Author's response to reviews

Title: Joint association of physical activity and body weight with subsequent physical and mental functioning: a follow-up study

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Author's response to reviews: see over
Response Reviewer 1

Reviewer: Cindy Gray

Reviewer’s report:

This is an interesting paper that examines the degree to which PA and bodyweight are associated with physical and mental health-related quality of life. It reports the secondary analysis of data from two time points 5-7 years apart that were obtained as part of a cohort study of City employees in Helsinki. It is well written on the whole, although some parts could benefit from a little more thought about punctuation. There are also a few typos.

Title

Minor revisions

The title suggests to me that the paper is reporting the conduct of a follow-up study, rather than secondary analysis of already collected data.

Response: The baseline questionnaire was collected in 2000-2002 and the follow-up questionnaire was sent in 2007 to all respondents of the baseline survey. These are all our own primary data and analyses from the Helsinki Health Study. The study was not conducted using secondary data or analysis. Therefore we have kept the title as it is.

Abstract

Major revisions

P2, Results – I wonder if the authors could add something about the association between poor physical functioning and overweight? Or at least make it clearer.

Response: We have now revised the results section. The following text has been added to the revised manuscript (shown in red, page 3, line 4):

“Being overweight regardless of activity level was associated with poor physical functioning.”

Our focus is on the joint association of overweight and physical activity on functioning. Therefore the association between overweight and functioning as such is not widely discussed in the manuscript.

Minor revisions

P2, Line 4 and elsewhere – the first mention of body mass index in the abstract and main body of the paper should have the acronym as well as the full version; thereafter it should just be the acronym.

P2, Line 9 – “baseline survey respondents” rather than “respondents of the baseline survey”?

P2, Line 13 – Short Form 36 looks a bit strange – it would be better to also add the acronym. Also a short description of what the SF-36 is (i.e. a health survey)
would be useful.
P3, Keywords – could “overweight” be included?

Response: Thank you for these suggestions. These are now included in the revised manuscript, as suggested (page 2-3).

Background

Major revisions

P4, Line 21 can the authors justify the statement “We also took into account the intensity of the physical activity…” as I am not convinced that using MET hours per week really does this – could someone not end up in the high activity category through lots of walking and moderate intensity activity?

Response: This statement is now omitted. We were referring to sensitivity analyses made taking into account the intensity of the physical activity. This is now only mentioned in the discussion, page 13, line 18.

Minor revisions

P3, Line 19 “Studies on [the impact of?] both physical activity…”

Response: This is now revised, as suggested, page 4, line 3.

Methods

The description of the Helsinki Health Survey etc is very clear.

Major revisions

P7, Line 10 could the authors provide some justification of why they used binge drinking rather than overall quantity to classify alcohol use?

Response: We conducted the analyses both using binge drinking and overall quantity of alcohol consumed. However, there were no differences in the results. We chose to use binge drinking, which refers to consumption of at least six portions of alcohol beverages on a single occasion. Such consumption could be assumed to have a larger impact on functioning than overall alcohol consumption since it more precisely measures heavy consumption.

This is now briefly mentioned in the revised manuscript, page 13, line 7:

“In addition to health behaviours and sociodemographics we controlled for limiting longstanding illnesses and common mental disorders. We also did sensitivity analyses adjusting for the overall quantity of alcohol used. These covariates had negligible effects on the results (data not shown).”

Minor revisions

P5, Line 4 “aged 40, 45, 50, 55 or 60 years”
Response: Revised as suggested.

P6, Line 5 could the authors provide the minimum recommendation for physical activity to contextualize the cut-offs selected?

Response: We have now added the minimum recommendation of 2.5 hours of brisk walking per week (approximately 1000kcal) to the manuscript, page 6, line 12.

P6, Line 8 3 hours of jogging per week does not sound like low activity!

Response: That is true. 30 MET or approximately three hours of jogging per week is the recommended amount of physical activity. We have now changed the description of the groups to moderate activity groups, throughout the manuscript.

P6, Line 20-21 the sentence “These were compressed…in the US general population” needs rewritten.

P6-7, could the authors provide the cut-offs used for the lowest quartiles of the PCS and MCS in men and women?

P8, Line 2 could the authors provide clarification of which analyses used the high activity normal weight group as the reference.

Response: Thank you for these suggestions. These lines are now revised as suggested, page 7-8. The cut-off points for the lowest quartile for men is 46.0 (PCS) and 48.6 (MCS) and for women 41.9 (PCS) and 48.0 (MCS). These are also mentioned in the manuscript.

Results

Major revisions

P8, Line 17 there are clear gender differences in binge drinking.

Response: Thank you for noticing this. We have now added the gender-stratified percentages to the revised manuscript. 7% of women and 24% of men were binge drinkers at baseline, page 9, line 4.

P9, Line 2-3 physical functioning appears to decline more at follow up in the inactive normal-weight group than in the high activity normal weight group. The least decline appears in the low activity groups?

Response: Thank you for noticing this. We agree and have now changed the text in the manuscript to:

"Physical functioning tended to decline more in the inactive and overweight groups" (page 9, line 16)

P9, Line 9 could the authors provide clarification that these are the highly active groups. Do the confidence intervals between the inactive and highly active normal-weight groups at follow up overlap?
Response: The text in the revised manuscript is now clarified, page 9, line 23. The confidence intervals do not overlap (22%, 95% CI 19.7-24.0 for highly active normal weight and 29%, 95% CI 24.0-34.3 for inactive normal weight).

**P9, Line 17-19 would it be clearer to say that being normal-weight and inactive, and being overweight regardless of activity level were associated with poor physical functioning?**

Response: The sentence is now clarified as follows:

“After adjustments both highly active overweight and inactive normal weight participants were equally associated with poor physical functioning”, page 10, line 6.

In this sentence we wanted to clarify the association between physical functioning of the highly active overweight and the inactive normal weight participants since it was one of our study questions.

We have also added the following sentence to the revised manuscript, page 3, line 4:

“Being overweight regardless of activity level was associated with poor physical functioning.”

**P9-10 my reading of the Table 5 suggests that, after adjustments, the association between mental functioning and physical inactivity in normal-weight adults disappears? It remains in the overweight cohort.**

Response: Thank you for noticing this. We have now revised the manuscript as suggested:

“After full adjustments the association disappeared among the normal-weight (OR 1.25, 95% CI 0.92-1.70) but remained among the overweight (OR 1.39, 95% CI 1.08-1.80).” (Page 10, line 17).

We have also revised a sentence about this in the abstract, page 3, line 7.

**Minor revisions**

**P9, Line 5 does the first sentence in this paragraph refer to baseline or follow up or both – could clarification be provided?**

**P9, Line 12 “joint” is not needed here – its addition confuses the meaning of the sentence, could this be changed to “being inactive and overweight”?**

Response: These are now revised in the manuscript as suggested.

**Discretionary revisions**

**P8, Line 13-14 should the percentage who were less active also be given?**

Response: This is now added to the revised manuscript, page 9, line 2. It is also added to the table 1.

**Discussion**
Major revisions

P10, Line 10-14 My reading of the findings does not entirely agree with this interpretation – my understanding is that the only association with poor mental functioning remaining after adjustments is for inactivity and overweight? The increase in the OR for poor mental functioning does appear to only increase between the less active and inactive groups, but this is not highlighted in the results section – and is the difference significant?

Response: We agree with these comments and the manuscript is now revised as suggested. We have also added a sentence about the relationship among different activity groups on mental functioning. As far as we see there are significant differences for the overweight inactive group.

"After full adjustments the association disappeared among the normal-weight (OR 1.25, 95% CI 0.92-1.70) but remained among the overweight (OR 1.39, 95% CI 1.08-1.80). The mental functioning was significantly poorer among the overweight inactive participants, while the mental functioning among the moderately and highly active participants was approximately the same." (Page 10)

P12, Line 1 see point above about overlapping confidence intervals between the inactive and highly active normal-weight groups at follow up?

Response: We agree that only overweight inactive participants showed significantly poorer mental functioning. The manuscript is now revised as follows:

"This is in accordance with our study, which showed only minor differences in mental functioning between the highly active and the moderately active participants, with the overweight inactive participants being most likely to show poor mental functioning." (Page 12, line 19)

P12, Line 2 the authors speculate that the small differences in mental functioning between the less active and highly active groups may reflect the high physical activity cut off point between these groups, but two paragraphs below they say they have conducted sensitivity analyses using lower cut off points and that the results did not change substantially.

Response: That is true. We have now revised the manuscript (Page 12, line 23).

P13, Line 8 most studies that I am aware of do find that people overestimate their height and underestimate their weight so I am not convinced by this argument.

Response: We agree that people usually overestimate their height and physical activity while they underestimate their weight. However, the referred study (Lang, Guralnik et.al. Physical activity in middle-aged adults reduces risks of functional impairment independent of its effect on weight, J Am Geriatr Soc) found that such overestimation and underestimation did not change the main outcomes of the study. The focus of the study was on the association between physical activity and subsequent physical functioning in middle-aged adults across a range of BMI categories. Both self-reported and measured height and weight data were used and the results were in broad agreement:

"In this study, both measured and self-reported performance was assessed, and the outcomes suggest they were in broad agreement."
In a study on different measures of body weight as predictors of sickness absence on the present data (Korpela K et al. Different measures of body weight as predictors of sickness absence. Scand J Public Health. 2012) it was shown that self-reported BMI performed equally well as measured BMI.

We have now revised the sentence to be clearer. We have also added that people usually overestimate their height.

“The limitations include self-reported measures. These might cause overestimation of physical activity, overestimation of height and underestimation of weight [37]. However, it has been shown [24] that self-reported and measured weight and height outcomes are broadly in agreement.” (Page 14, line 7)

Minor revisions

P10, Line 6 could the authors add clarification that overweight and physical inactivity AT BASELINE contributed to poor physical functioning AT FOLLOW UP?

Response: The sentence is now clarified as follows; “Thus high physical activity at baseline may lead to better physical functioning at follow-up both among those of normal weight and overweight.” (Page 11, line 2)

P13, Line 13 is this best paper to use to evidence reliability of the SF 36, as it examines older populations and also does not appear to look at the PCS or MCS as far as I can see?

Response: We agree and have now changed the referred paper to


Discretionary revisions

P 10, Line 5 should clarification that these were city of Helsinki employees be provided (alternatively just say adults)?

Response: The sentence is now revised.

"In this study we examined the joint association of physical activity and relative body weight with subsequent physical and mental functioning among middle-aged employees of the City of Helsinki over a follow-up of 5-7 years.” (Page 10, line 24)

Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable

Statistical review: Yes, but I do not feel adequately qualified to assess the statistics.

Declaration of competing interests: I declare that I have no competing interests’
Response reviewer 2

Reviewer: Gavin Turrell
Reviewer’s report:

Major compulsory revisions

1. As the authors note, the physical and mental functioning measures of the SF36 are continuous scales ranging from 0-100 with a mean of 50 in the US population. For analytic purposes, this measure was subsequently dichotomized into the lowest versus the other quartiles. In a recent article it was argued that “dichotomization of continuous measures...discards theoretically relevant information, reduces statistical power, and amplifies measurement error” (Lovasi GS et al. At odds: concerns raised by using odds ratios for continuous or common dichotomous outcomes in research on physical activity and obesity. Open Epidemiol 2012;5:13-17). Given this, can the authors please provide a rationale in the revised manuscript for re-scoring a reasonably normally distributed measure into a dichotomised measure? And why the lowest quartile for each measure of functioning: is there any evidence that this cut-point has clinical or policy relevance?

Response: We agree with the reviewer’s comment that dichotomizing of continuous measures can discard relevant information. However, since we are particularly interested in those with poor physical functioning, we preferred to dichotomize the outcomes. To further clarify the associations we have added the mean values of functioning to the tables 2 and 3. As mentioned in the discussion (page 13, line 10), we also conducted several sensitivity analyses:

“We also used different measures for physical functioning such as the physical functioning (PF) subscale of SF-36, mean values for physical and mental functioning component summaries and both the lowest quintile and highest quartile of functioning.”

These analyses showed similar results as those reported in the text.

We decided to focus on the lowest quartile of functioning since it refers to poor functioning. Similar procedures have been used in several previous large-scale studies (Stansfeld SA et.al: Psychosocial work characteristics and social support as predictors of SF-36 health functioning: the Whitehall II study. Psychosom Med. 1998), including analyses of the present cohort (Lahti et.al. The impact of physical activity on physical health functioning--a prospective study among middle-aged employees. Prev med 2010, Svärd A: Obesity is associated with declining physical but not mental functioning. In finnish: Finnish Medical Journal 2011). As mentioned in the above mentioned sensitivity analyses (page 13, line 10) we also used other cut-off points but the results were similar.

2. Also, why dichotomise BMI and again compromise the statistical and measurement properties of this variable; and why collapse overweight and obesity into the same group when it is likely that obesity will show a stronger association than overweight with functioning?
Response: We agree that obesity likely shows stronger associations than overweight with functioning. As mentioned in the manuscript (page 13, line 11) we made sensitivity analyses with BMI groups of normal weight (>25 kg/m²), overweight (25-30 kg/m²) and obese (>30 kg/m²). We also did further sensitivity analyses using both BMI 27 kg/m² and 30kg/m² as cut-off points besides the reported BMI 25 kg/m². The results were similar to those reported in the text. The high activity obese group was small in our data and we preferred to only show the analyses with cut-off point 25 kg/m². Since our data are based on employees, the proportion of obese participants likely is smaller than in the general population (Lahti-Koski M et.al: Age, education and occupation as determinants of trends in body mass index in Finland from 1982 to 1997.Int J Obes Relat Metab Disord. 2000). The cut-off point 25 kg/m² is also extensively used in previous epidemiological studies (see also WHO: “Obesity and overweight” http://www.who.int/mediacentre/factsheets/fs311/en/).

3. What was the basis for choosing the baseline covariates: why these and not others? Was there any theory or previous research that informed their selection? Obviously, the choice of covariates is important (and ideally should be informed by DAGs) so as to conceptually clarify their role as potential confounders, mediators or moderators. Adjusting for numerous factors in the absence of a rationale for their inclusion in the analysis can result in spurious associations and a loss of statistical power if the covariate is serving no useful substantive purpose.

Response: We chose the covariates based on key previous studies on the same data (Svärd A et.al.: Obesity is associated with declining physical but not mental functioning. Suomen Lääkärilehti 2011, Lahti J et.al. The impact of physical activity on physical health functioning--a prospective study among middle-aged employees. Prev Med 2010, Lahelma E et.al.: Occupational class inequalities across key domains of health: results from the Helsinki Health Study. Eur J Public Health 2005, Salonsalmi A et.al.: Drinking habits and disability retirement. Addiction 2012). These covariates have previously shown importance and associations with both physical and mental functioning.

As mentioned in the manuscript, page 13, line 5, we also controlled for limiting longstanding illnesses, common mental disorders and overall quantity of alcohol used but they had negligible effects on the results. Thus, they were omitted from the final analyses.

Our covariates included age, gender, baseline physical and mental functioning, health behaviours (smoking, alcohol use) and sociodemographics (marital status, socioeconomic position, work conditions). Details of these covariates are described in our previous reports: Lahelma E et.al.: Occupational class inequalities across key domains of health: results from the Helsinki Health Study. Eur J Public Health 2005, Salonsalmi A et.al: Drinking habits and disability retirement. Addiction 2012.

4. Has an investigation of attrition been conducted on the follow-up data? Is the physical activity, BMI, or functioning status of those who dropped out different to those who stayed in? Do any important baseline factors (e.g. SES, BMI) predict drop-out at wave 2? Non-random attrition might have important implications for bias in the manuscript’s reported associations between activity/overweight and functioning.
Response: Thank you for these suggestions. Our analyses showed that non-respondents to the follow-up had only slightly poorer physical functioning (48.9, 95%, CI 48.5-49.4) than the respondents (49.2, 95%CI 49.0-49.4). For mental functioning, the difference was equally small (50.9, 95%CI 50.4-51.4 vs. 51.7, 95%CI 51.5-51.9). The mean BMI for non-respondents to the follow-up was 25.8 kg/m² (95%CI 25.5-26.0) and 25.5 kg/m² (95%CI 25.4-25.6) for the respondents. The non-respondents were slightly less physically active (mean MET 27.9, 95%CI 26.8-29.1) than those who responded (mean MET 28.8, 95%CI 28.3-29.4). The proportion of non-respondents at follow-up was somewhat higher among lower social classes. These results are briefly discussed in the revised manuscript, page 5 line 17.

5. If the analyses were initially conducted separately for men and women how could it be determined that no interaction was evident? Formal tests of sex-interactions can only be undertaken on pooled data. From the text it seems that a separate analysis was performed for men and women and the pattern of results compared on the basis of visually inspecting the data: this approach might strongly suggest no interaction but that can't be statistically ascertained without formal interaction tests being conducted to confirm (or reject) the observed pattern.

Response: We have now revised the section about gender interactions (page 8). We have both done a gender interaction test and stratified the analyses for women and men. However, the stratified results did not substantially differ from the reported ones. No gender interactions were found and we decided to pool the data. The p-values from the interaction tests are now added to the revised manuscript.

"There were no significant interactions between the genders (P=0.65 for physical functioning and P=0.12 for mental functioning) and pooled data were used for the main analyses."

6. In a recent article about the use of odds ratios the authors concluded that “Use of odds ratios for common outcomes such as obesity may unnecessarily hinder the validity, interpretation, and communication of research findings”. Prevalence ratios are recommended instead (Lovasi GS et al. At odds: concerns raised by using odds ratios for continuous or common dichotomous outcomes in research on physical activity and obesity. Open Epidemiol 2012;5:13-17). In light of this, and given that the outcomes in this present study were common (i.e. 48% for overweight, 38% for highly active) can the authors please provide a justification for the use of odds ratios (rather than prevalence ratios) for their analyses.

Response: As mentioned in the referred article (Lovasi GS et al. At odds: concerns raised by using odds ratios for continuous or common dichotomous outcomes in research on physical activity and obesity. Open epidemiol 2012;5:13-17) using odds ratios is acceptable if outcome prevalence also is shown in the subgroups, as in our study we have. As the reported odds ratios are not very high they are near the prevalence ratio values.

The mentioned outcome values 48% for overweight and 38% for highly active from our Table 1 only show the prevalence of overweight and highly active participants in our study. The prevalence of the outcome in the reference group is 17% which is not particularly high.
7. Can the authors please discuss the implications of their study’s findings for public health policy, health promotion, or other types of interventions aimed at increasing population levels of physical activity and decreasing rates of overweight and obesity? At present, there is very little discussion about the policy implications of the findings. Where should governments be investing tax payers’ money and resources? These questions are especially pertinent in the context of ageing populations, increases in overweight and obesity, and likely increases in poor functioning as a result.

Response: We have discussed these issues in the revised manuscript (page 14, line 14).

“Within the ageing population maintaining good physical and mental functioning is one way of preventing disability and subsequent sickness absence [40] as well as disability retirement [41] and thereby helps lengthening work careers. Health and welfare policies should aim at preventing inactivity and overweight as they have adverse effects on functioning. Efforts should be made to emphasize people to engage in physical activity regardless of their body weight.”

**Level of interest:** An article whose findings are important to those with closely related research interests  
**Quality of written English:** Acceptable  
**Statistical review:** Yes, and I have assessed the statistics in my report.  
**Declaration of competing interests:**  
'I declare that I have no competing interests'