Ref.: Ms. No. MENPA-D-23-00325

Associations between physical activity and subcategories of mental health: A propensity score analysis among a global sample of 341,956 adults

Mental Health and Physical Activity

The authors thank the reviewers for their time and feedback. We hope to have adequately addressed their helpful suggestions below.

Reviewer #1:

General comments:

Introduction

1. The authors provide a comprehensive overview of the research topic but would benefit from a more balanced argument related to the evidence for the associations between physical activity and mental health. For example, associations are evident, but more needs to be known about clinical effectiveness for some population groups and conditions, as well as on the underlying causal mechanisms responsible for the association between physical activity and mental health. The following article might be useful https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4911759/.

Response: We thank you for an important point, and upon rereading our introduction, we agree that more balance regarding where the evidence is lacking should be made. We have read the reference provided, and incorporated this suggestion in lines 15-18 of the revised manuscript.

*“Nevertheless, much is unclear concerning the effects of physical activity on various clinical populations other than those diagnosed with depression, and establishing causality (and causal mechanisms) for observed associations with mental health outcomes (Biddle, 2016; Kandola et al., 2019).”*

Methods

2. Some justification behind the selection of covariates is warranted. There are numerous (and emerging) systematic reviews and meta-analyses examining the correlates and determinants of physical activity and/or mental health that can be used to provide rationale.

Response: We agree with the need for explicit justification of the selected covariates, and have made these changes in the revised manuscript in lines 117-119.

*“These were based on the variables available from the complete GMP questionnaire, and known correlates of physical activity and/or mental health (Choi et al., 2017; Kirkbride et al., 2024).”*

Results

3. Results are presented clearly. However, I am unsure why the ATCs and standard errors are not presented by age groups in text (see line 209). Given that this forms a significant part of the Discussion, it might be appropriate to include these here.

Response: We wanted to avoid crowding the text with too many numbers, but agree these should be presented. Thus, in lines 212-217 we added the ATCs, 95% CIs, and SMDs for each age group for MHQ estimated effects, while guiding readers to the supplementary table for these statistics for all subcategories.

Discussion

4. For readability and clarity, please provide the subcategories that "seem to demonstrate relatively consistent benefits from PA across the lifespan" (see line 260).

Response: We went ahead and incorporated these suggestions in lines 272-276 of the revised manuscript.

*“Core Cognition, Drive and Motivation, and Adaptability and Resilience followed the same trend as overall MHQ scores, and thus these specific aspects of mental health may benefit more by younger people adopting a more active lifestyle, whereas the other subcategories (i.e., Mood and Outlook, Social Self, and Mind-Body Connection) seem to demonstrate relatively consistent benefits from physical activity across the adult lifespan.”*

5. Whilst the author(s) note that results may not be globally representative and potentially overlook individuals living in regions with limited to no internet access (see line 305), it would be fruitful to raise this as an important area of future research, whilst also acknowledging levels of PA are vastly different across countries and territories.

Response: We agree with and have incorporated these suggestions in lines 323-325 of the revised manuscript.

*“Future research to explore communities not feasibly reached by internet surveys may be indicated, especially as rates of insufficient physical activity are high even among many low-income countries, with significant variability (Guthold et al., 2018).”*

Reviewer #2:

Specific comments:

Methods - are there any reliability/validity data for the PA measure utilised in the study? If so, please refer to this.

Response: As this was a secondary analysis from a questionnaire we did not design, there is much to be desired with the PA measure. We thank the reviewer for pointing this out, and attempted to support the use of this PA item in lines 109-111 of the revised manuscript.

*“Prior studies show that single-item assessments of physical activity perform similarly to other short physical activity questionnaires (Milton et al., 2010; Wanner et al., 2013).”*

Methods - further rationale of the covariates selected would be useful - otherwise it feels a little "cherry picked" - were these selected based on theoretical underpinning?

Response: We agree with the need for explicit rationale of the selected covariates, and have made these changes in the revised manuscript in lines 117-119.

*“These were based on the variables available from the complete GMP questionnaire, and known correlates of physical activity and/or mental health (Choi et al., 2017; Kirkbride et al., 2024).”*

Analyses - Description was excellent and I think could be used as a blueprint for future studies / researchers in the field. Perhaps worth flagging this in the discussion?

Response: We thank the reviewer for the comment, and incorporated the suggestion in lines 286-287 of the revised manuscript.

“Therefore, we encourage researchers to consider the use of propensity scores when estimating the effect of physical activity in non-randomized data.”

Results - The Figures are very small and appear low resolution. Can you please include larger, high-resolution figures?

Response: Thank you for bringing this to our attention, we have recreated the images and reuploaded them.