Revision round #1

Decision for round #1 :

I would like to thank the authors for the submission of their article "Cigarette smoke exposure as a potential risk factor for sleep problems in pregnant women" and congratulate them on the work carried out for this article.

The aim of the article is to investigate the relationship between active or passive smoking and the onset of three types of sleep problems (i.e. difficulty falling asleep, maintaining sleep and waking up too early) during pregnancy. The authors hypothesized that pregnant women's exposure to nicotine (active and passive) will increase their risk of sleep problems during pregnancy.

Participants were part of a larger study: Corona Mums project. This study included 3365 pregnant women from different parts of Poland, aged 18 to 43 years (M = 30.7, SD = 3.87) who completed an online questionnaire during the covid-19 pandemy. The authors perfomed multivariate logistic regression that included control variables (i.e., socio-demographic, related to pregnancy, and psychological variables)

The authors found that passive smoking is a risk factor for waking up too early but active smoking was not related to any of the sleep problems investigated. However, authors highlighted the roles of the control varibles included in the models performed.

All three reviewers found the article interesting and well-written. I agree with them. They also posed a number of questions that need to be answered and expressed a few concerns that need to be resolved before I can recommend the article.

All their comments are in the document(s) attached. In sum, 3 sections particularly need to be revised.

The background needs to be reinforced (e.g. explicitly state the added value of the article, explain and/or discuss the particular context of covid).

In the introduction, the section on COVID-19 was rewritten and the following paragraph was added:

"In addition to all other issues, the COVID-19 pandemic and the related restrictions (Alimoradi et al., 2021), i.e. uncertainty of the future, and limited access to medical care, have further burdened expectant mothers (Jahrami et al., 2021), contributing to numerous health and psycho-emotional problems and the need to find a way to cope with them (Ahlers-Schmidt et al., 2020; Wrześniowska et al., 2024, Żyrek et al., 2024). A meta-analysis published by Alimoradi et al. in 2022, presenting data collected between December 2020 and July 2021, found that pregnant women experienced a significant decrease in sleep quality (of about 13%), during the COVID-19 pandemic noting that the short- and long-term consequences of such sleep changes in pregnancy and offspring outcomes are unclear and require further research (Alimoradi et al., 2022)."

Also, we added an excerpt: "We believe that the different approaches published in the other articles, the analysis of sleep dysfunctions (division into 3 different categories), and the unique pandemic context add value to the article, which will allow to gain another portion of knowledge about the studied issue."

Methods need to be clarified (e.g. choice of questionnaire, variables, duration or dates of data collection) and alternative or complementary analyses were proposed.

The discussion section needs more explanation of the results, a section devoted explicitly to strengths and limitations could be written, and the conclusion needs to be revised.

Many thanks to all reviewers for their excellent comments and suggestions. The three sections mentioned above are discussed in response to each comment below.

I had some comments and questions (on my own) to add to their reviews :

The authors highlighted the possible bias due to the stimatization of pregnant women who smoke during pregnancy. This is an important point. What about the "discret way" (less visible) to have the daily nicotine dose (patch, gum...)? The women could have stop smoking but still be expose directly to nicotine.

Thank you for highlighting this issue. However, we do not have information regarding whether the study participants used alternative methods of nicotine intake, such as gum, patches, or nicotine sachets. The questionnaire only inquired about traditional cigarette smoking. We believe that the reviewer's suggestion should be considered an important constraint for the analysis conducted. This issue is now mentioned in the limitations section.

The difference between before and during the pregnancy can be discuss for some variables. For instance : the smoking cessation (because of the health problem, or the social pressure) was not investigate or discuss. Did some of the pregnant women used to smoke before pregnancy? Did this cessation increase stress, sleep problem? The fact that the women had contracted the covid before or during the pregnancy, or before and during the pregnancy (so, at least twice), could have different impact.

Thank you very much for this meaningful observation. In the questionnaire completed by the participants, there is a question "Have you smoked cigarettes since you found out you were pregnant?" This was a dichotomous variable. Our primary research question was the correlation between cigarette smoke (active and passive) and sleep issues. Hence the wording of the survey. Unfortunately, based on the answers, we are unable to determine whether pregnant women smoked cigarettes before becoming pregnant, and if so, what was the reason for the cessation. We agree that the lack of this information may influence interpretation of our results and drawing conclusions. In the case of contracting COVID-19, we have information on whether the participant was ill during data collection (May 2020-September 2021), but no details regarding the course of the disease and the number of cases during pregnancy. We included both of the above issues (no information on smoking before pregnancy, and no information on the number of COVID-19 cases) in the limitations section.

The authors stated that the research followed the guideline of the bioethics committee. However it is not clear for me if this particular study obtain an ethic committee agreement.

This particular study (on the association between smoking and sleep problems in pregnant women) is part of a larger project called Corona Mums. All data collected within this project was approved by the Bioethics Committee of the Jagiellonian University, with opinion number 1072.6120.359.2020, dated 16/12/2020. This information can be found in the manuscript.

The coding of "trimester of pregnancy" (LL 200-201) is not clear for me.

Thank you for pointing this out. Participants were in the 1st, 2nd, or 3rd trimester of pregnancy. Trimester of pregnancy was dummy coded, where trimester 1st was a reference level to trimester 2nd and trimester 3rd, respectively). The coding has been corrected in the manuscript.

I wonder how missing data were managed.

The analyses, presented in this manuscript, had no missing data.

Information added to the main text: "Only cases with no missing data were included in the analysis".

The article also contain some typos (e.g., foetus or fetus : both appear in the article, L102 the brackets).

Thank you for pointing this out. The typos have been corrected.

Finally, is it possible to add a figure that illustrate your results?

In this case, we are afraid that, due to the number and complexity of the variables, the illustration of the results may be unreadable or even misleading for the reader. In the logistic regression, we have included multiple confounding variables, and we analyze three sleep variables and two different independent variables (active and passive smoking) - we do not think that visual presentation of the results will actually make the interpretation of the results easier. Nevertheless, if the editor or reviewers disagree, we will gladly follow their instructions on how to design a readable figure.

Some of these articles (not exhaustive) may be helpful https://jcsm.aasm.org/doi/pdf/10.5664/jcsm.8930

https://onlinelibrary.wiley.com/doi/pdfdirect/10.1111/jsr.13432

https://www.thelancet.com/pdfs/journals/eclinm/PIIS2589-5370(21)00196-6.pdf

https://doi.org/10.1016/j.pec.2020.09.031

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7295479/

We greatly appreciate the articles you provided. We have incorporated them into the manuscript.

Thank you again for submitting your article to PCI health and movement science. I hope these comments will be useful.

Many thanks for recommending the relevant references and all the insightful comments.

Overview and general recommendation:

Thank you for giving me this opportunity to read this interesting manuscript. I have a few comments and I hope they will help to improve the overall quality of the article.

Introduction:

I have the feeling that the Introduction section is pretty straightforward and nicely introduces the aim of the study.

Methods and results:

1- I think it would be worthwhile to add the references that were used to create the administered questionnaires. Were they validated by previous studies? What were the exact questions? Thank you very much. If the scales were not validated, it should be at the very least mentioned as a limitation in the Discussion section.

The following questions were asked to verify whether the participant smoked during pregnancy (active smoking) and her exposure to nicotine smoke (passive smoking):

1) Have you smoked cigarettes since you found out you were pregnant? - yes/no

2) Do people in your immediate environment smoke cigarettes in your presence (traditional or electronic)? yes/no

Sleep problems of pregnant women were assessed in 3 categories - a) difficulty falling asleep (yes/no), b) difficulty maintaining sleep (yes/no) c) waking up too early (yes/no). Questions on smoking and sleep were author-designed and not reviewed in previous studies (added in the Discussion, in the limitations section).

2- What does "city100,000 =1" refer to? Could authors please clarify this point in the main text (as done in Table 1)?

In the description of the reference group in the main text, typos crept in, which have been corrected to city<100,000 residents=0 vs. city>100,000 residents=1. According to the text, table 1 has also been supplemented with missing information.

3- Just a point of curiosity: have authors considered combining active and passive smoking together? So, we would get four categories: "active + passive smoking"; "active smoking only"; "passive smoking only" and "neither active nor passive smoking".

Yes, such analysis were conducted, and the results are largely consistent with those presented in this manuscript. We found that the differences between the abovementioned four smoking categories in three different sleep problems were not statistically significant. However, in this case, adding three more variables that have a small sample size relative to the total sample and the nature of the study, which focuses on pregnant women, does not appear to be of primary importance. The results of this analysis are provided as supplementary materials (Supplementary Materials 3).

4- Were variables scaled and mean-centered before computing logistics regressions?

Yes, the variables were scaled and then mean-centered.

5- I am not an expert in these analyses, but I don't think that odds ratios can be interpreted as a percentage of reduction in risks (see Norton et al., 2018, JAMA, 10.1001/jama.2018.6971 for example). Could authors please clarify their interpretation of odds ratio?

In the present manuscript, we investigated how much greater or lesser the occurrence of sleep disorders (described in 3 categories) is in a group of pregnant women who smoke passively or actively compared to a group of non-smokers. If OR≈1, it means that the chance of the event occurring in either group is similar. If OR<1 means that there is a lower chance of an event occurring in the study group compared to the reference group. If OR>1, it means that there is a greater chance of an event occurring in the study group compared to the reference group. Interpretation of the results obtained from logistic regression analysis can be done using a percentage scale in estimating the relative risk, depending on what the confidence interval score is.

The described results were further discussed taking into account the reviewer's suggestion.

6- I would be curious to examine the univariate associations between smoking status and sleep patterns. For

example, it is possible that depression or anxiety could mediate (and blur) the association between smoking status and sleep (e.g., smoking ◊ depression ◊ sleep problems). Maybe that these univariate associations could be displayed in Table 1?

We have added univariate associations to supplementary materials (Supplementary Materials 2). If we were to add univariate associations between smoking status and sleep patterns, two additional tables of results would be created. Including all results in a single table (Table 1) would make it difficult to read.

Discussion:

1- I have the feeling that results should be discussed with a bit more caution in some parts of the Discussion section. For example, the sentence "Similarly, in our study, we found that women in the 3rd trimester reported 2 - 3 times higher occurrence of sleep problems, than women in earlier stages of pregnancy" does not echo the findings of Danilov et al., (2020) that focused on the links between smoking status and sleep, at different stages of pregnancy.

Thank you for this comment. Danilov et al. (2022) also showed that sleep quality deteriorated toward the end of pregnancy, while sleep duration remained stable over time. In the context of sleep quality, this is a result, in our opinion, similar to that presented in this manuscript. Although in our study we did not measure sleep duration per se. Difficulties in falling asleep in the 3rd trimester of pregnancy could result in poorer sleep quality for pregnant women, which is congruent with Danilov et al. (2022).

In the same perspective, the conclusions that are drawn from the study should be tempered: for example, "we suggest that nicotine exposure during pregnancy might have a potentially detrimental impact on a mother's sleep quality". Regarding high rates of Type 1 errors due to multiple tests and with a single significant association (without applying false discovery rate methods), I don't think that the evidence is strong enough to support this claim. Maybe authors could consider rephrasing this type of sentences?

The sentences were reformatted according to the reviewer's instructions: "Summarizing, we suggest that smoking exposure during pregnancy might have a potentially detrimental impact on a mother's sleep quality, yet the limitations of the study should be taken into account when interpreting the obtained results."

2- As nicely introduced (Lines 392-394), it could be relevant to examine the correlates of smoking status? Maybe authors could consider adding a correlation table between smoking status and demographic/psychological variables?

Correlations between smoking status and demographic/psychological variables were calculated. As suggested by the reviewer, we added the analysis to the manuscript, but as a supplementary file to the whole analysis (Supplementary Materials 1). We would like the main text to present the results of the most important analyses whose results answer the research problem posed.

3- The only significant association is between passive smoking and waking up too early. I struggle to understand why this significant association emerged for passive smoking, not for active smoking? And why it emerged only on this indicator of sleep patterns. I think that power issues partly account for the non-significant associations, but a more in-depth discussion of these results would be welcome. Thank you.

The appearance of a significant association between passive smoking and not in active smoking, in the context of waking up too early, could be explained by statistical reasons: the number of women who smoke passively vs. active smokers (pregnant women exposed to cigarette smoke are twice as many as pregnant women who smoke actively), the low statistical power to detect active smoking effect on sleep patterns. which could explain the non-significant associations. Unfortunately, due to the specificity of the topic, and thus the small number of papers on the subject, all the reasons presented should be considered as an attempt to explain the described issue. It is worth noting that there may be other direct or indirect causes of too early awakening that have not been analyzed, and exposure to cigarette smoke masks them or is an indirect factor, e.g. cigarette smoke inhalation may increase oxidative stress, leading to awakenings during the night.

The issue described above was added to other causes presented in the manuscript.

4- I think that limitations of the previous study would deserve to be mentioned in the Discussion section: self-reported nature of the data, lack of adjustment for important covariates (e.g., physical activity, food-related behaviors), cross-sectional nature of the data.

The limitations mentioned by the reviewer were added to the manuscript. Thank you for pointing that out.

I wish the best of luck to the authors for their ongoing projects.

Silvio Maltagliati

Review by Florian Chouchou, 27 Jul 2024 10:45

Ciochon and colleagues propose an interesting study on risk factors for sleep problems in pregnant women. They examined cigarette smoke exposure through an online survey conducted during the COVID-19 pandemic, involving 3,365 Polish adult women. Their findings revealed a higher independent risk for sleep problems associated with passive smoking, but not with active smoking. They utilized logistic multivariate analysis for this study. However, several issues undermine these results:

Major comments

· What is the added value of the article to the existing literature? Previous studies have shown the increased risk in pregnant women. What new insights do these findings provide? Specifically, how can the absence of an effect for active smoking be explained?

The study presents 3 different sleep dysfunctions (usually, authors treat sleep problems as one dichotomous variable, without dividing by type of problem). The differences in the results according to the sleep dysfunctions indicate that it is necessary to consider these issues in more detail than before, allowing new information to be gained about their causality, which will thus help propose more effective solutions. It is worth noting that the article additionally pays special attention to the importance of exposure to cigarette smoke on the health of pregnant women, which has been less frequently studied so far, showing its adverse effects on sleep. The lack of association between active smoking on sleep in pregnant women may be due to the small number of smoking pregnant women vs. non-smokers, which significantly affects the statistical results. This is one of the limitations of the study, which we mentioned in the Discussion section.

· The questionnaires regarding sleep pose a problem: only three binary (yes/no) questions about sleep were used, leading to coarse response sampling – is this why there was a lack of responses from smokers? Other validated questionnaires exist in the literature. Why were they not used? Have other studies used or validated the sleep questions you used? This point should at least be addressed in the limitations section.

Questions presenting sleep problems during pregnancy are part of the questionnaire assessing the physical health of participants in the longitudinal Corona Mums project. The investigation of sleep problems was an additional goal of the Corona Mums Project. Although there are questionnaires in the literature that assess sleep problems, they were not used in the project, due to the main objectives of the project (to investigate how chronic stress levels are related to the health of mothers and their children). The used sleep questions were author-designed and had not been utilized in previous studies (this information was added to the discussion and the limitations section).

On the other hand, the small number of female smokers is due to the peculiarities of the survey group - these are pregnant women, mostly residents of large cities, with higher education, with access to the Internet. The study group is not a representative group, which is a limitation of the study and affects the results of the analysis (added in the discussion, in the limitations section).

· Sleep disorders exist even in the absence of pregnancy. The lack of a control group does not allow for a real estimation of the disorders. This point should also be addressed in the limitations section.

Thank you for this comment. We will add the lack of a control group as another limitation of our analysis.

· In the analyses, segmenting into three different analyses excludes the exploration of the most severe profiles: those who accumulate all three types of sleep disturbances. I recommend constructing profiles with 3 sleep disturbances, then 2, then 1.

Thank you very much for your suggestion, the results of the analysis were added to the supplementary materials, in the file: Supplementary Materials 4.

· A large part of the analyses in the results section does not relate to the objectives. These parts should be

removed or significantly reduced.

The analyses we performed fully allowed us to verify our research hypotheses, taking into account the most relevant associated variables, selected based on the available scientific literature. All the results obtained are presented in tables, as well as described in the text. However, we realize that the amount of text may be too much, so we have shortened the descriptions of the results for the accompanying variables used in the models.

· Caution, the results do not support the conclusion: nothing in this work allows us to say that nicotine is at play here.

Thank you for pointing this out. Indeed, the use of the word "nicotine" in the article may be confusing to readers, since we have not measured nicotine levels and are not sure if it is the nicotine contained in cigarettes or cigarette smoke that affects sleep. Perhaps another substance contained in their composition is responsible. Therefore, we have replaced the passages that used the word nicotine with "smoking", where possible.

· For the variables of interest (smoking), an initial step with univariate models would be informative, followed by a complete model.

Thank you for your suggestion, the univariate models have been calculated and presented in the supplementary materials (Supplementary Materials 2).

· Other variables should be included in the model: chronic diseases: gestational diabetes, hypertension, etc.

The "Pregnancy complications" variable is the sum of all complications such as chronic diseases during pregnancy, i.e. hypertension, diabetes, anemia, and thyroid disease. Due to the number of various complications and a low number of mothers reporting particular complications, we decided to include solely to composite variable and not all possible listed complications. The mentioned complications were added to the manuscript in section 2.1. Study group.

· The particular context of COVID-19 should be discussed in more detail: it is not an ordinary context.

Thank you for the suggestion. The context of COVID-19 is discussed in more detail in the Introduction section, as mentioned in the response to Rev. 1

· As you point out in the text, the quality and quantity of sleep are two elements related to health and vulnerability. There is no exploration of sleep duration (number of hours) and its quality (e.g., "I slept well"). These points should be discussed in the limitations section at a minimum.

Thank you for the suggestion. Data on sleep duration was not gathered. We added the lack of information on sleep duration and quality to the limitations section.

<u>Minor comments</u>

· The references are not always relevant: Lester 2013 does not include sleep in Maslow's hierarchy.

Thank you for your suggestion. The reference has been changed to: Taormina, & Gao. (2013). Maslow and the Motivation Hierarchy: Measuring Satisfaction of the Needs. The American Journal of Psychology, 126(2), 155. doi:10.5406/amerjpsyc.126.2.0155.

· Missing definition of passive smoking exposure.

We have now added the definition to the Introduction section: Passive smoking, also known as second-hand smoke, refers to the involuntary inhalation of smoke from cigarettes or other tobacco products by nonsmokers [Nelson, 2001].

· Lack of references: lines 62, 83, 114.

Thank you for bringing our attention to this. We added the missing references.

·   Introduction: Sleep problems also affect men.

We agree with this information. We have added this information to the introduction section of the sentence:
From a biological standpoint, sleep plays a vital role in regulating hormones, cognitive functions, and the immune system's performance, aiding the body in fighting pathogens, both in men and women (Alimoradi et al., 2022; Besedovsky et al., 2019). According to the National Sleep Foundation, adults between the ages of 18 and 64 should aim for 7 to 9 hours of sleep per night (Chaput et al., 2020). Studies indicate that sleep problems are increasingly common, especially among women, who are more likely than men to report sleep difficulties, with one-third of women not getting enough sleep, particularly during pregnancy (Delgado & Louis, 2022).

·   Incorrect reference: line 120 is not relevant.

Thank you for your attention. The reference has been changed: Pataka A, Kotoulas S, Kalamaras G, Tzinas A, Grigoriou I, Kasnaki N, Argyropoulou P. Does Smoking Affect OSA? What about Smoking Cessation? Journal of Clinical Medicine. 2022; 11(17):5164. https://doi.org/10.3390/jcm11175164

·   The percentages presented in the results need to be explained in the methods.

Thank you for your suggestion. We have analyzed the obtained results once again and the percentages result from the interpretation of the regression results (OR values). We have added a sentence to the manuscript: We used the percentages calculated from the obtained ORs for each variable in the models to describe the results.

·   The names of the models (1, 2) should also be explained.

In section 2.3 Statistical Analysis in the article: "with "Model 1" referred to active smoking, while "Model 2" referred to passive smoking."

Responses to PCI questions

-     Does the title clearly reflect the content of the article? Yes

-     Does the abstract present the main findings of the study? Yes

-     Are the research questions/hypotheses/predictions clearly presented? No. No differentiation between the hypotheses of active and passive exposures.

-     Does the introduction build on relevant research in the field? No. The introduction is rich in references but a bit long and confusing, and it does not present the interest of the study here.

-     Are the methods and analyses sufficiently detailed to allow replication by other researchers? Yes

-     Are the methods and statistical analyses appropriate and well described? Yes

-     In the case of negative results, is there a statistical power analysis (or an adequate Bayesian analysis or equivalence testing)? No. The most vulnerable profiles are not studied here.

-     Are the results described and interpreted correctly? Yes

-     Have the authors appropriately emphasized the strengths and limitations of their study/theory/methods/argument? No. Several limitations are not presented.

-     Are the conclusions adequately supported by the results (without overstating the implications of the findings)? No, not the last conclusion.

Review by Jean-Philippe Chaput , 19 Jun 2024 17:19

This paper examines whether cigarette smoke exposure is a risk factor for sleep problems in pregnant women. The authors found that passive smoking is a risk factor for sleep problems in pregnant women, especially in the aspect of waking up too early. However, active smoking was not related to sleep problems. The paper is interesting and well-written. However, some aspects need to be clarified.

Abstract: The study design (i.e. cross-sectional) should be indicated. Years and months of data collection should also be mentioned.

We agree with this remark. We added in the abstract that the results presented in the article were prospective project, conducted from May 2020 to September 2021.

Introduction: Good section but quite long. Introduction sections should be concise and typically include 5 key things: (1) the problem; (2) what we know on the topic (existing evidence); (3) what this study adds (originality); (4) objective; and (5) hypothesis. I feel that point 3 is a bit missing. Authors should make the knowledge gaps more obvious and tell the readers how the present study will address them (i.e. incremental knowledge).

Based on previously published articles on this topic, we believe that the analysis of sleep dysfunctions presented in this manuscript, divided into three different categories not yet used in other work, along with the context of the COVID-19 pandemic, adds value to the article. The results obtained may draw attention to other aspects not yet analyzed, leading to incremental knowledge and serving as a starting point for further exploration of the topic.

In the introduction, the section on COVID-19 was rewritten and the following paragraph was added:

"In addition to all other issues, the COVID-19 pandemic and the related restrictions (Alimoradi et al., 2021), i.e. uncertainty of the future, and limited access to medical care, have further burdened expectant mothers (Jahrami et al., 2021), contributing to numerous health and psycho-emotional problems and the need to find a way to cope with them (Ahlers-Schmidt et al., 2020; Wrześniowska et al., 2024, Żyrek et al., 2024). A meta-analysis published by Alimoradi et al. in 2022, presenting data collected between December 2020 and July 2021, found that pregnant women experienced a significant decrease in sleep quality (of about 13%), during the COVID-19 pandemic noting that the short- and long-term consequences of such sleep changes in pregnancy and offspring outcomes are unclear and require further research (Alimoradi et al., 2022)."

Also, we added an excerpt: "We believe that the different approaches published in the other articles, the analysis of dysfunctions with sleep (division into 3 different sleep categories), and the unique pandemic context, add value to the article, which will allow to gain another portion of knowledge about the studied issue. "

Methods: It's not clear if the sample is a convenience sample of pregnant women or a random sample. This has implications for possible biases and external validity. Lines 172-176 are about the Results, not the Methods. This text should be moved to the Results section. With regard to the 3 sleep questions, have they been validated?

Participants in the project were recruited through various channels such as social media, local radio broadcasts, newspapers, and websites dedicated to pregnant women. The analysis excluded women with multiple pregnancies or serious complications during pregnancy, including genetic and developmental defects in the child, metabolic diseases of the mother (such as diabetes or thyroid disease), and the use of alcohol or other addictive substances during pregnancy. Due to the prevailing epidemiological conditions, the survey was conducted online and was limited to one report per device.

The sample is a convenience sample (added to the main text).

Lines 172-176 present the study group and are part of Table 1. The results section contains only the results of the regression performed. Moving lines 172-176 will result in a loss of consistency of information about the study group.

Sleep questions were author-designed and not reviewed in previous studies (added in Discussion, in the Limitations section).

Results: Please report only 2 decimals for the ORs and 95% Cls.

Thank you for bringing this to our attention. OR and 95% CI values were truncated to two decimal places.

Discussion: A paragraph highlighting the main limitations of this study should be included before the conclusions. Furthermore, the authors are encouraged to provide an explanation or at least speculate on the odd fundings observed, i.e. that only passive smoking and not active smoking was associated with sleep problems in pregnant women.

The limitations section was moved before the conclusions, and possible reasons/speculations on the results obtained have also been added.