**Peer-review Comments and Author Responses**

**Reviewer 1**

Answers for the Reviewer 1

INTRODUCTION:

1. *Please review epidemiological data about depression since rates mentioned are not in line with the words described on the text: 13.5% cannot rise to 11.5%. Additionally, it is not clear if the rate corresponds to adults living in the community or adults in need of homecare health.*

Answer: Thank you for your valuable feedback. We appreciate you pointing out the inconsistency in the depression prevalence rates mentioned in our introduction. You are correct that a rate cannot simultaneously rise and fall.

We have reviewed and corrected the text to clarify the disparity in depression prevalence across different care settings based on data from the Centers for Disease Control and Prevention (CDC) (2022).

2. *Please review first paragraph as the paraphrased text is too similar to the original text from the CDC website.*
    a. *"Some estimates of major depression in older people living in the community range from less than 1% to about 5% but rise to 13.5% in those who require home healthcare and to 11.5% in older hospitalized patients".*

Answer: Thank you for your keen observation regarding the paraphrasing of data in our first paragraph. We acknowledge that the original wording was overly similar to the source material from the CDC website. We have revised the paragraph to ensure clarity and originality while accurately reflecting the data.

3. Please cite reference for this statement "Furthermore, depression profoundly impacts older adults' lives, leading to a range of issues, including physical and cognitive impairment, social isolation, and increased mortality risk".

**Answer**: Thank you for highlighting the need for proper citation in our manuscript. We appreciate your attention to detail. We have reviewed your comment and revised the text to ensure proper citation.

4. *Please review third paragraph English composition. It states… "the study <u>further</u> found". However, it is not clear what was the first finding.*

Answer: Thank you for highlighting the potential ambiguity in the third paragraph of our manuscript. We appreciate you bringing this to our attention.

We agree with your observation that the phrase "the study further found" in the original wording implied a prior finding, but without explicit mention, created potential ambiguity. We revised the cited studies and provided more details regarding the cited studies that would enhance clarity and context. Revised for English composition.

5. *It is not clear what are the methods, population and findings of the study you are replicating.*

Answer: Thank you for raising this important point. We have added a section to the text that explicitly outlines the methods, population, and findings of the study we are replicating (Rothon et al., 2010).

METHODS:

6. *Important information is missing from the methods sections:*
    a. *What were the multivariate regression model covariates, and why were they chosen for the model.*

Answer: Thank you for your inquiry. We acknowledge the importance of clearly outlining the covariates used in our logistic regression models. In our study, we employed various covariates chosen based on established risk factors for geriatric depression and their potential influence on the association between physical activity and depression. These covariates were:

- Demographic factors: Age, sex, race, and region of residence.
- Health factors: History of chronic kidney disease, heart disease, diabetes, sleep problems, and pain.
- Lifestyle factors: Social life and engagement in entertainment activities.
- Marital status: Partner (defined as anyone with a partner vs. no partner).

We excluded marital status with its original four categories (single, divorced, widowed) due to insufficient differentiation and opted for a simpler "partner" variable.

Addressing Overlap in Physical Activity Data:

> You've rightly identified the overlap in participant responses regarding physical activity intensity and frequency. To address this challenge, we created a new binary variable called "weeklyPA." This variable indicates any physical activity (including walking for at least 10 minutes) performed at least once a week. This approach was necessitated by the observed overlap in responses across intensity levels.

Explanation of Model Selection:

> We performed logistic regression models twice: once with depression as the outcome and once with CES-D category as the outcome. The selection of covariates for each model aimed to capture the most relevant factors influencing the specific depression measure used.

b. *Were appropriate statistical methods used for survey data analysis that account for strata and sampling weights? If not, please provide justification.*

Answer: ELSI-Brazil it is a Population-Based: Population-based studies typically aim to represent the entire population and often use simple random sampling, which wouldn't require weighting or stratification.

*7. There is no clarity on what changes were incorporated in the sensitivity analysis to assess robustness of findings compared to the results of the primary analysis.*

Answer:

RESULTS:

8. *Included figures do not add important information to the paper. Figure 1 explains what is already written in the introduction and the pie figure information is already displayed on Table 1.*

Answer: Thank you for your careful review of our manuscript. While we value your input on Figure 1, we respectfully wish to retain it for the following reasons:

- Visual Impact and Accessibility: We believe Figure 1 provides a clear and concise visual summary of the impact of physical activity and depression on older adults. This serves as a visually engaging entry point for readers, potentially attracting attention and enhancing understanding of the core themes of our study.
- Diverse Readership: Scientific articles can be dense for some readers. We feel a visual representation can improve accessibility for a broader audience and enhance comprehension even for those already familiar with the topic.
- Complementary to Text: While we acknowledge that our introduction already discusses these concepts, we believe Figure 1 offers a complementary presentation of the information. Visual elements can reinforce key points and aid in the retention of research findings.

Thank you for your valuable feedback on Chart 1. We carefully considered your suggestions regarding alternative representations and the potential redundancy with Table 1.

Regarding the suggestion for a histogram:

We acknowledge that a histogram would indeed offer an alternative visualization of the distribution, allowing readers to assess both the proportion and raw number of participants within each category.

Rationale for removing Chart 1**:**

After careful consideration, we ultimately decided to remove Chart 1 to prioritize clarity and conciseness in the presentation of our findings. Here's our reasoning:

* Clear Information in Table 1**:** We believe that Table 1 accurately and clearly conveys the same information as Chart 1. In the interest of avoiding repetition and visual clutter, we chose to streamline the presentation by relying on the Table.

* Focus of Study**:** Our primary focus is the association between physical activity and depressive symptoms. While the demographic distribution of our sample is relevant background information, it is not a major emphasis of the analysis.

9. *Table 2 can be improved for clarity. Please consider leaving the TITLE of the table in one whole line, and the headings for the columns in a different row. Also, covariates for the multivariate model are usually listed as a footnote in the table, instead of expressing the OR for each individual covariate, unless it is important for the conclusions to see the effect of each independent covariate on depression.*

Answer: Thank you for your feedback on Table 2. We appreciate you pointing out areas for improvement in clarity.

Table 2 has been revised for improved clarity. We've implemented a single-line title and separated column headings for better readability.

DISCUSSION:

10. *Please justify how the results of the study support your conclusions. It seems that the effect of exercise differs according to the two definitions of depression and do not have a clear relationship with the frequency or intensity of exercise. When depression was diagnosed by physician, only vigorous exercise more than once a week and low intensity once a week had a significant effect, but moderate exercise at any frequency or low intensity at higher frequency did not have a significant effect, which does not support a clear effect of exercise. Also, when depression was diagnosed by CES-Scale, there was no effect of exercise on depression at any intensity or frequency which further limits the interpretation of the findings.*

Answer:

Thank you for pointing out that we need to justify better. It is a complex relationship that is affected by the way depression was measured, since the physician diagnosis reflect a clinical perspective that the CES-D scale doesn't. Since this is the case we changed the discussion stating that the study indicates that vigorous exercise may protect against depression, with moderate and low-intensity exercise showing less clear benefits, and highlights that the method of assessing depression significantly influences the perceived relationship, suggesting the optimal type and intensity of exercise for mental health benefits may vary by individual and diagnostic approach.

**Reviewer 2**

11. *A more comprehensive and detailed overview of your statistical methods, particularly regarding logistic regression assumptions and their validation, would be required. In addition, while the selection of logistic regression is adequate for the purposes of the analysis, ELSI data is obtained from survey designed to ensure Brazil's population representativeness. Omitting this aspect can have implications for the interpretation of the data and its conclusions. Thus, a deeper discussion of potential biases, where you can discuss and expand the implications of the observational nature of your study is suggested.*

Answers for the Reviewer 2:

Answer: Thank you for this comment, Due to the nature of our data which uses surveys as the information source, we used the command svy:logistic. Because our 2 outcomes CESDcat and depression were both dichotome we used logistic regression with the covariates which were proven to be associated with senile depression and were defined well in this dataset.

12. *You also need to state the statistical model justification, clearly articulating your rationale for choosing logistic regression over other models, such as Poisson regression, as well as the selection of the covariates included in your final model.*

Answer: Thank you for this comment, Due to the nature of our data which uses surveys as the information source, we used the command svy:logistic. Because our 2 outcomes CESDcat and depression were both dichotome we used logistic regression with the covariates which were proven to be associated with senile depression and were defined well in this dataset.

13. *The use of single participants instead of a survey design could greatly limit the statistical power of the study. This is because the ability to detect a true effect or association often depends on the size of the sample. With larger samples, typically obtained through surveys as is the case of the ELSI study, there is greater power to discern true relationships from noise. Additionally., survey methods also allow for more complex analyses, like multivariate analysis, which can be critical in understanding multifaceted phenomena.*

Answer: We used the multivariate svy:logistic regression here. Because some of the covariates were associated with each other we investigated intensively to bring clinically important covariates, which are not associated with each other in our multivariate log reg, After that we tested the goodness of fit with estat gof command to see if our model is fit or not.

14. *When addressing the discussion and conclusions, you need to discuss how representative this sample is of the broader older adult population in Brazil. Consider factors like geographic, socio-economic, and ethnic diversity that might affect your conclusions. If there are limitations in representativeness, acknowledge how this might affect the generalizability of your findings.*

Answer:

Thank you for your recommendation, we added information about how the predominance of urban residents and specific racial groups may limit the extent to which our findings can be generalized to the entire older adult population in Brazil.

15. *As is stated in the manuscript's conclusions, the study relies on self-reported data for physical activity and depressive symptoms, you could discuss the potential for problems such as recall bias or social desirability bias. These aspects could affect the accuracy of the data, as participants might underreport depressive symptoms or overreport physical activity.*

Answer: Thank you for your recommendation, we added that both the original study and the replication study relied on self-reported measures of physical activity, which can be prone to inaccuracies due to recall and social desirability bias.

16. *Finally, the manuscript requires improvements in English syntax and grammar for clearer communication of your findings.*

Answer: Thank you for your valuable advice. We improved the grammar and communication findings.

Additional Comments:

17. *Given the unique demographic and cultural aspects of Brazil, a more detailed discussion of how these factors influence your study's findings and their relevance to Brazil's public health landscape would be beneficial. This is particularly important given the source of the ELSI study data.*

Answer: Thank you for this comment, we added it in the discussion section.

18. *Your document doesn't follow the recommendations to cite the ELSI survey, as it omits "ELSI" from the title, and omits to mention its funding as required by the ELSI collaboration (https://elsi.cpqrr.fiocruz.br/data-access/).*

Answer: We would like to thank you for your valuable feedback. We have carefully considered your recommendations and have made the necessary revisions to our document. We have now properly cited the ELSI survey by including "ELSI" in the title and acknowledging its funding as required by the ELSI collaboration. Additionally, we have ensured that the ethical approval from ELSI has been appropriately acknowledged.

19. *A division by depression, such as one column displaying each attribute displayed for an extra characteristic, such as depressed vs. non-depressed participants, could improve Table 1.*

Answer: Thank you for the suggestion to divide Table 1 by depression status (depressed vs. non-depressed participants). We appreciate your feedback and considered this approach.

However, in this initial analysis, our primary aim is to present the overall characteristics of the study population. We believe the current format effectively highlights the key demographics and physical activity levels of the older adults participating in the study.

20. *Chart 1 could be redrawn as a histogram displaying frequencies. This would allow the readers to evaluate both the proportion and number of participants for each of the categories, instead of just evaluating the proportion as part of the total.*

Answer: Thank you for your valuable feedback on Chart 1. We carefully considered your suggestions regarding alternative representations and the potential redundancy with Table 1.

Regarding the suggestion for a histogram:

We acknowledge that a histogram would indeed offer an alternative visualization of the distribution, allowing readers to assess both the proportion and raw number of participants within each category.

Rationale for removing Chart 1:

After careful consideration, we ultimately decided to remove Chart 1 to prioritize clarity and conciseness in the presentation of our findings. Here's our reasoning:

Clear Information in Table 1: We believe that Table 1 accurately and clearly conveys the same information as Chart 1. In the interest of avoiding repetition and visual clutter, we chose to streamline the presentation by relying on the Table.

Focus of Study: Our primary focus is the association between physical activity and depressive symptoms. While the demographic distribution of our sample is relevant background information, it is not a major emphasis of the analysis.

21. *Table 2 displays an extensive amount of information, crucial to the complete understanding of the manuscript, yet, the covariates are only presented as coefficients, without displaying any associated p-value that could help to interpret the models the authors built. In addition, no confidence intervals are shown for the covariates as they were for the main exposure. Finally, the table does not mention the reference value against which all the comparisons are made. This should be clearly stated.*

Answer: Thank you for your thorough review of our manuscript, particularly your feedback on Table 2. We appreciate you highlighting areas where the table can be improved for clarity and interpretation.

We agree that the previous version of Table 2 did not fully present the information needed to understand the models effectively.

In response to your feedback, we have created a revised Table 2 (attached) that incorporates the following changes:

- Inclusion of p-values: We have added p-values for each covariate, allowing readers to assess the statistical significance of their associations with depression.
- We have included the ORs for all covariates. This provides a clearer picture of the other comparisons are made in the table title or a footnote. This ensures a clear understanding of the interpretation. Uncertainty surrounding the estimated effect sizes.

22. *Table 3 displays a sensitivity analysis, however, from the table it is not clear which contrasts are being evaluated as part of it. This should be explained as part of the main text or as a footnote in the table.*

Answer: Thank you for bringing this oversight to our attention. We re-runned the sensitivity analysis to ensure all relevant interactions are captured.

23. *The infographic conveys a summary of the topic reviewed, however, the flow of the topics covered in it is confusing. Arrows stating the order of the concepts could be included to enhance its readability.*

Answer: Thank you for your valuable feedback regarding the infographic's flow. We appreciate you taking the time to analyze its clarity and providing suggestions for improvement. We have improved the infographic by incorporating arrows to illustrate the intended sequence of the presented concepts. We believe this addition will significantly enhance the infographic's readability and guide the viewer through the information in a logical and clear manner.

**Reviewer 3**

Answers for the Reviewer 3

*24. Title*

*1a. The title is succint and properly indicates that the study is a replication of previous work and the main associations that were investigated. On the other hand, it's my understanding that the analysis conducted is a cross-sectional analysis, even though the dataset from which the data originated was created in a prospective cohort, as there is no mention of the time element in any of the analysis. It's important, then, that the title informs the reader about the cross-sectional*

*nature of the analysis, by including the study design. From this point on, I'll continue with the assumption of a cross-sectional analysis in order to give feedback on the paper.*

Answer: Thank you for your valuable feedback regarding the clarity of the study design in the title. We appreciate your expertise and agree that explicitly mentioning the cross-sectional nature of the analysis in the title would be beneficial for readers. While the original title did acknowledge the replication aspect and the main associations investigated, it lacked the crucial detail of study design. Therefore, we have revised the title to explicitly state the cross-sectional nature.

*1b. I'm then assuming that the data was taken from only one of the "waves" of ELSI-Brazil.*

Answer: Thank you for raising this important clarification. You are correct in your assumption. The data analyzed in our study was derived solely from the second wave of the ELSI-Brazil study, conducted between 2019 and 2021

*Abstract*

25. *The abstract reads very well, the flow of the narrative is appropriate and the reader is taken from introduction to discussion with very few distractions. In the methods section of the abstract, it is also important to describe exactly from which of the "waves" from ELSI-Brazil the data used originated from. It's also important to mention the study design. Result section of the abstract is appropriate. The discussion section of the abstract needs work. While the claim that promoting physical activity among older adults might be an effective strategy for preventing depression is not too controversial, and the findings from this study do support that claim, cross-sectional analyses are limited in pointing out causality. Discussing the limitations of cross-sectional and observational analysis as a whole is important in this section. In the abstract, mentioning those two points and adding that the results support previous evidence that points in this direction might be more appropriate.*

Answer: Thank you for your thoughtful feedback on our abstract. We appreciate your suggestions and have revised it to address your points.

Introduction section

26. The introduction uses good sources to convince the reader of the importance of the issue *at hand, be it with explaining the prevalence of depression, the previous findings linking physical activity with depression prevention or explaining the utility of replication studies. As the text itself claims, external validity is important and can be improved with replication studies. One of the strengths of this paper is that the population enrolled in it (the elderly from a middle-income country) is not usually well-represented in most of the influential research. Stating this strength in the introduction is important, as well as trying to better define the importance of the issue at hand to the specific target population (elderly as a whole, middle-income countries as a whole, Brazil as a whole, or an intersection of them all).*
*In the introduction there is also a sentence which states: "While a link between depression and physical activity has been suggested, the underlying mechanisms remain unclear.".*

*While this is true, the following sections describe associations between depression and certain factors. Elucidating the mechanisms which lead to depression is not possible within this design. I would suggest more clearly stating the knowledge gap that this paper aims to fill and then describing how this study aims to fill that gap, which then links into the specifics in the methods section, which comes next.*

Answer: We would like to express our sincere gratitude to the reviewers for their insightful comments and suggestions. Their valuable feedback has significantly contributed to improving the clarity and comprehensiveness of our manuscript. We have revised the introduction to emphasize the underrepresentation of older adults from middle-income countries in depression research.

Methods section

*27. While the methods section goes in appropriate depth about the ELSI-Brazil study, it does not clearly address the study design of this paper.*

Answer: Thank you for your feedback. We would like to clarify that this study is a replication study with a cross-sectional design. The title and methods section of our paper already mention this aspect of the study design. We have also provided detailed information about the ELSI-Brazil study in the methods section.

*28. It's important to describe if the entirety of the data was used or if only a part of it was included.*

Answer: Thank you for your feedback. The data analyzed in our study was derived solely from the second wave of the ELSI-Brazil study, conducted between 2019 and 2021. And we already clarified it in the paper.

*29. It is important to describe the study being replicated, as well as the differences between it and the present study. In defining the dependent variable, two definitions were used - "direct questioning and the CES-D-8 questionnaire". It's important to differentiate a history of having depression from currently having depressive symptoms. CES-D-8 assesses symptoms occurring in the past week, which is different from what is asked in question n59 from the ELSI-Brazil questionnaire "Has a doctor ever told you that you have depression?".*

Answer:

We appreciate the reviewer's emphasis on clearly outlining the differences between the replicated study (Rothon et al., 2010) and our current work.

Original Study:

- Population: Adolescents
- Design: Prospective cohort study (tracks participants over time)

- Depression Measurement: current depressive symptoms using the Short Moods and Feelings Questionnaire (SMFQ).

Current Study:

- Population: Older adults (aged 50+) in Brazil
- Design: Cross-sectional study (data collected at one point in time)
- Depression Measurement: We employed a two-pronged approach to capture both lifetime history and current symptoms:
    - Direct questioning (aligned with question n59 from ELSI-Brazil) aimed to identify a doctor's diagnosis of depression at any point in the participant's life.
    - CES-D 8 questionnaire assessed depressive symptoms experienced in the past week, providing a snapshot of current mental state.

Rationale for Dual Measurement:

This distinction between lifetime diagnosis and current symptoms is crucial. Someone might have a past depression diagnosis but not experience current symptoms, and conversely, someone might have recent symptoms without a formal diagnosis. By using both methods, we gain a more comprehensive picture of depression in older adults compared to the original study's focus on current symptoms in adolescents.

30. *"Data cleaning, descriptive statistics, bivariate and multivariate logistic regression analysis, and sensitivity analyses" are mentioned without further detail. This warrants expansion. How exactly was the data cleaned?*

Answer: The data was cleaned to prepare it for analysis. Missing data ("don't know/did not answer") were identified as missing data, while "do not apply" responses were re-coded into relevant categories based on the question context. We also checked for and removed outliers to ensure reliable results.

31. *If there was data imputing, how was it done? How were different variables treated in the descriptive analysis? Which variables were included in the regressions? Were these variables modified in any way (such as dichotomized, used as ordinal, etc)? What variables were considered independent variables and what variables were the dependent variables? How many models were created? How did they differ? Were any tests conducted in order to test for the assumptions of the statistical methods? Which sensitivity analysis were performed? To what purpose were they conducted?*

Answer: We did not perform data imputation for this study. Observations with missing data on key variables were excluded to maintain data integrity and avoid potential biases introduced by imputation techniques.

Continuous variables, such as age, were summarized using measures of central tendency (mean/median) and dispersion (standard deviation/interquartile range). Categorical variables like sex and race were described using frequencies and percentages."

Regression Analysis:

- Independent and Dependent Variables: "Physical activity (weeklypa) was the primary independent variable of interest. Depression (diagnosed by physician or based on CES-D scores) was the dependent variable in separate logistic regression models."
- Variable Selection and Modification: "We included well-established risk factors for geriatric depression as covariates in the models. These covariates were chosen based on published literature and their lack of direct interaction with the outcome variable. Some categorical variables, like marital status, were combined into dichotomous variables (partner vs. no partner) for better model fit."
- Number and Differences of Models: "We created two logistic regression models. One model used depression diagnosis as the outcome, while the other used CES-D categories. These models differed slightly in the significance of certain covariates based on their association with depression diagnosis vs. daily depressive symptoms.

Assumptions Testing:

We conducted tests to ensure the assumptions of logistic regression were met. These tests included checking for linearity in the logit and the absence of multicollinearity among the independent variables. We can provide further details on these tests if necessary.

Results section

32. *In table 1 of the results section, what does "Does not apply" mean in the Smoking Status section?*

Answer: Thank you for pointing out the need for clarification regarding "Does not apply" in the Smoking Status section of Table 1. We apologize for any confusion this may have caused.

We have addressed this by adding a footnote or legend directly below Table 1 to explain that "Does not apply" signifies participants who have never smoked before or at the moment of the interview.

33. *While the N at the top of table 1 is considered 6974, few sections actually sum to this number. As an example, in the frequency of moderate physical activity section this number is 6880. Assuming this means there are 94 observations that were missing, this needs to be reported. One way is to show the N for each of the variables as well, or to report the number of missing data for each variable*

Answer:

Thank you for bringing the discrepancy in sample sizes between the total (N=6974) and some specific sections in Table 1 to our attention. You're absolutely right; this indicates a small amount of missing data for certain variables.

We've reviewed the missing data points (detailed in the attached table) and believe they represent a very small percentage of the overall sample. Given the minimal amount of missing data, we are confident it has a negligible impact on the overall results of our analysis.

| Variable | Nr of missing | observation | Percentage of missing |
|---|---|---|---|
| vigorousintensity | 105 | 6869 | 0.015 % |
| moderateintensity | 94 | 6880 | 0.014 % |
| lowintensity | 79 | 6895 | 0.011% |
| depression | 11 | 6,963 | 0.001 % |
| race | 16 | 6,958 | 0.002% |
| sleepproblems | 33 | 6,941 | 0.005% |
| heartdisease | 6 | 6,968 | 0.001 % |
| ckd | 7 | 6,967 | 0.001 % |
| social | 1 | 6973 | less than 0.001 % |
| entertainment | 1 | 6973 | less than 0.001 % |
| diabetes | 31 | 6943 | 0.004% |
| l5 | 103 | 6871 | 0.015% |
| l7 | 103 | 6871 | 0.015% |
| l9 | 91 | 6883 | 0.013% |

| | | | |
|---|---|---|---|
| pain | 0 | 6974 | 0 |
| marital | 0 | 6974 | 0 |
| sex | 0 | 6974 | 0 |
| region | 0 | 6974 | 0 |

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| Variable | Obs=. | Obs>. | Obs<. | Unique values | Min | Max |
|---|---|---|---|---|---|---|
| race | 16 | | 6,958 | 5 | 1 | 5 |
| children | 14 | | 6,960 | 20 | 0 | 20 |
| grandchild~n | 140 | | 6,834 | 66 | 0 | 79 |
| siblings | 114 | | 6,860 | 21 | 0 | 20 |
| education | 43 | | 6,931 | 5 | 1 | 5 |
| dis_med | 23 | | 6,951 | 2 | 0 | 1 |
| dis_social | 36 | | 6,938 | 2 | 0 | 1 |
| dis_work | 58 | | 6,916 | 2 | 0 | 1 |
| dis_family | 16 | | 6,958 | 2 | 0 | 1 |
| dis_place | 17 | | 6,957 | 2 | 0 | 1 |
| work_12 | 20 | | 6,954 | 2 | 0 | 1 |
| workability | 16 | | 6,958 | 5 | 1 | 5 |
| retired | 3 | | 6,971 | 2 | 0 | 1 |
| reasonretire | 2,996 | | 3,978 | 5 | 1 | 5 |
| incomescore | 181 | | 6,793 | 10 | 1 | 10 |
| vigorousin~y | 105 | | 6,869 | 4 | 1 | 4 |
| moderatein~y | 94 | | 6,880 | 4 | 1 | 4 |
| lowintensity | 79 | | 6,895 | 4 | 1 | 4 |
| l5 | 103 | | 6,871 | 8 | 0 | 7 |
| l7 | 103 | | 6,871 | 8 | 0 | 7 |
| l9 | 91 | | 6,883 | 8 | 0 | 7 |
| alcohol | 13 | | 6,961 | 3 | 1 | 3 |
| farsight | 7 | | 6,967 | 5 | 1 | 5 |
| nearsight | 6 | | 6,968 | 5 | 1 | 5 |
| cataractsurg | 8 | | 6,966 | 2 | 0 | 1 |
| hearingdev~e | 4 | | 6,970 | 2 | 0 | 1 |
| hearing | 45 | | 6,929 | 5 | 1 | 5 |
| numberfalls | 18 | | 6,956 | 3 | 0 | 2 |
| hypertension | 11 | | 6,963 | 2 | 0 | 1 |
| diabetes | 31 | | 6,943 | 2 | 0 | 1 |
| cholesterol | 73 | | 6,901 | 2 | 0 | 1 |
| stroke | 8 | | 6,966 | 2 | 0 | 1 |
| strokeprob~s | 6,723 | | 251 | 2 | 0 | 1 |
| oxygen | 4 | | 6,970 | 2 | 0 | 1 |
| arthritis | 37 | | 6,937 | 2 | 0 | 1 |
| depression | 11 | | 6,963 | 2 | 0 | 1 |
| cancer | 4 | | 6,970 | 2 | 0 | 1 |
| ckd | 7 | | 6,967 | 2 | 0 | 1 |
| parkinson | 7 | | 6,967 | 2 | 0 | 1 |
| alzheimers | 7 | | 6,967 | 2 | 0 | 1 |
| dementia | 5 | | 6,969 | 2 | 0 | 1 |
| weightloss | 150 | | 6,824 | 2 | 0 | 1 |
| sleepquality | 6 | | 6,968 | 5 | 1 | 5 |
| sleepprobl~s | 33 | | 6,941 | 2 | 0 | 1 |
| sleepmeds | 4 | | 6,970 | 4 | 1 | 4 |
| p_intensity | 4,391 | | 2,583 | 3 | 1 | 3 |
| p_opioids | 4,391 | | 2,583 | 2 | 0 | 1 |
| run_diff | 82 | | 6,892 | 2 | 0 | 1 |
| walk_di~100m | 13 | | 6,961 | 2 | 0 | 1 |
| stair_diff_1 | 25 | | 6,949 | 2 | 0 | 1 |
| sitstill_d~f | 17 | | 6,957 | 2 | 0 | 1 |
| weight_diff | 8 | | 6,966 | 2 | 0 | 1 |
| read_write | 18 | | 6,956 | 2 | 0 | 1 |
| memory | 11 | | 6,963 | 5 | 1 | 5 |
| date | 87 | | 6,887 | 3 | 0 | 2 |
| month | 82 | | 6,892 | 3 | 0 | 2 |
| year | 130 | | 6,844 | 3 | 0 | 2 |
| day | 37 | | 6,937 | 3 | 0 | 2 |
| n_animals | 143 | | 6,831 | 21 | 0 | 20 |
| r2 | 21 | | 6,953 | 2 | 0 | 1 |
| r3 | 29 | | 6,945 | 2 | 0 | 1 |
| r4 | 27 | | 6,947 | 2 | 0 | 1 |
| r5 | 64 | | 6,910 | 2 | 0 | 1 |
| r6 | 45 | | 6,929 | 2 | 0 | 1 |
| r7 | 87 | | 6,887 | 2 | 0 | 1 |
| r8 | 55 | | 6,919 | 2 | 0 | 1 |
| r9 | 71 | | 6,903 | 2 | 0 | 1 |
| s1 | 9 | | 6,965 | 2 | 0 | 1 |
| s2 | 1,318 | | 5,656 | 6 | 1 | 6 |
| s3 | 1,344 | | 5,630 | 6 | 1 | 6 |
| s4 | 24 | | 6,950 | 2 | 0 | 1 |
| s5 | 661 | | 6,313 | 6 | 1 | 6 |
| s6 | 710 | | 6,264 | 6 | 1 | 6 |
| s7 | 18 | | 6,956 | 2 | 0 | 1 |
| s8 | 624 | | 6,350 | 6 | 1 | 6 |
| s9 | 712 | | 6,262 | 6 | 1 | 6 |
| sbp | 30 | | 6,944 | 264 | 70.5 | 247 |
| dbp | 30 | | 6,944 | 164 | 40 | 150 |
| pulse | 30 | | 6,944 | 155 | 40 | 164.5 |
| waist | 432 | | 6,542 | 177 | 58 | 168 |
| hip | 300 | | 6,674 | 175 | 61 | 178 |
| balance3 | 872 | | 6,102 | 193 | 1 | 30 |
| currentcou~e | 5 | | 6,969 | 2 | 0 | 1 |
| eyedisease | 114 | | 6,860 | 2 | 0 | 1 |
| jointsurg | 6 | | 6,968 | 2 | 0 | 1 |
| viral | 7 | | 6,967 | 2 | 0 | 1 |
| gk | 34 | | 6,940 | 2 | 0 | 1 |
| discrimina~n | 8 | | 6,966 | 2 | 0 | 1 |
| hgs | 438 | | 6,536 | 63 | 2 | 85 |
| walking | 890 | | 6,084 | >500 | .03 | 366.08 |
| balance | 500 | | 6,474 | 28 | 1 | 10 |
| balancenew | 872 | | 6,102 | 2 | 0 | 1 |
| movement_d~f | 1 | | 6,973 | 2 | 0 | 1 |
| badl | 1 | | 6,973 | 2 | 0 | 1 |
| social | 1 | | 6,973 | 2 | 0 | 1 |
| entertainm~t | 1 | | 6,973 | 2 | 0 | 1 |
| heartdisease | 6 | | 6,968 | 2 | 0 | 1 |
| lungdisease | 6 | | 6,968 | 2 | 0 | 1 |
| bmi | 124 | | 6,850 | >500 | 12.32742 | 59.16753 |

34. *Depression as defined by the results of the CES-D questionnaire is an important variable in this study, but it is not present in table 1.*

Answer: Thank you for your insightful review and for identifying the missing data in Table 1. You are absolutely correct; depression scores, as measured by the CES-D questionnaire, are an important variable in this study and should be included in the table.

We apologize for this oversight. We have revised Table 1 to incorporate the CES-D scores for participants.

35. *In table 2, the authors did well to include the N for both the adjusted and unadjusted models. Including the confidence interval for the confounders that were adjusted for in the multivariable logistic regression model would be helpful for the reader to understand which other variables were also significantly associated with the odds of having depression. The column that describes the odds-ratios is also probably not correct. Some of the values make no sense, such as the line in the model that uses CES-D as the definition for depression and taking the OR for more than once a week physical activity. The OR stated is 0.00 and the CI is 0.59-0.86 with a p-value of (0.71). It looks like certain lines were wrongly reported with the p-value in the OR slot and vice-versa, although this needs to be looked into.*

Answer: Thank you for your careful review of Table 2. We appreciate you pointing out the errors in the odds ratios (ORs) and confidence intervals (CIs) for some entries, as well as the suggestion to include CIs for adjusted confounders.

In response to your feedback, we have made the following revisions to Table 2:

- Corrected Errors: We have meticulously reviewed the table and corrected all errors in the ORs, CIs, and p-values. This ensures accurate representation of the statistical results.
- Replaced Table: We have replaced the original Table 2 with a completely revised version that reflects these corrections.
- Confounder CIs: We have added CIs for the adjusted confounders in the multivariable logistic regression model. This will provide readers with a clearer understanding of the impact of these variables on the odds of depression.

Additionally:

- Combined PA Levels: We would like to clarify that we have also re-analyzed the data and replaced the original results in Table 2 with those using a new variable, "weeklypa." This variable combines various physical activity levels (low, moderate, vigorous) into one category representing any physical activity at least once a week.

Explanation:

We believe that using "weeklypa" provides a more concise picture of the association between overall physical activity and depression risk. However, we understand the value of the original analysis with separate intensity levels.

36. *Looking at the results section, it's my understanding that twelve models were initially performed. A combination of the two definitions of depression (as dependent variables) with the three levels of physical activity (as independent variables) and adjusted or unadjusted (2x3x2). While it would be important to clarify this in the methods section, the physical activity variable could also be dichotomized (an idea would be to dichotomize between those that do at least moderate activity more than once a week and those that don't - this transformation would include those that do moderate once a week and vigorous once a week, as an example). This could improve the clarity of the results.*

Answer: We have chosen to revise the analysis strategy in a slightly different direction:

- Combined PA Levels: We have re-analyzed the data by combining the various physical activity levels (low, moderate, vigorous) into a single variable, "weeklypa." This variable captures any physical activity at least once a week, regardless of intensity.

Rationale:

We believe this approach offers several advantages:

- Conciseness: It simplifies the presentation of results by focusing on the overall impact of physical activity on depression risk.
- Public Health Relevance: It aligns more closely with public health recommendations that emphasize the importance of any physical activity for health benefits.

Future Exploration:

We recognize the potential value of exploring the effects of different physical activity intensities. As a possible next step, we could conduct additional analyses to investigate associations between depression risk and specific combinations or frequencies of low, moderate, and vigorous activities within the "weeklypa" category.

By incorporating these revisions, we aim to strike a balance between clarity and comprehensiveness in presenting the results**.**

37. *As there was the issue of having two definitions for the dependent variable, when reporting the results, it is important to be clear which one the result refers to. The statement, "Low-intensity PA once a week was associated with 44% lower odds of depression, (OR = 0.56, 95% CI 0.37 to 0.83), regardless of confounders." does not*

*accomplish this goal. It's also important to describe one of the variables as a "history of having depression" and the other as "currently experiencing depressive symptoms" or something similar to this. The chi-square test that was conducted between the two frequencies was not described in the methods section. The null-hypothesis of this test (that the frequencies are equal) is also not reasonable, as the variables are different.*

Answer: Thank you for raising these important points. We acknowledge that our initial reporting of results could be clearer regarding the two depression measures and the chi-square test.

- We revised the results section to explicitly differentiate between the two depression measures used:
    - Physician-diagnosed Depression: We replaced references to "depression" with "physician-diagnosed depression" when reporting results related to this measure.
    - CES-D Scores: We described this measure as "current depressive symptoms" or "elevated CES-D scores" to clarify its focus on current experiences.
- Chi-Square Test: We recognize that the chi-square test used to compare the two depression frequencies was not adequately described in the methods section. We addressed this.

Discussion section

38. *In the discussion, while the authors did well to note on previous results from the literature, the issue of there being two definitions for the dependent variable is not brought up. This needs to be front and center. The discussion must differentiate what was found for one of the dependent variables from the other. Only in the discussion section was the study design of the present study mentioned.*

Answer: Thank you for your valuable feedback. We appreciate you raising the issue of the two depression measures and the importance of differentiating their findings.

In response to your suggestion, we have revised the discussion section to explicitly address this point. We have added a new paragraph that clarifies:

- The use of both physician diagnosis and CES-D scores to assess depression in older adults.
- The different perspectives these measures capture (clinical confirmation vs. self-reported symptoms).

39. "*The original study on adolescents was a prospective cohort study that examined the relationship between physical activity and depressive symptoms. It included 2,093 adolescents aged 11-14 years old and used a questionnaire to measure physical activity and the Short Moods and Feelings Questionnaire (SMFQ) to measure depressive symptoms. On the other hand, the replication study on older adults was a cross-sectional study that included 6,974 adults with an average age of 65.5 years. Physical activity was measured using a questionnaire that asked about the frequency and intensity of activities,*

*while depressive symptoms were measured using the CES-D questionnaire and physician diagnosis." This section is better suited for the methods*.

Answer: We appreciate the reviewer's suggestion to move the paragraph comparing the original and replication study designs to the Methods section. This placement improves the clarity and organization of the paper by ensuring that the methods used in our study are clearly explained upfront.

40. *Authors did well to note on the possible social desirability and recall biases. Here, the mention that no causality can be established is correct, but in conflict with the abstract, that suggests taking clinical action based on the results found.*

Answer: Thank you for your feedback on our manuscript. We appreciate you acknowledging the strengths of our work, particularly regarding the limitations of self-reported data and the inability to establish causality.

We recognize the inconsistency between the suggestion in the abstract to take clinical action and the limitations of the study design. We have revised the abstract to address this issue.

Conclusion section

41. *In the conclusions, authors did well to note: "More research is needed to confirm these findings and explore the mechanisms behind this association.". The present study does not inform on the mechanisms of this association, although hypothesis can be suggested.*

Answer: 12. In the conclusions, authors did well to note: "More research is needed to confirm these findings and explore the mechanisms behind this association.". The present study does not inform on the mechanisms of this association, although hypothesis can be suggested.

**Reviewer 4**

Answers for the Reviewer 4

Introduction

42. *What is CDC? This is the first time it appears, so it would be advisable to write what CDC stands for, even though its meaning is well known.*

Answer: Thank you for your careful review and for pointing out the missing definition for the CDC. We acknowledge your suggestion and agree that providing context for first-time mentions of acronyms enhances clarity and accessibility. We have revised the relevant section within our manuscript to address this issue. Now, the first mention of "CDC" is accompanied by its definition.

43. *Is there data about depression prevalence in older adults in general and not only for older adults requiring home health care or hospitalized ones? It would be interesting to state what age group "older adults" refers to: >60y? >65y? '' The CDC estimates that up to 13.5% of older adults living in the community, requiring home health care, may experience depression, a figure that rises to 11.5% in hospitalized older patients (CDC, 2023)''.*

Answer: Thank you for your insightful comments on the prevalence of depression in older adults. We appreciate you raising these relevant points and have addressed them as follows:

- Data on Depression Prevalence: We understand your request for data on depression prevalence in older adults not limited to those requiring home health care or hospitalization. We have reviewed and incorporated the changes.
- Age Group Clarification: As our study focuses on replicating previous findings in a cross-sectional design and targets older adults aged 50 and above, we have explicitly stated this information in the revised manuscript to avoid ambiguity.

44. *Since the previous estimate is 13,5%, it sounds off saying here that it "rises" to 11,5%, because in this sentence, it gives the impression that the prevalence in hospitalized patients is higher than in older adults requiring home health care…*

Answer: Thank you for your careful observation regarding the sentence about depression prevalence. We appreciate you pointing out the ambiguity associated with the term "rises" when discussing hospitalized patients and those requiring home healthcare. We have revised the paragraph to improve clarity and avoid any potential misinterpretation.

45. *'' The CDC estimates that up to 13.5% of older adults living in the community, requiring home health care, may experience depression, a figure that rises to 11.5% in hospitalized older patients (CDC, 2023).''*

*This webpage reference doesn't show the prevalence estimates presented here. I found it here: https://www.cdc.gov/aging/depression/index.html#:~:text=How%20Many%20Older%20Adults%20are,11.5%25%20in%20older%20hospitalized%20patients.*

Answer: Thank you again for your meticulous review and for pointing out the discrepancy between the provided CDC reference and the cited prevalence estimates. We apologize for this oversight. We have thoroughly reviewed the CDC webpage and have corrected the reference accordingly.

46. *In this piece, it's said:*

*"How Many Older Adults are Depressed*

*The good news is that the majority of older adults are not depressed. Some estimates of major depression in older people living in the community range from less than 1% to about 5% but rise to 13.5% in those who require home healthcare and to 11.5% in older hospitalized patients."*

*You better rephrase your statement and reference.*

Answer: Thank you for your feedback regarding the text and reference on depression prevalence. We appreciate you bringing this to our attention. We understand your suggestion to rephrase the statement and reference even though we have already paraphrased the information. While paraphrasing the original text is a common practice for avoiding plagiarism, we acknowledge that sometimes further revision might be necessary. Therefore, we have reconsidered our approach and revised the text

47. It would be interesting to have reference for this: ''*Furthermore, depression profoundly impacts older adults' lives, leading to a range of issues, including physical and cognitive impairment, social isolation, and increased mortality* ***risk*** *(Figure 1).''*

Answer: Thank you for your valuable feedback on the impact of depression in older adults. We appreciate your suggestion and agree that providing a reference would strengthen the statement and enhance reader understanding. We have revised the sentence to improve clarity and include the suggested reference. (*(Greenberg et al., 2021))*

48. *According to the reference,: Its financial burden is also substantial, with the economic cost of major depressive disorder (MDD) in the United States rising by 37.9% from $236.6 billion (about $730 per person in the US) in 2010 to $326.2 billion (about $1,000 per person in the US) in 2018 (year 2020 values). Workplace costs accounted for the largest portion of this growing burden, increasing by 73.2% (Greenberg et al., 2021).''these numbers are for all adults (>18y) and not only older adults. Here, it gives the impression that refers to numbers of older adults.*

In methods section of Greenberg et al paper, it says about direct costs estimation: "Because the claims data did not contain cost information for patients aged ≥ 65 years, costs for these patients were assumed to be equal to those observed in patients aged 50–64 years ". By this, we can assume that any costs in this age group were actual numbers, but derived assumptions.

Since the article has prevalence numbers of cost estimation divided by age group (which in the paper's case older is >50y), it would be better to cite cost numbers of this age group, to keep the subject focused on older adults

Answer: Thank you again for your meticulous review and insights. We appreciate you pointing out the initial limitation of the cost data in our cited reference (Greenberg et al., 2021). We are pleased to inform you that we have addressed this issue by carefully reviewing the study and incorporating this information in our study.

49. *This reference:'' Regular physical activity, even at relatively low levels, could be a promising approach to preventing depression in older adults, according to a recent meta-analysis of 111 prospective cohort studies by Laird et al. (2023).'' is not a meta-analysis. It's a prospective observational study much like ELSI. Here's the paper's extract about the study design: "Design, Setting, and Participants A longitudinal cohort study of the same 4016 individuals at each of 5 time points (ie, waves) from The Irish Longitudinal Study on Ageing was conducted. Data were collected from October 2009 to December 2018, and data were analyzed from June 15 to August 8, 2022".*

Answer: Thank you for your careful review and for pointing out the error in our reference. You are absolutely correct; the study by Laird et al. (2023) is not a meta-analysis, but rather a prospective observational study. We apologize for the mistake. We have revised the text and citation accordingly

50. *I couldn't find this number in Laird et al paper "The study further found that physical activity reduced the odds of developing depression by 21% after adjusting for other factors (Laird et al., 2023).''*

*, but I found this extract in the introduction section of Laird's paper that it me the data this paragraph refers to: "across 111 prospective cohort studies including more than 3 million adults, after physical activity exposure the odds of incident cases of depression or an increase in subclinical depressive symptoms were reduced by 21% in fully adjusted models".*

*It is worth reviewing the information in this paragraph.*

Answer: Thank you for your meticulous review and for pointing out the discrepancy between the information we presented and the source cited (Laird et al., 2023). We appreciate your attentiveness to detail and agree that ensuring accurate information is crucial. While we initially revised the text based on the information presented in the Laird et al. (2023) paper, we acknowledge that relying solely on the introduction section might not be the most precise approach. To ensure accuracy and avoid confusion, we have carefully considered your valuable suggestions and conducted a further review of the Laird et al. (2023) study. We believe that new updates strengthen our analysis and the relevance of our findings.

51. Since in this sentence: "*By replicating a previous study (Rothon et al., 2010), this research aims to clarify the association between physical activity and depressive symptoms in older adults and shed light on the underlying mechanisms''.*

*you are justifying replicating the study, here it would be good to cite another cohort study with older adults that analyzed physical activity and depression, instead of cohort of adolescents, for example, the TILDA survey used in Laird et al 2023.*

Answer: Thank you for your valuable feedback regarding the citation in our research aim statement. We appreciate your suggestion to cite a cohort study focusing specifically on older adults when replicating previous research. Therefore, we have revised our research aim statement and citation accordingly. We also acknowledge your suggestion regarding the TILDA survey used in Laird et al. (2023). We agree that it is a valuable resource for further exploration and discussion, which we already incorporated into our introduction section.

Methods section

52. *"Accordingly, waves 1 and 2 were conducted in 2015-2016 and 2019-2021, with 9412 and 9949 participants, respectively. Utilizing this dataset, we conducted a descriptive analysis*…." Question: both waves?

Answer: Thank you for raising this important clarification. You are correct in your assumption. The data analyzed in our study was derived solely from the second wave of the ELSI-Brazil study, conducted between 2019 and 2021

53. *"Physical activity was assessed by questionnaires and categorized into vigorous, moderate, and low-intensity PA. Frequency of PA was also assessed."*

*Question, was assessed How? Which categories?*

Answer: Thank you for your valuable suggestion. You're right, the initial description of physical activity in our study lacked clarity.

The ELSI-Brazil study utilized the short version of the International Physical Activity Questionnaire (IPAQ) to assess physical activity. This questionnaire captures information on the frequency, duration, and intensity of various physical activities performed by participants in the week preceding the interview. It categorizes activities into three domains:

- Moderate-intensity activities: These include activities that cause a moderate increase in heart rate and breathing, such as brisk walking, cycling, light aerobics, and dancing.
- Vigorous-intensity activities: These activities substantially increase heart rate and breathing, requiring a significant effort, such as running, swimming laps, fast cycling, and heavy yard work.
- Low -intensity activity, Walking: This domain specifically assesses walking for transportation, leisure, or pleasure.

54. “*Depression was assessed through direct questioning and the CES-D-8 questionnaire.’’*

It would be interesting to briefly explain what this questionnaire is.

Answer: Thank you for the suggestion to provide more information about the CES-D-8 questionnaire. We've added a brief explanation within the Methods section, clarifying that it's a validated 8-item self-report measure used to assess depressive symptoms in adults (range: 0-24).

55. “*The relationship between physical activity and depressive symptoms in older adults was investigated using the ELSI Brazil dataset (Lima-Costa et al., 2023)’’*

*This information was presented in the first paragraph.*

Answer: Thank you for your careful review and for pointing out the repetition in our text. We appreciate you bringing this to our attention. We agree that reiterating the data source in this sentence is unnecessary as it was already mentioned in the first paragraph. To improve clarity and avoid repetition, we have removed the following sentence.

56. *“The findings suggest a potential link between physical activity and depressive symptoms in older adults.’’*--This is not methods. It belongs to results or discussion

Answer: We appreciate your suggestion. The statement has been relocated to the results section to more accurately reflect its nature as an outcome of our work.

Results

57. *“The study sample consisted of 6,974 adults, with an average age of 65.5 years. Over half were retired (57.1%), female (60.6%), and White (44.7%)’’--This is not over half as the other percentages cited in this sentence are.*

Answer: Thank you for the helpful feedback regarding the sample description. You're absolutely right, the previous sentence contained an error in how the demographics were presented. We have revised the sentence and provided a clearer picture of the sample composition.

58. *(Chart 1, Racial Distribution of Participants)-I think this pie chart is dispensable.*

Answer: Thank you for your input. After careful consideration, we ultimately decided to remove Chart 1 to prioritize clarity and conciseness in the presentation of our findings. Here's our reasoning:

* Clear Information in Table 1**:** We believe that Table 1 accurately and clearly conveys the same information as Chart 1. In the interest of avoiding repetition and visual clutter, we chose to streamline the presentation by relying on the Table.

* Focus of Study**:** Our primary focus is the association between physical activity and depressive symptoms. While the demographic distribution of our sample is relevant background information, it is not a major emphasis of the analysis.

59. "*Detailed participant characteristics are provided in (Table 1, Sample Characteristics) characteristics.''---This should be outside parentheses.*

Answer: Thank you for pointing this out. Parentheses are typically used for additional information that can be omitted. To clarify the reference to the table, We've revised the sentence.

60. *"Participants reported the frequency of low-, moderate-, and vigorous-intensity PA (more than once a week, once a week, 1 to 3 times a month, or rarely or never)''-----There are 3 intensity categories: low, moderate and vigorous intensity PA. And there are 4 descriptions for PA frequency: more than once a week; once a week; 1.*

Answer: Thank you for your feedback. You're correct that the original paragraph primarily presented results without further analysis.

Changes Made:

To address this concern, we have revised our analysis and Table 2 accordingly.

- Combined PA Levels: We have re-analyzed the data by combining various physical activity levels (low, moderate, vigorous) into a single variable, "weeklypa." This variable captures any physical activity at least once a week, regardless of intensity.
- Revised Table 2: Table 2 has been updated to reflect the new analysis using "weeklypa" instead of separate intensity levels. This will provide a more concise picture of the association between overall physical activity and depression risk.

Explanation:

Our initial analysis explored the effects of individual physical activity intensities (low, moderate, vigorous). However, by combining them into "weeklypa," we investigate the overall impact of engaging in any physical activity on depression, potentially providing a more generalizable finding for public health recommendations.

61. "*Fewer participants did vigorous PA (14.33%) than moderate PA (29.39%) or low-intensity PA (55.11%). We ran three models, one for each intensity level (Table 2, Odds Ratio of Depression by PA (Crude and Adjusted for Covariates))''. ---Which one is the reference category?*

Answer: Thank you for your inquiry about the reference category in Table 2. We appreciate your feedback and have addressed the overlap in participant responses regarding physical activity intensity and frequency.

> In response to your suggestion, we have re-analyzed the data and created a new Table 2. We combined the information on low-intensity, moderate-intensity, and vigorous-intensity activity into a single variable indicating any physical activity (yes/no).
>
> Since we no longer have separate models for each intensity level, the concept of a reference category for different intensities becomes irrelevant. The new model uses "no physical activity" as the reference category for all physical activity levels.
>
> We believe this revised approach provides a clearer picture of the association between overall physical activity and depression in our study population.

62. *"Low-intensity PA once a week was associated with 44% lower odds of depression, (OR = 0.56, 95% CI 0.37 to 0.83), regardless of confounders.'' —*

In table 2 the OR is 0.55

Which confounders? It's better to mention what was controlled for

Answer: Upon closer examination, we identified a need to refine the analysis of the association between physical activity and depression. We have recalculated the odds ratios (ORs) and covariates included in the logistic regression model. As a result, we have created a new Table 2 that reflects the updated analysis

63. *"When depression was defined using the CES-D questionnaire, only low-intensity PA done 1 to 3 times a month (OR = 0.39, 95% CI 0.20 to 0.77) was associated with a statistically significant reduced risk of depression*.''----It appears in table 2: 0.05 0.39 - 0.99 (0.62).

Answer: Upon closer examination, we identified a need to refine the analysis of the association between physical activity and depression. We have recalculated the odds ratios (ORs) and covariates included in the logistic regression model. As a result, we have created a new Table 2 that reflects the updated analysis

64. *"Sensitivity analysis (Table 3", ...--Each table has a different layout.*

Answer: Thank you for pointing out, we corrected all tables and figures with the same layout.

65. "*Sensitivity analysis (Table 3, Sensitivity Analysis of Association between Level of Physical Activity and Depression) showed that moderate-intensity PA more than weekly was associated with lower risk of depression in females (OR = 0.75, p = 0.011) and males (OR = 0.65, p = 0.042)."*

*Table 3 doesn't show information about frequency, only about intensity. Which one is the reference category?*

*These numbers are not presented in table 3.*

Answer: Thank you for bringing this oversight to our attention. We re-runned the sensitivity analysis to ensure all relevant interactions are captured.

66. "*White race was associated with lower risk of depression in cases of moderate intensity more than weekly (OR = 0.63, p = 0.001) or low intensity PA weekly (OR = 0.46, p = 0.001). Moderate intensity PA more than weekly was associated with lower risk of depression in individuals with brown race (OR = 0.64, p = 0.008) but no association was found for the black race. Regardless of retirement status, moderate intensity PA more than once a week was associated with lower risk of depression (OR = 0.64, p = 0.008 in non-retired and OR = 0.69, p = 0.008 in retired). However, in retired persons, low intensity PA weekly was also associated with low risk of depression (OR = 0.60, p = 0.027). Living in urban areas was associated with low risk of depression in persons with moderate intensity PA more than weekly (OR = 0.65, p < 0.001) or weekly (OR = 0.65, p = 0.019). Living in rural areas was associated with low risk of depression in individuals with moderate intensity PA more than weekly (OR = 0.55, p = 0.023).*"

*These numbers are not presented in table 3*

Answer: Thank you for bringing this oversight to our attention. You are absolutely correct; the results mentioned in your comment regarding race, retirement status, and living area with different physical activity levels are not currently reflected in Table 3. We apologize for this error.

We have addressed this issue by: Re-running the sensitivity analysis to ensure all relevant interactions are captured.

Discussion

67. *"Our study demonstrates that physical activity, regardless of intensity, is associated with a reduced risk of depression in older adults''. --It was not demonstrated in all levels of intensity, so it can be affirmed that it demonstrated regardless level of intensity*.

Answer: We would like to express our sincere gratitude for your insightful input on our study. This modification ensures that we appropriately convey the observed protective effect without making overarching claims regarding intensity levels.

Based on the reviewer's observation, reevaluation of this statement led to a better understanding and interpretation of the results yielding to a correction that describes the associations between the variables of the study in a more precise way.

“Our study shows an apparent protective effect of physical activity against depression in older adults. Vigorous physical activity suggests protective effects across both methods of diagnosis. In low-intensity PA, the observed effect was only significant when depression was diagnosed by a physician, while moderate-intensity PA lacked significant effects across both diagnostic methods. The study’s findings indicate that the relationship between exercise and depression is multifaceted. This, could be attributed to various biases, including selection bias, information bias, confounding factors, and medication use”.

68. “*However, the observed effect of vigorous-intensity and low-intensity PA and the absence of an effect for moderate-intensity PA could be attributed to various biases, including selection bias, information bias, confounding factors, and medication use.”*

If there are so many biases, how can the results be valid?

Answer:

We appreciate the reviewer's thoughtful comments regarding the limitations of our observational study design. We agree that self-reported data and the cross-sectional nature of the study introduce potential biases, including selection bias, information bias, and confounding.

To mitigate these limitations, we controlled for several known risk factors for depression in our statistical models, including age, sex, race, chronic health conditions, and social factors. We also explored potential interactions between variables to understand how certain factors might influence the relationship between physical activity and depression.

While our study cannot definitively establish causality, its strengths lie in the large sample size and the use of validated tools for assessing physical activity and depression. The findings provide valuable insights into potential associations between physical activity and depression in older adults.

We acknowledge the need for future research using an RCT design to definitively establish a causal relationship between physical activity and depression in this population.

69. “*After adjusting for confounders, engaging in low-intensity physical activity once a week and vigorous physical activity more than once a week were found to be linked to a reduced risk of depression. Even engaging in low-intensity physical activity once a month showed a significant reduction in depression.”*

This paragraph repeats results information without adding any new analysis

Answer: Thank you for your feedback. You're correct that the original paragraph primarily presented results without further analysis.

Changes Made:

To address this concern, we have revised our analysis and Table 2 accordingly.

- Combined PA Levels: We have re-analyzed the data by combining various physical activity levels (low, moderate, vigorous) into a single variable, "weeklypa." This variable captures any physical activity at least once a week, regardless of intensity.
- Revised Table 2: Table 2 has been updated to reflect the new analysis using "weeklypa" instead of separate intensity levels. This will provide a more concise picture of the association between overall physical activity and depression risk.

Explanation:

Our initial analysis explored the effects of individual physical activity intensities (low, moderate, vigorous). However, by combining them into "weeklypa," we investigate the overall impact of engaging in any physical activity on depression, potentially providing a more generalizable finding for public health recommendations.

70. "*For instance, Pearce et al. (2022) discovered that adults who engaged in low levels of physical activity had an 18% lower risk of depression. Similarly, Park et al. (2014) found that exercise training reduced depressive symptoms in older adults. However, Forsmann et al. (2011) did not find a statistically significant association between physical activity and depressive symptoms in older adults. Furthermore, Csajbók et al. (2022) found that the reduction of depressive symptoms in older adults due to increased physical activity was primarily an indirect result of improved cognitive functions."*

*Here, it's said that the study results are in accordance with the literature. However, the reader is presented to 2 papers that go along with this study's result and 2 papers with opposing conclusions. This way, the reader doesn't know what to conclude from the literature.*

Answer: Thank you for raising this important point. You are right that the existing literature on the relationship between physical activity and depression presents mixed findings.

- Mixed Evidence: We acknowledge the existence of studies with varying conclusions, like Pearce et al. (2022) and Park et al. (2014) observing a protective effect, and Forsmann et al. (2011) not finding a significant association. Csajbók et al. (2022) suggested an indirect effect through cognitive function.
- Despite these mixed findings, our study adds valuable insights.

71. "*The findings from both the original study on adolescents and the replication study on older adults are consistent with the findings of Keadle et al. (2016), which showed that*

*adherence to physical activity guidelines varies across different populations and subgroups.''*

*Which original study on adolescents? It is a bit confusing reading about an original study on adolescents for the first time in the discussion section. So, ELSI is a replicating study from a previous study on adolescents?*

*And how was adherence to PA in your study? Any hypothesis for that?*

Answer: Thank you for pointing out the need for additional clarity regarding the studies mentioned in the discussion section. We apologize for any confusion this may have caused.

We explained a bit more about the study on adolescents in the introduction and methods sections.

Unfortunately, we don't have detailed information on adherence to PA guidelines in the ELSI study. However, based on previous research by Keadle et al. (2016), we hypothesized that adherence to PA guidelines might vary across different populations, including older adults.

72. *"It's worth noting that the CES-D questionnaire relies on self-reporting of depressive symptoms, which may not always provide an accurate reflection of the severity of depression."*

*Self-reporting*- This is the first time this information appears in the text. It would be good to have that in methods

*the severity of depression.* –Here, I understood that this questionnaire was used to make a diagnosis and to assess severity. In that sense, what is more important would be to know if this questionnaire and the physician diagnosis (which is based on what by the way?) have the same ability to tell if a person has depression or not.

Answer: Thank you for raising these important points regarding the CES-D questionnaire. We acknowledge that self-reported measures have inherent limitations. We have added a sentence to the Methods section acknowledging the CES-D as a self-reporting tool and briefly mentioning potential limitations, such as social desirability bias or under-reporting of symptoms.

The CES-D is a valuable tool for screening for potential depressive symptoms and assessing their severity level. It is not intended for sole clinical diagnosis of depression.

High scores indicate a higher likelihood of depression, but a formal diagnosis requires a clinical evaluation by a mental health professional.

73. *"In the replication study involving elderly Brazilians, a reduced likelihood of depression was associated with low, moderate, and vigorous-intensity physical activities,''*----

According to data on table 2, it was not associated in all PA intensities

Answer: Thank you for this feedback, we changed the variable of physical activity to “weeklypa” because there were overlaps between intensities and the best logic way to use the variable of physical activity was categorizing it in weekly positive or negative.

74. “*For example, engaging in vigorous physical activity once a week was associated with a 39% reduction in odds of depression.’’*--

*According to table 2, vigorous PA once a week had an OR 0.64 (CI 0.37-1.13, p-value 0.127).*

Answer: Thank you for this feedback, we changed the variable of physical activity to “weeklypa” because there were overlaps between intensities and the best logic way to use the variable of physical activity was categorizing it to weekly positive or negative.

75. “*In contrast, the original study on East London adolescents revealed an 8% reduction in depressive symptoms per additional weekly exercise hour.”* ----

*Missing the reference.*

Answer: Thank you for your careful review and for identifying the missing reference. We appreciate your attention to detail.

You're absolutely right about the missing reference for the statistic on the 8% reduction in depressive symptoms per additional weekly exercise hour in the original study on East London adolescents. We apologize for this oversight.

76. *“The samples used in the studies may not be fully representative, with the replication study having a higher proportion of females and individuals of white ethnicity and being conducted in Brazil, limiting generalizability to other countries”.* --- *I*f it is national wide representative, with a large sample size, I wouldn’t say the fact that it was in Brazil only is a limitation. Most big cohort studies, if not all, are conducted in one country.

Answer: Thank you for this feedback, the fact that Brazil has special weather and culture, also that only 16 people with Asian ethnicity were involved in the study proves that this study has limitations for generalizability on an international level.

77. “*Additionally, the replication study was an observational study, which cannot establish causality.’’*----

*It is not that observational studies cannot be used to establish causality; it is cross-sectional ones that can't because you cannot separate cause from consequence as you observe both phenomena ate the same time.*

Answer: Thank you for pointing out this important distinction. You're correct that observational studies, in general, can be used to investigate causal relationships under certain conditions. However, cross-sectional studies, which capture data at a single point in time, cannot definitively establish cause-and-effect due to the inability to distinguish between cause and consequence.

Our Clarification:

In our study, we aimed to replicate and extend previous findings on physical activity and depression in older adults. While the original study was prospective, we employed a cross-sectional design from the ELSI Brazil cohort data due to its population-based nature and the availability of relevant variables.

Addressing Causality:

We acknowledge that the cross-sectional nature of our analysis limits our ability to definitively establish causality between physical activity and depression. However, the observed association aligns with existing research on the potential benefits of physical activity for mental health. Our findings add to this body of knowledge by examining this relationship in a large, representative sample of older adults.

Future Directions:

We recognize the value of longitudinal studies for investigating causal relationships. Future research using this approach could further explore the potential benefits of physical activity in preventing or mitigating depression in older adults.

Improved Clarity:

We will revise the manuscript to clarify the limitations of our cross-sectional design in establishing causality.

78. *“Despite these limitations, the findings from both studies suggest that physical activity is associated with a reduced risk of depression in both adolescents and older adults.’’*---

*Here, it is important to list what the study did to deal with the limitations that make the results valid*

Answer: We acknowledge the limitations inherent in observational studies, particularly the cross-sectional design of our analysis. While this design cannot definitively establish causality between physical activity and depression, we employed several strategies to strengthen the validity of our findings:

- Population-Based Sample: We utilized data from a large, population-based cohort (ELSI Brazil), which helps to minimize selection bias and improve generalizability of the results.
- Control for Covariates: We included relevant covariates in the statistical models to account for potential confounding variables such as chronic health conditions, sleep problems, and social life. This helps to isolate the association between physical activity and depression.
- Consistency with Existing Research: Our findings align with a growing body of research demonstrating the potential benefits of physical activity for mental health across different age groups. The observed association, while not causal, adds weight to the existing evidence.

Despite limitations, our study, along with the referenced prospective study on adolescents, provide suggestive evidence for a link between physical activity and reduced depression risk in both younger and older populations. Future research utilizing longitudinal designs is warranted to definitively establish causality.

Conclusion

79. *“More research is needed to confirm these findings and explore the mechanisms behind this association”*--

In the last paragraph of introduction, it is said that “this research aims to clarify the association between physical activity and depressive symptoms in older adults and shed light on the underlying mechanisms.”. However, the topic underlying mechanisms was explored, and it would be hard to

do so as this was a cross-sectional study. Since, this topic is mentioned here again, it is worth to revies this objective in the introduction.

Answer: Thank you for your valuable feedback. We have carefully considered your suggestions regarding the statement about further research and the study objective in the introduction.

As you pointed out, a cross-sectional study design limits our ability to definitively establish causality or explore underlying mechanisms. To address this limitation, we have revised the objective in the introduction to more accurately reflect the scope of our study:

This study aims to investigate/replicate the association between physical activity and depressive symptoms in older adults.

Additionally, we have revised the statement in the conclusion to acknowledge the limitations of the study design and the need for further research.

80. "*Objective measures of physical activity should be employed whenever possible to enhance the precision of the findings''*---

And objective tools to depression diagnosis as the results from physician diagnosis and self-reported questionnaire were too different.

Answer: Thank you for this feedback. There is no doubt that depression should be classified more precisely, too. If you look, because of the overlap between 3 different physical activities we changed our variable to "weeklypa", that shows if weekly physical activity with any intensity was present or not.

81. *''To ensure the validity of the findings, future studies should be meticulously designed to eliminate the potential effects of confounding factors''.*--

Here you may suggest prospective cohort, better assessment tools, or other approaches that could have been used to reduce bias or confounders that hindered this study

Answer: Thank you for the feedback, we edited this part.

**Reviewer 5**

Answers for Reviewer 5:

Introduction:

82. *Quote: "These findings suggest that regular physical activity, a low-cost and accessible intervention, could be a promising strategy to prevent depression in older adults.". This reviewer is of the belief that it is necessary to provide more details about the type of physical activity to which it refers: aerobics, muscle strengthening, or both. Please revise.*

Answer: Thank you for your valuable suggestion. You're right, the initial description of physical activity in our study lacked clarity.

The ELSI-Brazil study utilized the short version of the International Physical Activity Questionnaire (IPAQ) to assess physical activity. This questionnaire captures information on the frequency, duration, and intensity of various physical activities performed by participants in the week preceding the interview. It categorizes activities into three domains:

- Moderate-intensity activities: These include activities that cause a moderate increase in heart rate and breathing, such as brisk walking, cycling, light aerobics, and dancing.
- Vigorous-intensity activities: These activities substantially increase heart rate and breathing, requiring a significant effort, such as running, swimming laps, fast cycling, and heavy yard work.
- Low -intensity activity, Walking: This domain specifically assesses walking for transportation, leisure, or pleasure.

Methods:

83. *The authors claim to be a replication study. I would like to have more information about the main study used as a reference. Please clarify***.**

**Answer**: We appreciate the reviewer's request for more information regarding the original study used as a reference in our replication attempt.

To address this, we have added a new subheading titled "Original and Replication Study Design" within the Methods section of our manuscript. This section now provides a clearer comparison between the original study by Rothon et al. (2010) and our replication effort.

Results:

84. *This reviewer finds that the results are easy to read. The authors well presented their tables. However, it is important to add a legend to the chart. Please revise.*

Answer: After careful consideration, we ultimately decided to remove Chart 1 to prioritize clarity and conciseness in the presentation of our findings. Here's our reasoning:

* Clear Information in Table 1**:** We believe that Table 1 accurately and clearly conveys the same information as Chart 1. In the interest of avoiding repetition and visual clutter, we chose to streamline the presentation by relying on the Table.
* Focus of Study**:** Our primary focus is the association between physical activity and depressive symptoms. While the demographic distribution of our sample is relevant background information, it is not a major emphasis of the analysis.

Discussion:

85. *Well performed. The difference in activity type (aerobic versus strength) should be included in the limitations.*

Answer: Thank you for the positive feedback on the discussion section and for identifying this important point. You're absolutely right; the limitations section should acknowledge that our analysis did not differentiate between aerobic and strength activity types within the "weeklypa" variable.