

Peer Review File

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Reviewer A

General comments

I commend your efforts to investigate the sleep experience of Chinese high school students in two unique periods, during the COVID-19 pandemic and then shortly after quarantine. I think you have interesting data that will help school administrators and education specialists improve the sleep experience of students.

I have concerns, however, about how your study is framed. Is it a paper about pandemic restrictions and sleep or about forced sleep restriction, exam stress and sleep? Unfortunately, you do not appear to have pre-pandemic sleep data. Such data could clarify what changes are to do with the pandemic and what is just a typical high-pressure senior year in Chinese high schools. Had you had data on other than seniors, you may have been able to determine the role of Gaokao-related challenges.

Your sample size is small and your methodology has significant limitations, only some of which are acknowledged. Your use of the PSQI on a population it was not designed for was not addressed. You have no measure of anxiety or perceived stress and yet you frequently refer to the stress which your sample experiences. There are no prospective measures or attempts for sleep assessment through physiological assessment devices, such as smartwatches or cell phones. There is also a very fundamental issue of establishing voluntary participation in minors. This was not addressed and needs to be.

I have provided my feedback for each section of your paper. I hope these comments are helpful and wish you all the best with this interesting and important area of scholarship.

Reply 1: We extend our heartfelt gratitude to you for taking the time and effort to review our manuscript. Your expertise and insights have been invaluable in enhancing the quality and rigor of our research. Your thoughtful feedback and constructive suggestions have significantly contributed to the refinement of our work. We genuinely appreciate your meticulous review, which has undoubtedly strengthened the overall integrity and clarity of our manuscript. We have carefully considered each of your comments and recommendations and have made appropriate revisions to address the points raised. Your input has played an instrumental role in shaping the final version of our paper.

This study has many limitations, as you mentioned. We examined the sleep of Chinese high school seniors over two periods. Due to objective reasons and our negligence, our sample size was small, and factors affecting sleep were not perfectly explained. The pandemic, sleep restriction, and exam stress have all changed, but we can't pinpoint exactly how they affect sleep. In terms of sleep measurement tools, although the Chinese version of PSQI has proved effective in some studies (supplemented in the main text), this tool cannot fully explain the sleep of the samples. The voluntary participation of minors is one aspect we consider, and we also add some new explanations in the main text, the main method is the speeches given by researchers and teachers to students before the survey.

We will revise the manuscript based on the reviewers' comments to the greatest extent possible. Unfortunately, we have no way to expand the sample size or re-run the survey, as the same situation no longer exists. We hope that this study can make some contributions to the field and attract more

scholars to pay attention to the sleep of high school students, especially commuter students and residential students. In future research, we will consider designing the research framework in a more reasonable way and implementing the survey better.

Abstract

L23. Consider changing the purpose statement from "...sleep quality between..." to "...sleep between..." You are also evaluating total sleep time and the amount of sleep is one of your most significant findings.

Reply 2: "...sleep quality between..." has been changed to "...sleep between..."

L23. You used a Chinese version of the PSQI, so this should be made clear in the abstract and appropriately referenced.

Reply 3: The Chinese version of the Pittsburgh Sleep Quality Index (PSQI) is mentioned. (line 27)

L30. Do you mean to report that "all" Chinese high school seniors had significantly higher PSQI scores? Or, is this a mean difference?

Reply 4: What we would like to mention is that both commuter students and residential students achieved higher PSQI scores in the second survey, referring to the mean difference.

Changes in the text: Therefore, the original text has been revised to state that "both commuter students and residential students had significantly higher PSQI scores ($M=7.09$, $SD=3.208$)" (line 30)

L34. You misrepresent sleep duration as being "higher after school reopened." Previously you stated that "actual sleep time was significantly shorter in the second survey"

Reply 5: The "subjective sleep quality, sleep duration, and daytime dysfunction scores" all refer to the scores of the PSQI, where higher sleep duration scores indicate lesser actual sleep time. Changes in the text: To avoid confusion, we have rephrased it as follows: The subjective sleep quality, sleep duration, and daytime dysfunction of both commuter and residential students worsened after the school reopened. (line 35)

L35. As I understand your results, sleep efficiency increased for commuter students after school reopened.

Reply 6: The expression here is also not clear enough. We mean that the scores of sleep latency and sleep efficiency have decreased, so the corresponding performance has become better.

Changes in the text: We have made a revision, denoted as "the sleep latency and sleep efficiency of commuter students improved after the school reopened". (line 38)

L39. Total sleep time was also significantly greater during quarantine. Worth mentioning.

Reply 7: The total sleep time is mentioned in the abstract: their actual sleep time was significantly shorter in the second survey ($M=5.67$, $SD=0.582$) compared to the first ($M=7.85$, $SD=1.738$). (line 32)

L39. In US English "run-up" is understood but perhaps "preparation period" would be more specific.

Reply 8: We appreciate your suggestion and have made the change from "run-up" to "preparation". (line 45)

L39. As a formal noun, why is the title of the exam not capitalized? "Gaokao"

Reply 9: We have used "Gaokao" here, thank you for the reminder. (line 45)

L40. It is probable that the exam preparation period was causally related to students' reported fatigue, but you do not have a controlled research design to make this statement.

Reply 10: This conclusion is inferred from the PSQI scores for daytime dysfunction. However, as you pointed out, it cannot be definitively attributed to Gaokao preparation. In comparison to the first survey, two changes occurred: the reopening of schools and exam preparation.

Changes in the text: Therefore, we have revised the text accordingly: "After the reopening of

schools and the commencement of preparation for the national college entrance exam (Gaokao), the sleep quality and duration of Chinese high school seniors declined. Additionally, they reported feeling more tired and lacking in energy during the daytime.”. (line 44)

L43. Students who commute appear forced into sleep restriction, which does increase “efficiency” but is not a marker of better sleep overall. Your statement gives the impression that commuter students have an advantage.

Reply 11: The term "sleep efficiency" here refers to the calculation of actual sleep time divided by time spent in bed, as indicated by the PSQI. The results demonstrate that commuter students did indeed improve their sleep efficiency. We have changed the description here so that the reader does not understand this as an advantage.

Changes in the text: commuter students have higher sleep efficiency although it may not be a good thing. (line 49)

L48. You mention gender differences as a key finding but this is not made clear in the abstract or developed in the text.

Reply 12: Gender differences were indeed not a key finding and have been removed.

L48. “...influenced by various factor.” Consider eliminating this statement or be specific as to what these factors are.

Reply 13: The mentioned sentence has been removed, and an important result has been added. Changes in the text: “Sleep quality of Chinese high school seniors differs before and after school reopened from COVID-19 quarantine.” (line 54)

Introduction

L54. AASM guidelines for teens (13-18 years of age) are TST of 8-10 hours/24 hours.

Reply 14: Increased sleep time recommended by AASM.

Changes in the text: The American Academy of Sleep Medicine recommends that teens ages 13 to 18 get eight to 10 hours of sleep a day. (line 63)

L62. “...change one’s life” seems vague.

Reply 15: This sentence was changed.

Changes in the text: In China, the gaokao is considered an important exam, which has a direct effect on students' future professional learning and career development. (line 71)

L62. “...only task...” This absolute statement seems inaccurate. Do you mean “paramount focus” Or “most significant challenge”?

Reply 16: Change “only task” to “paramount focus”. (line 74)

L65. Not all students sleep time is greatly reduced, just most.

Reply 17: Change “Their sleep time” to “Sleep time of most students”. (line 12)

L66. Up to this line, it appeared that all students must take the Gaokao. I recommend explaining that the exam is optional and that you are studying essentially two groups of students, those who are preparing for the exam and those who are not. Your analysis should reflect these populations.

Reply 18: Although exact statistics are not available, nearly all high school students in China take the gaokao.

L65. Phrasing as “need” is absolute and refers to another study’s findings.

Reply 19: "need to" was changed to "usually" and added references. (line 77)

L69. Recommend a heading here, e.g., “Governmental Pandemic Policies regarding Education”

Reply 20: We added a second level heading to the Introduction and took your suggestion into account.

1.2. Governmental pandemic policies regarding education (81)

L77. “...sleep quality and total sleep time of...”

Reply 21: Changed the wording according to your suggestion. (90)

L90. A thesis statement(s) appears missing at the end of the Introduction section.

Reply 22: Added the thesis statement.

Changes in the text: This study aims to investigate the relationship between the concentrated isolation measures implemented during the pandemic and the sleep patterns of Chinese high school seniors upon the reopening of schools. The study particularly focuses on the differences between commuter students and residential students, emphasizing the significance of sleep for high school students and the impact of living arrangements on their sleep. (line 105)

Methods

L92. Methods

L93. Recommend leaving out “quality” which leaves the investigation open to include total sleep time and sleep phase.

Reply 23: The word “quality” was dropped. (line 112)

L97. “...not undergone surgery...” doesn’t translate well. Does this mean students not have reported significant medical illnesses?

Reply 24: Yes, the translation here is inappropriate. Modified the expression based on your suggestion.

Changes in the text: All participants had no reported significant medical illnesses. (line 116)

L98. “...collective learning sessions...” US readers will probably not know what these sessions are. Also, missing a single study session will disqualify you from the study? This does not seem realistic and may overly restrict participation.

Reply 25: There are some problems with the expression in this place. Our original intention is that participants must be at the same learning stage and have participated in the same courses during the previous epidemic. Students who missed a few sessions due to special reasons were not excluded. We have revised the sentence: did not miss a semester.

Changes in the text: All participants had no reported significant medical illnesses, and did not miss a semester as required by the school. (line 117)

L99. “...or other reasons...” This is not acceptable by ethical review standards. Here you must be specific. Also, delineating “assent” from “consent” should be addressed. How voluntary was participation? How was the pressure to conform and defer to authority managed?

Reply 26: Participants were informed that the study was anonymous and optional, and that they had teachers' guarantees. Students who were not interested or concerned about the risks did not participate in the survey.

Changes in the text: Added explanations for other reasons, (including have no interest, don't want to waste time, worry about risks, subjectively reject the questionnaire). (line 119) Added a sentence: Before the survey, the researcher explained the purpose and significance of the survey to the

teachers and students, and emphasized that the survey had nothing to do with studies, that the survey was anonymous and not compulsory. (line 121)

L109. It is unclear what would constitute an “unreasonable” answer. Outliers?

Reply 27: Unreasonable answers include: 1. Time in bed [item 3 (waking time) minus item 1 (going to bed)] is less than item 4 (sleep time). 2. In the second survey, the time in bed was more than 9 hours (school ends at 10:00 p.m. and class starts at 7:00 a.m.)

L188. The PSQI was developed for use with adult populations, 19-years and older. The two studies cited for its use in Chinese populations are both college-age studies. You should find support for the PSQI use in adolescents and acknowledge that this measure may have limited validity for your sample.

Reply 28: Added citations supporting the use of the PSQI in Chinese adolescents, and added a statement of this limitation to the Discussion.

Changes in the text: A study evaluated the validity and reliability of the Chinese version of the PSQI in nonclinical adolescents, and the results support the use of this tool to assess sleep quality in Chinese nonclinical adolescents. (line 144)

the PSQI is a scale designed for adults. Although some studies have used the Chinese version of the PSQI for sleep assessment in adolescents, targeted improvements may be necessary. (line 313)

L118-L121. Good job on describing PSQI.

Reply 29: Thank you.

L124. Unclear why you transformed a continuous variable into a categorical variable.

Reply 30: Because students' daily commuting time will not be accurately recorded by students, accurate continuous data cannot be obtained, so we think it is reasonable to use categorical variable.

L131. You were able to match students with their surveys. Nice! How was this done? How did you preserve anonymity? The matching process should be described.

Reply 31: Yes, this matching process should appear in the Method.

Changes in the text: Added two sentences: All participants received a unique identification code, which was composed of their class name combined with random numbers. This identification code was known only to the participants themselves and was used to link their responses in the two surveys. (line 129)

Results

L135. Again, remove “quality” so that you have latitude to include results of quantity, i.e., TST.

Reply 32: Removed “quality”.

L138. I recommend being clearer re: reporting of a single item from the PSQI, i.e., question 6. Referring to a “PSQI score”, many readers will assume it represents the composite measure PSQI score.

Reply 33: The expression here may be misleading, so it is deleted. The results of question 6 are detailed below. Subjective sleep quality was reported as very good for 32.8%, fairly good for 48.9%, fairly bad for 16.1%, and very bad for 2.2%. (line 172)

L142. “varying degrees of difficulty” what does this mean? Do you mean PSQI question 5a.?

Reply 34: Yes. We have modified the expression here.

Changes in the text: 57.2% of students experience difficulty falling asleep within 30 minutes at least once a week. (line 171)

L153-155. There is no need to inform the reader that residents have significantly less commute time than commuters.

Reply 35: We have removed the text here.

L160-161. "...different degrees of sleep latency problems." This is unclear.

Reply 36: We have modified the text here to make it more explicit.

Changes in the text: cannot fall asleep within 30 minutes at least once a week. (line 189)

L163. Again, how was this determined? It seems you are taking all but the response "not in the past month" on question 8—but you don't explain this.

Reply 37: Yes, this is based on the results of Question 8 and Question 9. We presented the data in detail.

Changes in the text: According to the results of question 8, only 9.5 % of students did not have trouble staying awake, 8% less than once a week, but 23.4% once or twice a week and 58.4% three or more times a week. 20.6% of students did not have a problem keeping up their enthusiasm, 17.5% had a very slight problem, 25.5% had somewhat of a problem and 41.6% had a very big problem according to the results of question 9. (line 193)

L178. Sleep quality and TST were lower in the second survey but here you contradict this.

Reply 38: The higher the PSQI score, the worse the sleep situation represented. The subjective sleep quality, sleep duration, and daytime dysfunction scores here are higher in the second time, which corresponds to poorer sleep quality and shorter sleep time.

L187. Here you state sleep quality and duration were higher but they were not.

Reply 39: It's the same situation here. Expressed here they scored better, implying worse sleep quality and duration.

L192. "...with a large difference." Leave this phrase out or be specific.

Reply 40: We leaved this phrase out.

L196. Here you start referring to the literature. Is this the start of your Discussion section? There doesn't seem to be a Discussion section marker.

Reply 41: Yes, this is where the discussion begins. "4. Discussion" exists in the text, but it appears in an inconspicuous position (line 190 at the bottom of page 10 and now line 225).

L203. Here you mention that the school starts the day earlier than normal in preparation for the Gaokao. There is a large literature on school start times and the consequences to sleep when school systems start too early for health, well-being, and consolidation of memory/learning.

Reply 42: We have added descriptions of the impact of school start times on young students.

Changes in the text: Added: Not only that, many studies have found that earlier school start times are not conducive to the control of negative emotions, attendance, concentration, and test scores. (line 239)

L209. Here you frame a decrease in sleep latency as a benefit for commuting students after school

reopened. This is a problematic interpretation of this data. An alternate interpretation, and one that I suspect is more accurate, is that students are being forced into a sleep-restriction schedule. Commuting time reduces their time to study, really to do everything, including sleep. These students are fatigued by this cycle, so they fall asleep quickly and have to awake prematurely due to the insensitive and rather blind-sided thinking that more study time means more learning. Be careful about putting a positive spin on this rather cruel misguided practice of reducing students' sleep time.

Reply 43: We very much agree with your point of view. We made a similar comment after this sentence: "However, the improvement in these two aspects may not have been positive or contributed to improving their daytime functioning. Part of the reason may be that students' sleep time decreased, meaning they felt more tired and wanted to sleep, so the time taken to fall asleep decreased, while sleep efficiency improved. Their fatigue and drowsiness had not been relieved, as reflected by the increased daytime dysfunction after school reopened". (line 246) We have revised this text to make it clearer.

Changes in the text: Commuting time reduces their sleep and study time, and they have to go to bed later and wake up earlier. As a result, they feel sleepier and fall asleep faster. Their fatigue and drowsiness had not been relieved, as reflected by the increased daytime dysfunction after school reopened. We do not recommend reducing the sleep time that high school students already do not get enough in order to increase sleep efficiency. (line 248)

L217. I believe most studies of gender differences re: sleep reflect that girls/women have poorer sleep than boys/men.

Reply 44: Yes, this is also confirmed in this study. When sleep time is taken up partly by study and exam pressure is greater, girls' sleep quality is more affected than boys'. We increase our discussion of the situation.

Changes in the text: In the case of such intense study pressure and longer study time, the sleep of female students should be paid more attention. (line 257)

L221. That most students prefer to be with their families may not be about sleep but about missing their families! Did you measure students' reasons for making this decision? It is not clear where you got this information. The study you cite is of middle-schoolers.

Reply 45: Here is our inference, no direct evidence. We modify the text here.

Changes in the text: The reason for this may be that they prefer to spend time with their families, or they think that the living and sleeping environment at home is better. (line 262)

L229. "...and so on." Remove or be specific.

Reply 46: Deleted "and so on".

L235. Remove "quality"

Reply 47: Deleted "quality".

L240. Again, reconsider if sleep restriction is a sleep advantage!

Reply 48: Advantage is indeed inappropriate, we emphasized that increasing sleep efficiency is not necessarily a good thing.

Changes in the text: the disparity in sleep quality and duration between commuter students and residential students emphasizes the importance of living arrangements as a contributing factor. Residential students have a longer sleep time, while going home to sleep can increase sleep efficiency although this is not necessarily a good thing. (line 287)

L242. Mention that it is a small sample and that they are seniors.

Reply 49: Yes, we did as you suggested.

this study has identified the changes in sleep quality of Chinese high school seniors by comparing a small sample's sleep before and after school reopened. (line 278)

L249. Large-scale samples, at least of college-age students, have been collected and most appear to be from China.

Reply 50: Yes. However, there is almost no research on the comparison of sleep before and after the epidemic, especially on commuter students and residential students in high school.

L266. There is no implications section, which could be a strength of this study.

Reply 51: Added the implication section.

This study has identified the changes in sleep quality of Chinese high school seniors by comparing a small sample's sleep before and after school reopened, and has compared commuter students to residential students. The implications derived from the discussed findings are multifaceted and hold significance for understanding the sleep patterns and factors influencing Chinese high school seniors, especially in the context of pandemic-related disruptions and the reopening of schools.

Changes in the text: This study has identified the changes in sleep quality of Chinese high school seniors by comparing a small sample's sleep before and after school reopened, and has compared commuter students to residential students. The implications derived from the discussed findings are multifaceted and hold significance for understanding the sleep patterns and factors influencing Chinese high school seniors, especially in the context of pandemic-related disruptions and the reopening of schools. (line 277)

Firstly, the study highlights a substantial difference in sleep quality and duration for Chinese high school seniors between the period of concentrated isolation during the pandemic and after schools reopened. The observed decline in sleep quality and shorter sleep duration after reopening underscores the need for educational institutions and policymakers to consider the impact of changes in daily routines on students' sleep patterns. Secondly, the disparity in sleep quality and duration between commuter students and residential students emphasizes the importance of living arrangements as a contributing factor. Residential students have a longer sleep time, while going home to sleep can increase sleep efficiency although this is not necessarily a good thing. Recognizing these differences can aid in developing strategies to address the specific needs of both groups. The implications extend to the role of school start times and daily schedules. The study suggests that earlier school start times negatively affect sleep duration, which in turn influences students' daytime functioning. Thus, revisiting school start times and scheduling arrangements could have potential benefits for students' sleep and overall performance. Additionally, the findings suggest that female students' sleep patterns warrant particular attention due to the observed differences in sleep duration and quality between genders. Acknowledging these disparities and their potential impact on female students' well-being can lead to tailored interventions and support mechanisms. (line 283)

Tables.

The tables appear to be analyzing individual item responses from the PSQI. This is not clearly stated and difficult to determine the meaningfulness of the numbers.

Reply 52: The purpose of these tables is to compare the scores on the seven components of the PSQI from the two surveys and to determine whether there are significant differences between them. A higher value represents a poorer performance of the item. This compares the performance

of the two stages of sleep.

If you have PSQI data then you can report sleep efficiency as percentages.

Reply 53: In 3.3.2 Comparison of sleep quality for commuter students before and after school reopened, a comparison of sleep efficiency displayed as a percentage is added.

Changes in the text: The second sleep efficiency (M=93.5%, SD=0.0726) was higher than the first sleep efficiency (M=92.1%, SD=0.1131). (line 214)

I would recommend providing a table with sleep parameters, such as Time in Bed, Sleep onset, Terminal awakening, TST, and PSQI scores.

Reply 54: We also planned to use such a table at the beginning. There are two reasons why this table is not provided: 1. The useful data is presented in text, and the table will be repeated if it is made; 2. The data in the result part is presented in different sub-sections, and there is no suitable place to insert this table.

Reviewer B

This manuscript aimed to explore the differences in sleep quality between commuter students and residential students, as well as to identify factors that are associated with their sleep quality.

It is a manuscript that deals with a current and important topic.

I have some comments:

The importance of sleep quality has recently been re-evaluated during the pandemic and this has also been underlined by the AHA association which has included sleep quality in the assessment of factors affecting future cardiovascular risk.

As suggested by the AHA consensus, one way to assess lifestyle factors and their impact on cardiovascular health is by evaluating the Life's Simple 7 or Life's Essential 8. Originally defined in 2010, the Life's Simple 7 framework includes seven key health factors: diet, physical activity, no smoking, body mass index, blood pressure, lipids, and blood sugar. This framework provides a comprehensive approach to assessing and promoting cardiovascular health. In a more recent update, sleep health was included as an eighth factor, resulting in the Life's Essential 8 framework.

This topic should be brought up for discussion and I suggest quoting:

- Lloyd-Jones DM, Hong Y, Labarthe D. et al. on behalf of the American Heart Association Strategic Planning Task Force and Statistics Committee. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's Strategic Impact Goal through 2020 and beyond. *Circulation* 2010;121:586–613. doi: 10.1161/CIRCULATIONAHA.109.192703

- D'Ascenzi F, Sciacaluga C, Cameli M. et al. When should cardiovascular prevention begin? The importance of antenatal, perinatal and primordial prevention. *Eur J Prev Cardiol.* 2021;28(4):361-369. doi: 10.1177/2047487319893832.

Reply 1: Sleep is indeed related to cardiovascular risk. We added a description to the Introduction and cited related literature.

Changes in the text: The American Heart Association has included sleep quality in its assessment of future cardiovascular risk factors. Sleep habits play an important role in the prevention of cardiovascular diseases. (line 59)

With regard to the analysis of the impact of the school, the system described is very peculiar, however there is other evidence on the effects of the pandemic on students and their rhythms. A comment in the discussion section would improve the manuscript. as an example I recommend to look at

- Hamvai C, Kiss H, Vörös H, Fitzpatrick KM, Vargha A, Pikó BF. Association between impulsivity and cognitive capacity decrease is mediated by smartphone addiction, academic procrastination, bedtime procrastination, sleep insufficiency and daytime fatigue among medical students: a path analysis. *BMC Med Educ.* 2023;23(1):537. Published 2023 Jul 27. doi:10.1186/s12909-023-04522-8
- Coppi F, Nasi M, Sabatini S, et al. Lifestyle changes during the first and second waves of the COVID-19 pandemic in medical college students: are there gender-related differences?. *Acta Biomed.* 2022;93(5):e2022312. Published 2022 Oct 26. doi:10.23750/abm.v93i5.13694
- Osei Bonsu E, Afetor M, Munkaila L, et al. Association of food insecurity and sleep difficulty among 189,619 school-going adolescents: a study from the global in-school students survey. *Front Public Health.* 2023;11:1212254. Published 2023 Jul 12. doi:10.3389/fpubh.2023.1212254

Reply 2: Thank you for the literature you provided. We have carefully read all three articles and have revised the Discussion section in our manuscript. In addition, we revisited the entire manuscript and made revisions where it was unclear or unreasonable.