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Testing the activitystat hypothesis: authors' response

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ABSTRACT

Our study is neither a perfect nor a definitive test of the activitystat hypothesis. In the absence of such definitive evidence, however, our rich behavioural data does give us an advantage over much other observational research. We therefore believe that our finding that there was no evidence of even partial same-day activity compensation contributes to the literature on this important public health question.

TEXT

We agree with Wilkin and Metcalf that the activitystat hypothesis is important, should be tested rigorously, and is best evaluated 'following perturbation': as our paper states "confirmation in intervention studies is required". At present, however, we feel our research contributes to a literature in which definitive experimental evidence is lacking. For example, Wilkin and Metcalf cite two primary research papers in support of the activitystat hypothesis. The first, observational study sampled 206 children from an out-of-town private preparatory school, a village state primary school and an inner-city primary school (Fremeaux, et al., 2011). Children in the private school were more physically active within school but no different from the other two schools overall. This is certainly consistent with the activitystat hypothesis, but interpretation is arguably complicated by other differences between the schools (e.g. in location, socio-economic privilege, day-school vs. partially boarding school). The second, intervention study evaluates a school-based physical activity (PA) programme (Kriemler, et al., 2010). This reported a significant positive difference between intervention and control groups in mean school-time PA counts/minute (0.92, 95%CI 0.35,1.50), a non-significant negative trend in out-of-school PA (−0.14, 95%CI−0.51,0.22) and a non-significant positive trend overall (0.21, 95%CI−0.21,0.63). While consistent with the activitystat hypothesis, this is equally consistent with the interpretation that the study was adequately powered to detect changes in school-time PA but not in total PA (reflecting the general statistical phenomenon that more power is needed for broad outcomes going beyond the specific intervention target). This second interpretation is perhaps supported by the intervention group's decreased body fat and increased aerobic fitness, suggesting a genuine increase in PA.

Regarding our methods, we followed conventional practice in defining 'moderate-to-vigorous physical activity' (MVPA) as all activity above the moderate intensity cut-point. Wilkin and Metcalf's comment that MVPA "may not have involved any vigorous activity, and therefore invite no compensation" seems to imply that compensation is only expected with respect to vigorous PA. This had not been our understanding, and seems inconsistent with the use of MVPA in activitystat research from Wilkin's group, again defining MVPA as everything above the moderate-intensity cut-point (e.g. Fremeaux, et al., 2011). As Wilkin and Metcalf

note, although our paper presents this MVPA measure, we report obtaining the same results for total volume of physical activity defined as mean counts/minute. We used 'mean counts' rather than the 'sum of all counts' as we believed that increased sleeping time was not hypothesised to be a major mechanism underlying activity compensation. As such, and contrary to Wilkin and Metcalf, we felt the sum of all counts would be *more* confounded by differences in waking time. It is also less amenable to examining partial activity compensation, as spending more time in any behaviour would necessarily be expected to predict accumulating fewer counts across the rest of the day (approaching zero counts as the percent time in the behaviour approaches 100%). For complete activity compensation, however, we re-ran our analyses using the sum of all counts and obtained very similar findings (data on request).

We accept the critique that we only tested the hypothesis of 'same-day' compensation, and our paper should have emphasised this more. Our null findings in this respect replicate one previous study which found no evidence of same-day or next-day compensation (Baggett, et al., 2010). We accept that these data do not address the possibility that any activity compensation is delayed until later in the week.

In summary, we agree that our study is neither a perfect nor a definitive test of the activitystat hypothesis. In the absence of definitive evidence, however, our rich behavioural data does give us an advantage over much other observational research. We therefore believe that our finding that there was no evidence of even partial same-day activity compensation contributes to the literature on this important public health question.

Conflict of interest:
No conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at doi:10. 1016/j.ypmed.2011.12.010 .

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