, we considered a more severe effect on students' mental health aged between 18-25 years old and wellbeing as the main

outcome. During the Preliminary Review, we identified a large number of qualitative papers either analyzing or expanding on existing social theories through Literature Reviews. While we believe in the importance of this type of research and its contribution to the general debate, we excluded them to properly assess the state of the art of quantitative and empirical research on this topic. Finally, we excluded papers that were not accessible or not in English.

Web of Science and PubMed were adopted as the main bibliographic database and extensive research was conducted between September and October 2021. In terms of key words, (*Appendix 2*) we looked for mental health related terms and high school students' wellbeing in their titles and abstracts to make sure we could exclude papers that made only a casual reference to the topic of interest. To exclude qualitative papers, we asked for a variety of keywords to avoid an excessive restriction of our research (i.e., "Data" or "Study" to adjust for their genericness). We finally restricted the papers to be classified under certain broader categories - mainly related to the social and the demographic field.

The results of the screening process are listed in the table below (*Appendix 3*). 105 articles were screened by title and abstract for eligibility criteria, resulting in a total of 75 to be assessed through full text examination. In the end, only 30 were included in our final Systematic Review. Specifically, 20 from Web of Science, 9 from PubMed, and 1 from Scopus. Papers were mainly excluded for lacking substantial quantitative analysis (i.e., statistical tests) or not focusing on a population that was at least of partial interest for this Systematic Review.

While the effect of some sort of Covid-19 induced restriction on students' mental health was studied by all papers, some also analyzed more punctual variables such as the impact of the restriction on stress levels, anxiety, or psychiatric illness. Lastly, a small portion of them checked also for connected negative effects such as academic performance and introversion. Thus, in our exposition we provided the results on the main elements related to our topic that a policy maker should address in evaluating the importance of such socially relevant phenomena. Specifically, we placed a strong emphasis on the relevance of restrictions duration, potential drawbacks, as well as the different levels of policy commitment aimed at curing for the repercussions of Covid-19 induced lockdowns on young students' mental health aged between 18-25 years old.

Results

The main characteristics of the paper we analyzed are summed up in *Appendix 3*. As mentioned in the *Methods* section, 30 articles are considered in detail. They form the basis of our systematic review and will be analyzed to examine the effect of Covid-19 induced lockdowns on young students between 18 to 25 years old. As specified in the introduction, mental health is a complex, multifaceted issue. This systematic review focuses on some of the most studied mental health aspects, including anxiety, depression, stress, loneliness, quality of life or life satisfaction.

Most of the current literature on this topic only analyzes data from periods during the pandemic, after lockdowns and social-distancing measures were implemented by governments. Since these studies do not make a comparison with pre-pandemic data, they do not give direct insights on the effect of the pandemic/lockdowns on mental health. Nonetheless, they are of great importance, since they help to form an understanding about how prevalent mental health issues are among the student population and which are the most common risk factors for low mental health, or which groups of students are more likely to suffer from mental illnesses during the Covid-19 pandemic. Furthermore, there exist studies that have a longitudinal approach, meaning that the same group of people is observed before and after the start of the pandemic. As the pandemic was an unforeseeable event this type of research is much rarer. Lastly, there exists research in which mental health data from a certain population during the pandemic is compared with pre-pandemic data from a similar population. Studies incorporating pre-pandemic data are crucial to determine differences of mental health levels between regular and pandemic periods.

According to these three types of research bodies this results section will be divided into the following parts: 1) Longitudinal Research, 2) Research comparing pandemic data with pre-pandemic data, 3) Research analyzing only pandemic data.

1) Longitudinal Research

Giannopoulou, Ioanna et al (2020) studied levels of depression and anxiety among Greek senior high school students, using data from one month before and during the lockdown. They found that the lockdown increased the number of students experiencing depression or anxiety (48.5% to 63.8%), as well as the percentage experiencing severe forms thereof (10% to 27%). Furthermore, females were significantly more affected from these mental health symptoms at both points in time. Another study (Arad et al, 2021) among university students in Israel, shows that social anxiety levels among socially anxious first year university students remained high throughout their first semester which was marked by Covid-19 social distancing measures, whereas social anxiety levels of similar students during previous years tended to decrease during their first semester. The lack of exposure to social interactions during the pandemic is suggested as the main cause for these findings. Yang et al. (2021) performed a study of Chinese university students. Participants suffered from increasing levels of depressive symptoms and higher prevalence of probable depression of 69.2% compared to 41-49% for periods between 18 and 6 months before the pandemic. Wu et al (2020) found that among Chinese 7th graders the prevalence of psychotic-like experiences increased significantly, from 22.9% before the onset of Covid-19 to 30.2% after the lockdown.

2) Research comparing pandemic data with pre-pandemic data

A study (Jiang, 2020) of Chinese university students showed that they were exhibiting higher levels of anxiety and OCD-symptoms than the population norm before the lockdown.

Depression levels on the other hand were not significantly different. Myhr et al. (2021) examined the mental health of Norwegian adolescents and compared them with data from the years preceding the lockdown, analyzing boys and girls separately. For both genders the percentage of students reporting life satisfaction (boys: from 91% to 80%; girls: 82% to 69%) and a high quality of life (boys: from 43% to 34%; girls: 23% to 16%) dropped significantly. While only girls were found to be exhibiting higher levels of depressive symptoms. Another study (Guerrero-Gomez et al, 2021) showed that due to the Covid-19 pandemic, there was an increase anxiety that reflected in an increase of nightmares (pandemic-related-dream).

3) Research analyzing only pandemic data

One research (Camacho-Zuñiga et al, 2021) investigated the feelings of high school, undergraduate and graduate students in Mexico during the Covid-19 pandemic. It showed that students across all academic levels are suffering from negative feelings. The most reported feelings were being anxious, stressed, overwhelmed, tired, and depressed. Additionally, 14% of affected students were also in need of professional help. Another study (Herbert et al, 2021) investigating the mental health of university students in Egypt and Germany during the lockdown revealed that the mean anxiety score among participants was significantly higher than the cut-off value distinguishing between high and low anxious subjects. Van Der Feltz-Cornelis et al (2020) conducted research among students and staff of the University of York (UK) examining their stress levels, anxiety, and depressive symptoms. The percentage of students suffering from high levels of stress, anxiety and depression was 28.3%, 37.2% and 46.5%, respectively. Female students were found to be more vulnerable to these mental health issues. Likewise, Ali et al. (2020) examined the mental health of Bangladeshi adults and found that the lockdown had a significantly negative effect on general mental health status, while females suffered more severely from it. An article studying Palestinian university students (Ghandour et al., 2020) indicate generally high levels of distress and insecurity among participants. Furthermore, women were more likely to report higher levels of insecurity and distress compared to men. Similarly, Woday et al. (2021) explored anxiety, depression, and stress disorders among Ethiopian university students. They found that females were twice as likely to suffer from the psychological problems than males. The fact that females were more likely to exhibit higher stress levels was also confirmed by Chhetri et al. (2021), studying Indian high school and university students. Another research (Hoque et al, 2020) conducted among undergraduate students in Bangladesh showed that 82.5% of participants were suffering from mild to extreme anxiety. Female students were showing significantly higher anxiety levels. Similarly, Baloch et al (2021) find that among Pakistani students' anxiety levels were also higher for females than for males, While Sundarasan et al. (2020) studying university students in Malaysia, show that next to females, also younger students exhibit significantly higher anxiety levels. Al-Shannaq et al. (2021) investigated mental health among Jordanian adults. Female participants had significantly higher levels of depression and lower levels of quality of life than male participants, whereas age was not found to be correlated with depression or quality of life

scores. Narayanan and Sriram (2021), studying Indian university students, also found that females were more likely to exhibit depressive symptoms. A similar finding was shown by Patsali et al. (2020), studying Greek university students. Skapinakis et al. (2020) showed depressive symptoms were higher for younger people and students compared to the rest of the Greek population. Cao et al, 2021 showed that high school students in China were commonly showing anxiety (7.1%), depression (12.8%), and PTSD symptoms (16.9%) during the COVID-19 pandemic. Family relationships and lack of social support were shown to be the most important predictors. Research (Wan Mohd Yunus et al, 2020) among Malaysian university students showed that private university students exhibited higher anxiety and depression levels than public university students. Furthermore, younger students displayed higher levels of anxiety. McKune et al (2021) studying the mental health of primary to high school students in Florida, showed that loss of household income and being female increase the risk of higher anxiety-related, depressive, and obsessive-compulsive disorder (OCD)-related symptoms. Mekonen et al. (2021) investigated the mental health of Ethiopian university students and found that living in an urban area, where physical distancing is more difficult, was a significant predictor for higher stress, anxiety, and depression levels. Zapata-Garibay et al (2021) studied how the pandemic and remote education contributed to create differences in learning approach and in general both group of students, from private and public universities, agree regarding strenuous study days. Furthermore, Xu et al (2020), highlighted that at the time their study was conducted there was a *general optimism* between university students which may alleviate negative effects. Finally, Xiao et al (2021), studied how mood disturbance correlated screen time and lower possibility to practice outdoor activity.

Discussion

The main results in which the majority of the papers agreed was that the greater the exposure to a Covid-19 restrictive measure (such as lockdowns), the more significant the impact was on the mental health status of young people aged between 18-25. However, because of the limited time period that can be analyzed, it is still unclear how much a prolonged state of emergency associated with heavy restrictions actually increases this effect.

Thus, investing resources in the healthcare system aimed at assisting mental health difficulties could help in creating a faster recovery on this side. This is especially desirable in a moment of heightened crisis such as the one we are currently living. The gap in research identified is reasonably clear. There is a need for longitudinal studies analyzing the length of heavy restrictions effects on young people mental health status. Attention should be placed also on possible consequences on depression, anxiety disorders, abnormal sleep, appetite changes that we previously hinted at, and that check for confounders. This would guide policy options to both the long-term results of investing in the treatments and protection from mental illness and disorders, as well as possible dangers of doing so.

Finally, concerning the limits of our Systematic Review, we believe that future reviews should take into consideration more publication databases. Furthermore, a meta-analysis might be carried out to boost our qualitative results.

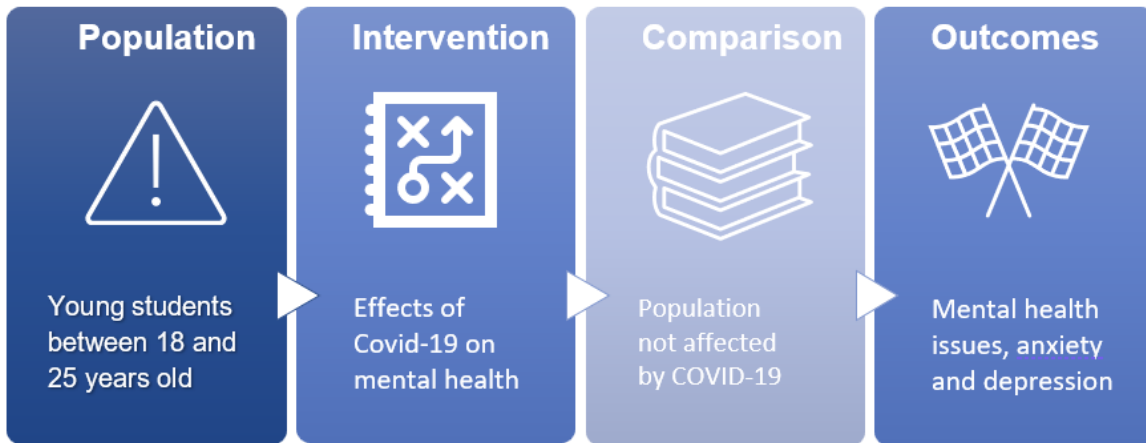
References

1. Ali, Mohammad, Gias U. Ahsan, Risliana Khan, Hasinur Rahman Khan, and Ahmed Hossain. 2020. 'Immediate Impact of Stay-at-Home Orders to Control COVID-19 Transmission on Mental Well-Being in Bangladeshi Adults: Patterns, Explanations, and Future Directions'. *BMC Research Notes* 13(1):494. doi: 10.1186/s13104-020-05345-2.
2. Al-Shannaq, Yasmin, Anas A. Mohammad, and Mohammed Aldalaykeh. 2021. 'Depression, Coping Skills, and Quality of Life among Jordanian Adults during the Initial Outbreak of COVID-19 Pandemic: Cross Sectional Study'. *Heliyon* 7(4): e06873. doi: 10.1016/j.heliyon.2021.e06873.
3. Arad, Gal, Dana Shamai-Leshem, and Yair Bar-Haim. 2021. 'Social Distancing During A COVID-19 Lockdown Contributes to The Maintenance of Social Anxiety: A Natural Experiment'. *Cognitive Therapy and Research* 1–7. doi: 10.1007/s10608-021-10231-7.
4. Baloch, Gul Muhammad, Sheela Sundarassen, Karuthan Chinna, Mohammad Nurunnabi, Kamilah Kamaludin, Heba Bakr Khoshaim, Syed Far Abid Hossain, and Areej AlSukayt. 2021. 'COVID-19: Exploring Impacts of the Pandemic and Lockdown on Mental Health of Pakistani Students'. *Peerj* 9:e10612. doi: 10.7717/peerj.10612.
5. Bu, F., A. Steptoe, and D. Fancourt. 2020. 'Who Is Lonely in Lockdown? Cross-Cohort Analyses of Predictors of Loneliness before and during the COVID-19 Pandemic'. *Public Health* 186:31–34. doi: 10.1016/j.puhe.2020.06.036.
6. Camacho-Zuñiga, Claudia, Luis Pego, Jose Escamilla, and Samira Hosseini. 2021. 'The Impact of the COVID-19 Pandemic on Students' Feelings at High School, Undergraduate, and Postgraduate Levels'. *Heliyon* 7(3): e06465. doi: 10.1016/j.heliyon.2021.e06465.
7. Cao, Chengqi, Li Wang, Ruoqiao Fang, Ping Liu, Yajie Bi, Shu Luo, Emma Grace, and Miranda Olff. 2021. 'Anxiety, Depression, and PTSD Symptoms among High School Students in China in Response to the COVID-19 Pandemic and Lockdown'. *Journal of Affective Disorders* 296:126–29. doi: 10.1016/j.jad.2021.09.052.
8. Chhetri, Bijoy, Lalit M. Goyal, Mamta Mittal, and Gopi Battineni. 2021. 'Estimating the Prevalence of Stress among Indian Students during the COVID-19 Pandemic: A Cross-Sectional Study from India'. *Journal of Taibah University Medical Sciences* 16(2):260–67. doi: 10.1016/j.jtumed.2020.12.012.
9. Esposito, Susanna, Nino Giannitto, Antonella Squarcia, Cosimo Neglia, Alberto Argentiero, Paola Minichetti, Nicola Cotugno, and Nicola Principi. 2020. 'Development of Psychological Problems Among Adolescents During School Closures Because of the COVID-19 Lockdown Phase in Italy: A Cross-Sectional Survey'. *Frontiers in Pediatrics* 8:628072. doi: 10.3389/fped.2020.628072.
10. Ghandour, Rula, Rasha Ghanayem, Farah Alkhanafsa, Ayah Alsharif, Hiba Asfour, Aisha Hoshiya, Amani Masalmeh, Muna Nadi, Laila Othman, Sameera Ryahe, Yasmeen Wahdan, Shatha Wahsh, Ala'a Yamani, and Rita Giacaman. 2020. 'Double Burden of COVID-19 Pandemic and Military Occupation: Mental Health Among a Palestinian University Community in the West Bank'. *Annals of Global Health* 86(1):131. doi: 10.5334/aogh.3007.
11. Giannopoulou, Ioanna, Vasiliki Efstathiou, Georgia Triantafyllou, Panagiota Korkoliakou, and Athanassios Douzenis. 2021. 'Adding Stress to the Stressed: Senior High School Students' Mental Health amidst the COVID-19 Nationwide Lockdown in Greece'. *Psychiatry Research* 295:113560. doi: 10.1016/j.psychres.2020.113560.

12. Guerrero-Gomez, Ana, Isabel Nothen-Garunja, Michael Schredl, Annelore Homberg, Maria Vulcan, Asja Brusic, Caterina Bonizzi, and Cecilia Iannaco. 2021. 'Dreaming in Adolescents During the COVID-19 Health Crisis: Survey Among a Sample of European School Students'. *Frontiers in Psychology* 12:652627. doi: 10.3389/fpsyg.2021.652627.
13. Herbert, Cornelia, Alia El Bolock, and Slim Abdennadher. 2021. 'How Do You Feel during the COVID-19 Pandemic? A Survey Using Psychological and Linguistic Self-Report Measures, and Machine Learning to Investigate Mental Health, Subjective Experience, Personality, and Behaviour during the COVID-19 Pandemic among University Students'. *BMC Psychology* 9(1):90. doi: 10.1186/s40359-021-00574-x.
14. Hoque, Md Najmol, Afsana Hannan, Shahin Imran, Muhammad Ashiqul Alam, Bidyut Matubber, and Sourav Mohan Saha. 2021. 'Anxiety and Its Determinants among Undergraduate Students during E-Learning in Bangladesh Amid Covid-19'. *Journal of Affective Disorders Reports* 6:100241. doi: 10.1016/j.jadr.2021.100241.
15. Jiang, Ruichen. 2020. 'Knowledge, Attitudes and Mental Health of University Students during the COVID-19 Pandemic in China'. *Children and Youth Services Review* 119:105494. doi: 10.1016/j.chidyouth.2020.105494.
16. McKune, Sarah L., Daniel Acosta, Nick Diaz, Kaitlin Brittain, Diana Joyce-Beaulieu, Anthony T. Maurelli, and Eric J. Nelson. 2021. 'Psychosocial Health of School-Aged Children during the Initial COVID-19 Safer-at-Home School Mandates in Florida: A Cross-Sectional Study'. *Bmc Public Health* 21(1):603. doi: 10.1186/s12889-021-10540-2.
17. Mekonen, Enyew Getaneh, Belayneh Shetie Workneh, Mohammed Seid Ali, and Niguse Yizgaw Muluneh. 2021. 'The Psychological Impact of COVID-19 Pandemic on Graduating Class Students at the University of Gondar, Northwest Ethiopia'. *Psychology Research and Behavior Management* 14:109–22. doi: 10.2147/PRBM.S300262.
18. Myhr, Arnhild, Linn Renée Naper, Indira Samarawickrema, and Renate K. Vesterbekkmo. 2021. 'Impact of COVID-19 Pandemic Lockdown on Mental Well-Being of Norwegian Adolescents During the First Wave-Socioeconomic Position and Gender Differences'. *Frontiers in Public Health* 9:717747. doi: 10.3389/fpubh.2021.717747.
19. Narayanan, Mini, and Sujata Sriram. n.d. 'COVID-19 and Depression: Prevalence and Risk Factors in Youth from Maharashtra, India'. *Human Arenas*. doi: 10.1007/s42087-021-00252-9.
20. Patsali, Mikaella E., Danai-Priskila V. Mousa, Eleni V. K. Papadopoulou, Konstantina K. K. Papadopoulou, Chrysi K. Kaparounaki, Ioannis Diakogiannis, and Konstantinos N. Fountoulakis. 2020. 'University Students' Changes in Mental Health Status and Determinants of Behavior during the COVID-19 Lockdown in Greece'. *Psychiatry Research* 292:113298. doi: 10.1016/j.psychres.2020.113298.
21. Skapinakis, Petros, Stefanos Bellos, Achilleas Oikonomou, Georgios Dimitriadis, Paschalis Gkikas, Evridiki Perdikari, and Venetsanos Mavreas. 2020. 'Depression and Its Relationship with Coping Strategies and Illness Perceptions during the COVID-19 Lockdown in Greece: A Cross-Sectional Survey of the Population'. *Depression Research and Treatment* 2020:3158954. doi: 10.1155/2020/3158954.
22. Sundarasan, Sheela, Karuthan Chinna, Kamilah Kamaludin, Mohammad Nurunnabi, Gul Mohammad Baloch, Heba Bakr Khoshaim, Syed Far Abid Hossain, and Areej Sukayt. 2020. 'Psychological Impact of COVID-19 and Lockdown among University Students in Malaysia: Implications and Policy Recommendations'. *International Journal of Environmental Research and Public Health* 17(17):6206. doi: 10.3390/ijerph17176206.

23. Van Der Feltz-Cornelis, Christina Maria, D. Varley, Victoria L. Allgar, and Edwin de Beurs. 2020. 'Workplace Stress, Presenteeism, Absenteeism, and Resilience Amongst University Staff and Students in the COVID-19 Lockdown'. *Frontiers in Psychiatry* 11:588803. doi: 10.3389/fpsy.2020.588803.
24. Wan Mohd Yunus, Wan Mohd Azam, Siti Khadijah Zainal Badri, Siti Aisyah Panatik, and Firdaus Mukhtar. 2020. 'The Unprecedented Movement Control Order (Lockdown) and Factors Associated With the Negative Emotional Symptoms, Happiness, and Work-Life Balance of Malaysian University Students During the Coronavirus Disease (COVID-19) Pandemic'. *Frontiers in Psychiatry* 11:566221. doi: 10.3389/fpsy.2020.566221.
25. Woday Tadesse, Abay, Setegn Tarekegn Mihret, Gebeyaw Biset, and Ayesheshim Muluneh Kassa. 2021. 'Psychological Problems and the Associated Factors Related to the COVID-19 Pandemic Lockdown among College Students in Amhara Region, Ethiopia: A Cross-Sectional Study'. *BMJ Open* 11(9):e045623. doi: 10.1136/bmjopen-2020-045623.
26. Wu, Zhipeng, Zhening Liu, Zhulin Zou, Feiwen Wang, Mengran Zhu, Wen Zhang, Haojuan Tao, Brendan Ross, and Yicheng Long. 2021. 'Changes of Psychotic-like Experiences and Their Association with Anxiety/Depression among Young Adolescents before COVID-19 and after the Lockdown in China'. *Schizophrenia Research* 237:40–46. doi: 10.1016/j.schres.2021.08.020.
27. Xiao, Suhua, Zi Yan, and Li Zhao. 2021. 'Physical Activity, Screen Time, and Mood Disturbance Among Chinese Adolescents During COVID-19'. *Journal of Psychosocial Nursing and Mental Health Services* 59(4):14–20. doi: 10.3928/02793695-20201104-04.
28. Xu, Huifang, Maria Jose Gonzalez Mendez, Lanwei Guo, Qiong Chen, Liyang Zheng, Peipei Chen, Xiaoqin Cao, Shuzheng Liu, Xibin Sun, Shaokai Zhang, and Youlin Qiao. 2020. 'Knowledge, Awareness, and Attitudes Relating to the COVID-19 Pandemic Among Different Populations in Central China: Cross-Sectional Survey'. *Journal of Medical Internet Research* 22(10):e22628. doi: 10.2196/22628.
29. Yang, Xue, Huahua Hu, Chengjia Zhao, Huihui Xu, Xiaolian Tu, and Guohua Zhang. 2021. 'A Longitudinal Study of Changes in Smart Phone Addiction and Depressive Symptoms and Potential Risk Factors among Chinese College Students'. *BMC Psychiatry* 21(1):252. doi: 10.1186/s12888-021-03265-4.
30. Zapata-Garibay, Rogelio, Jesus Eduardo Gonzalez-Fagoaga, Elsa B. Meza-Rodriguez, Edgar Salazar-Ramirez, Ismael Plascencia-Lopez, and Clara Judith Gonzalez-Fagoaga. 2021. 'Mexico's Higher Education Students' Experience During the Lockdown Due to the COVID-19 Pandemic'. *Frontiers in Education* 6:683222. doi: 10.3389/feduc.2021.683222.

APPENDIX 1 - PICO Model



APPENDIX 2 – Search on PubMed, Scopus, and Web of Science

Our reporting strategy follows the PRISMA guidelines. We searched PubMed, Scopus and Web of Science for records published between 2020 and 2021, using the following search terms in title and abstract:

(i) [covid OR lockdown OR covid-19 OR virus]

AND

(ii) [School OR High school OR higher education OR college]

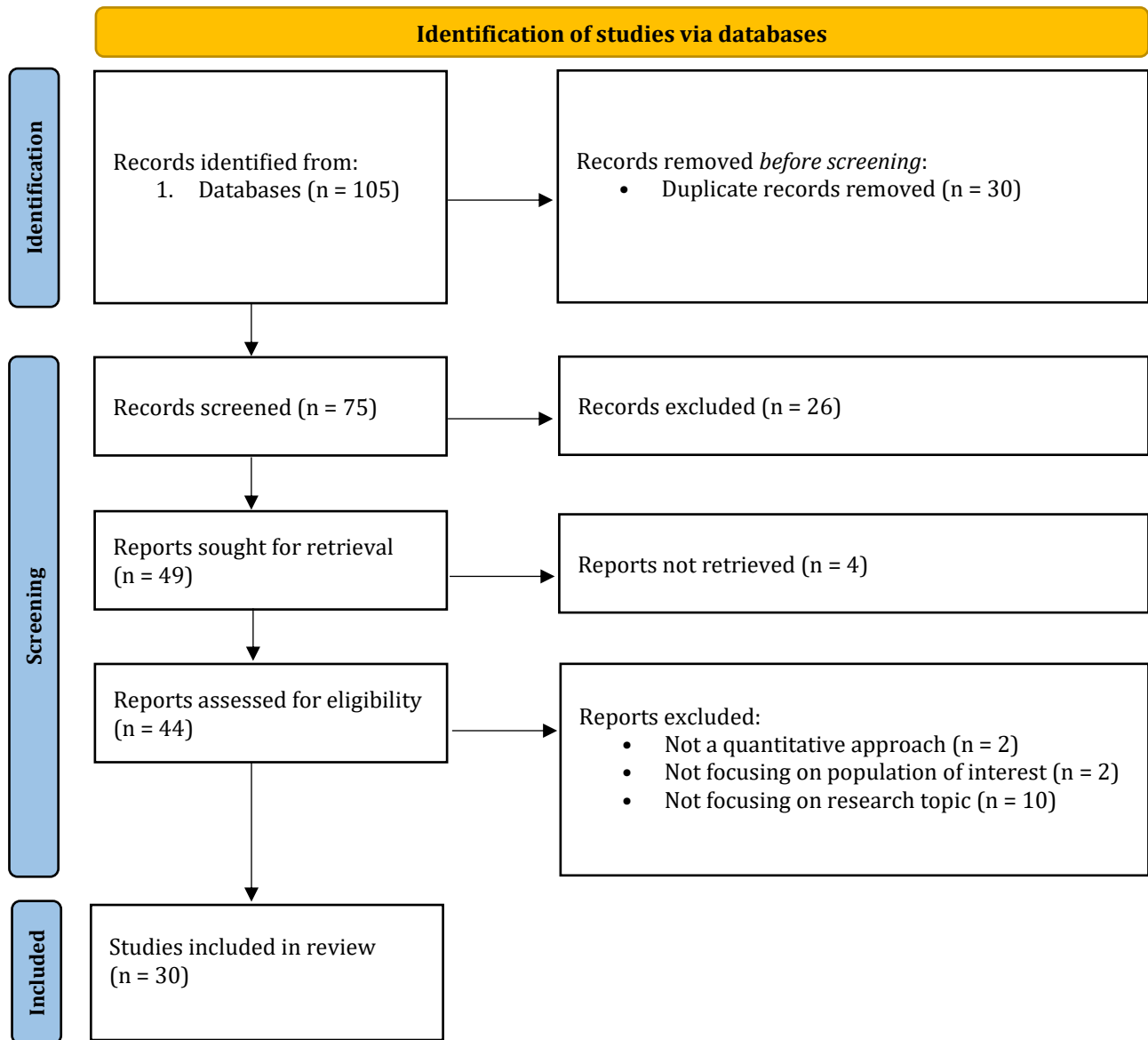
AND

(iii) [students OR young people OR young age]

AND

(iv) [mental health OR stress OR anxiety OR depression]

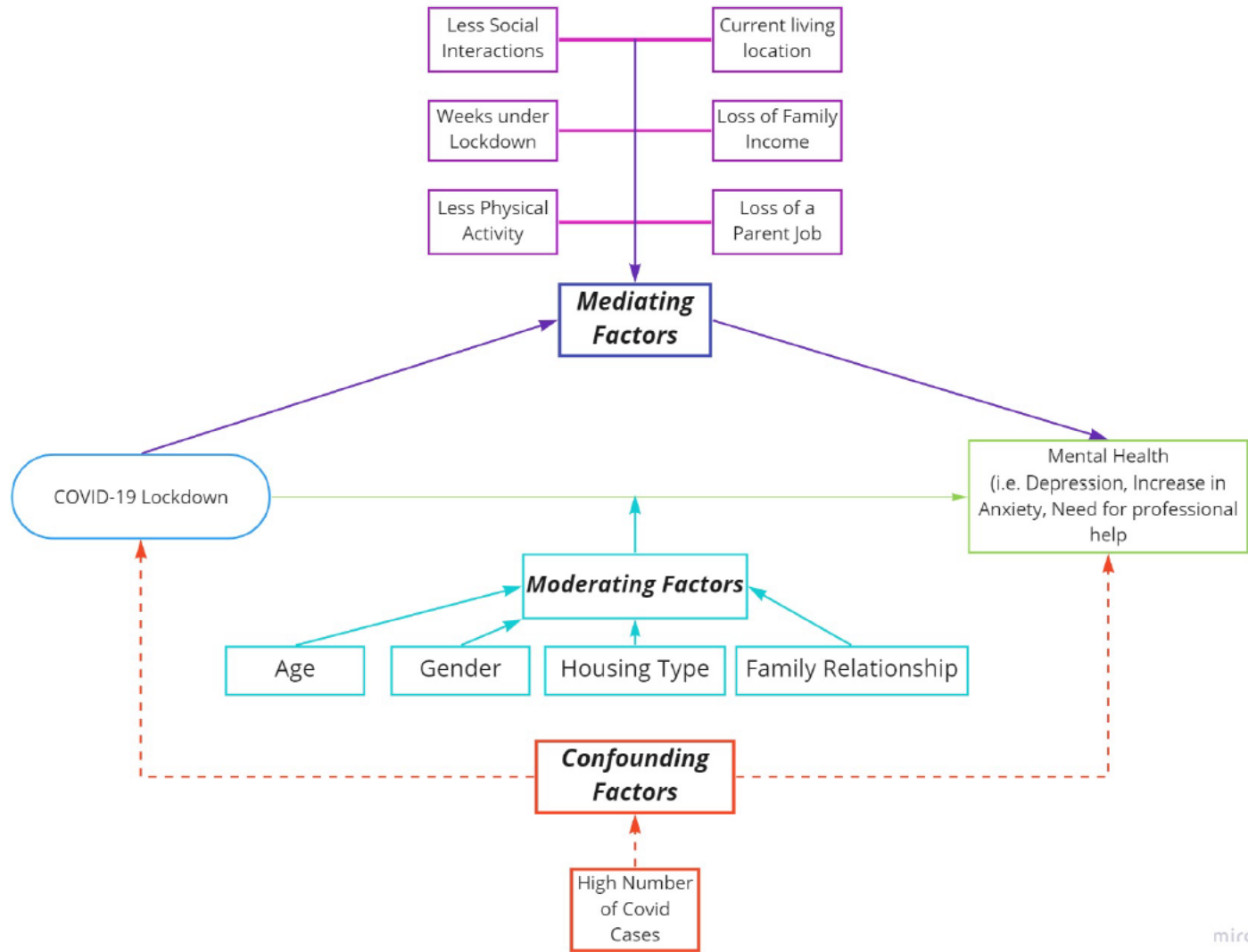
APPENDIX 3 – PRISMA Flow Diagram



APPENDIX 4 – Excel File

<https://docs.google.com/spreadsheets/d/1ulnv-IHaQPbz3KaZPIxznZzYS0jZDs4BBAszcVMiwE/edit?usp=sharing>

APPENDIX 5 – Directed Acyclic Graph (DAG)



APPENDIX 6 – PRISMA Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 1
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 1
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 1
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 1-2
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 1-2
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 11
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 1-2
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	N/A
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 13
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Page 13
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	N/A
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	N/A
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 1-2 and Page 13
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 2
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 13
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	N/A
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	N/A
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 1-2 and Page 12
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 1-2
Study characteristics	17	Cite each included study and present its characteristics.	Page 2-5
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	N/A
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Page 2-5 and Page 13
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	N/A
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	N/A
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	N/A
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 2-5
	23b	Discuss any limitations of the evidence included in the review.	Page 5-6
	23c	Discuss any limitations of the review processes used.	Page 5-6
	23d	Discuss implications of the results for practice, policy, and future research.	Page 5-6
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	N/A
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	N/A
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	N/A
Competing interests	26	Declare any competing interests of review authors.	N/A
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	N/A