Author's response to reviews

Title: The association between indoor temperature and body mass index in children: the PIAMA birth cohort study

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Author's response to reviews: see over
Dear Editor

Thank you for your e-mail dated 02-10-2013. We have addressed the reviewers’ last comments and adapted our manuscript as required. We detail our revisions below.

With respect to the ethics committee which granted approval: we have listed details of the approvals granted at different stages of the study underneath this letter. In the manuscript we have added the details of the approval obtained at the start of the study as follows: “The study protocol was approved by the Medical Ethics Committees of the participating institutes (Rotterdam, MEC 132.636/1994/39 and 137.326/1994/130; Groningen, MEC 94/08/92; Utrecht, MEC-TNO 95/50)”.

Later approvals (at ages 4, 8 and 12 years) were given for clinical examinations of the children, but results of these examinations were not used in this specific study. Please let us now if the information on the approvals at ages 4, 8 and 12 years also needs to be included in the manuscript.

With respect to the financial competing interests: Gerard Koppelman has received grants for the PIAMA study from the Dutch Asthma Foundation, Ubbo Emmius Fund and BBMRI-NL but results of this work were not used for this specific study.

We thank you for considering the revised version of our manuscript for publication in BMC Public Health and hope that you will find our additional revisions satisfactory.

Yours sincerely,
Floor Scheffers
Alet Wijga, corresponding author

Ethics Committees’ approvals of the study: The study protocol was approved by the Medical Ethics Committees of the participating institutes. At start project: Rotterdam, MEC 132.636/1994/39 and 137.326/1994/130; Groningen, MEC 94/08/92; Utrecht, MEC-TNO 95/50; At 4 years: Utrecht CCMO P000777C; At 8 years: Utrecht CCMO P04.0071C and METC 04-101/K; Rotterdam P04.0071C/MEC 2004-152; Groningen P04.0071C/M 4.019912; At 12 years: Utrecht METC 07-337/K.
Reviewer: Fiona Johnson

Reviewer's report:
I am happy with the changes made to this manuscript, and am of the view that it provides a very useful addition to the literature. The methods, analysis and discussion are appropriate and the findings are novel and important. This paper provides a good example of null results which require publication.

Major Compulsory Revisions: None
Minor Essential Revisions: None

Discretionary Revisions:
1. Some reference in the discussion to the specificity of these results to children would be beneficial. Particularly since thermogenesis is known to differ between adults and children.


2. I also suggest two references stating that changes to eating behavior and clothing are likely to partially, but not fully compensate for effects of ambient temperature on energy expenditure:


Response:
We mentioned the study of Warwick et al. in our discussion. In this study dietary and physical activity were standardized. They did not standardize for clothes and bedding. Indeed, they still found an association between ambient temperature and energy expenditure. However, this association was weaker than in other experimental studies which did use also standardized conditions for clothes and bedding. We have now added the reference of Cannon et al. to our discussion:

   Experimental studies in human subjects consistently found inverse associations between ambient temperature and energy expenditure under standardized conditions (i.e. for clothes, food intake and/or physical activity) [11-17]. ...................... One of the earlier mentioned experimental studies did not standardize for clothes and bedding, as was done in all other experimental studies [14]. The subjects in this study wore more clothes and used warmer bedding at lower ambient temperatures. This resulted in a weaker association between ambient temperature and energy expenditure than in the experimental studies that did standardize for clothes and bedding. ...................... Evidence from adult studies suggests that changes in eating behavior and clothing are likely to compensate at least partially for effects of ambient temperature on energy expenditure [14, 19].
The paper by Tews et al. provides a review of brown adipose tissue. We added this reference in the discussion to emphasize the difference between adults and children as suggested. It now reads: Since thermogenesis is known to differ between adults and children [18], results from studies in adults and studies cannot be easily compared.

Reviewer: William Johnson

Reviewer's report:
The authors have responded well to my comments and I have no further concerns. They may, however, out of interest want to re-run their longitudinal growth curve model using a structural function (e.g., Berkey-Reed) which will provide a much better fit for the data than a quadratic polynomial.

Response:
We would like to thank the reviewer for his advice regarding our longitudinal growth curve model. We will definitely re-run our model using the suggested structural function out of interest. Furthermore, we will also use this advice for further longitudinal analyses of the PIAMA data in the future.

Reviewer: Denise Heppe

Reviewer's report:

Major Compulsory Revisions:

First of all I would like to thank the authors for their detailed response to the authors. I agree with all their changes or comments to the suggested changes except for the one addressing how the authors’ speculations were barely based on scientific evidence. In my opinion the “Results of other studies and interpretation of the present study” part in the Discussion as well as the conclusion remain of suboptimal quality and need to be thoroughly revised.

Reviewer: The suggested explanation for the findings is not very well founded. It is not unlikely that there may be no association between indoor temperature and BMI in childhood. At least, this should be one of the explanations suggested.

Author: This point was partly addressed in our reaction to the reviewers first two comments. If we understand the reviewer correctly, she here suggests as a possible explanation for our findings that an association between indoor temperature and BMI in childhood may simply not exist. We are convinced, based on theoretical grounds and on experimental studies, that an inverse association between ambient temperature and energy expenditure exists: at lower ambient temperatures more energy is needed to maintain body temperature. Based on this consistently found inverse association between ambient temperature and energy expenditure, an association between indoor temperature
and BMI was suggested. We observed no evidence for this hypothesized association with BMI. This implies that energy balance was not affected by differences in indoor temperatures. In our opinion this could be explained by the compensatory mechanisms speculated on in our paper: more clothing and bedding in colder environments so that energy expenditure is not increased or reduced energy intake to compensate reduced energy expenditure in homes with higher temperatures.

I do not agree with the authors perspective. The hypothesis of this study was based on theoretical extrapolation of results from experimental and ecological studies and one earlier cohort study (low level of evidence). The authors performed a well-conducted study in a large cohort and their results do not support the proposed hypothesis. The suggested mechanism may indeed explain the absence of significant findings, however there could be many other mechanisms. And, more importantly, there may also be many reasons, not addressed by this or any other study, why no association exists. For example, why couldn’t it be the case that the body undergoes certain adaptations when exposed to a lower temperature for a longer period to compensate for the higher energy expenditure? Therefore, I think that the authors should also consider and discuss the possibility that there is no association and more carefully mention the suggested mechanism as the evidence used for this speculation is of very low level of evidence. Please revise “We speculate that families that… been confirmed in other studies.” as the speculations in this part do not include citations. I propose the authors change the order of the sentences and start with describing what Mavrogianni et al. (or others) suggested (in its perspective of level of evidence; study type/quality/size etc) instead of starting with describing what they “think”.

Also, I am not sure if readers understand what the authors are trying to suggest by “One of these experimental studies…did standardize for clothes and bedding [14]. “as no actual suggestion is mentioned. Further, my suggestion would be that the authors describe the only study that has previously assessed this hypothesis in a non-experimental setting in more detail and point out the differences or similarities between this Italian study and the current study. Potentially, there may also be differences between the experimental and real-life setting that may explain the differences in findings. Please remove “but we think that our null finding reflects the reality in this population and is not the result of any study limitations.” as you cannot be sure. Please remove or change “As long as the results of Bo et al. have not been confirmed in other studies.” Into a more general statement. It is not clear what exactly is suggested, yet it seems that the authors suggest that the results of Bo et al. reflect the truth and the results of the current study don’t? Please revise “The results of our study do not necessarily contradict the hypothesis that historic changes in domestic temperatures may have contributed to the increase in the prevalence of obesity.” as the results of this study do contradict this hypothesis. Please revise “As long as the results of Bo et al. Have not been confirmed in other studies, we therefore consider it premature to recommend turning down the thermostat as a measure to prevent overweight.” into something more refined (see earlier comment).
We revised the “Results of other studies and interpretation of the present study” part in the discussion and the conclusion as suggested. It now reads:

Results of other studies and interpretation of the present study

Experimental studies in human subjects consistently found inverse associations between ambient temperature and energy expenditure under standardized conditions (i.e. for clothes, food intake and/or physical activity) [11-17]. An Italian observational population-based cohort study of 1597 Caucasian adults investigated the association between indoor temperature reported at baseline and incident obesity during 6 years of follow-up. Although adjustment for confounders considerably attenuated the risk for incident obesity, still a twofold increased risk for incident obesity was found in people reporting an indoor temperature higher than 20°C compared to people reporting an indoor temperature lower than or equal to 18°C [3]. In this study indoor temperature was reported at baseline, as was also the case in our study. Beside similarities between above-mentioned study and our study, there were also some differences. First, their study population consisted of adults, while our study population consisted of children. Since thermogenesis is known to differ between adults and children [18], results from studies in adults and studies in children cannot be easily compared. Furthermore, in the Italian study incident obesity during follow-up was used as outcome variable, while we used repeated measurements of BMI. In addition, in contrast to their study, we made a distinction between living room and bedroom temperature. Our own observational study did not provide evidence for the hypothesis that also under real life conditions ambient temperature affects energy balance and as a result influences BMI. Evidence from adult studies suggests that changes in eating behavior and clothing are likely to compensate at least partially for effects of ambient temperature on energy expenditure [14, 19]. Mavrogianni et al. suggested in their review that the association between ambient temperature and energy expenditure could be weakened by behavioral factors in a real life setting [20]. In other words, families that keep their indoor temperatures relatively low might compensate by using more blankets and clothing to make their children comfortable. One of the earlier mentioned experimental studies did not standardize for clothes and bedding, as was done in all other experimental studies [14]. The subjects in this study wore more clothes and used warmer bedding at lower ambient temperatures. This resulted in a weaker association between ambient temperature and energy expenditure than in the experimental studies that did standardize for clothes and bedding. The mechanism suggested by Mavrogianni et al. could be an explanation for why lower ambient temperature is consistently associated with higher energy expenditure in experimental studies, but not with lower BMI in our real life study.

Conclusion

This study in children did not support the hypothesized association between indoor temperature and BMI in a real life setting. Due to a lack of evidence for this hypothesis, we consider it premature to recommend turning down the thermostat as a measure to prevent overweight.