Author’s response to reviews

Title: Comparisons of Intensity-Duration Patterns of Physical Activity in the US, Jamaica and 3 African Countries

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Author’s response to reviews:

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Diana Marshall
Senior Managing Editor
BMC Public Health

Dear Dr. Marshall

Thank you for the opportunity to address the reviewers concerns. We are now re-submitting our manuscript (MS: 3021439901278142) titled “Comparisons of Intensity-Duration Patterns of Physical Activity in the US, Jamaica and 3 African Countries”, after addressing all the reviewers responses.

Yours truly,
Lara Dugas, PhD, MPH

Comment’s to reviewer 1

Major Compulsory Revisions:

1. The association between SES and physical activity needs to be more clearly articulated in the abstract as well as the introduction.
2. Although the primary aim of the manuscript is to examine associations between physical activity and obesity across the epidemiologic transition, these results are not discussed until the sixth paragraph of the discussion and the final section of the results section. Only one paragraph of the results section is devoted to this research question, and the analyses do not thoroughly compare the associations between physical activity and adiposity across the five countries.

The reviewer is quite correct that the overarching primary aim is to compare PA and obesity across the epidemiologic transition. In the results section, we felt it was necessary to first describe the levels of PA at each site before reporting on the PA and obesity relationships, which are introduced in lines 260-268, and tables 3a & 3b and figures 2 & 3. Similarly, with regards to moderate PA we first describe the site-levels of moderate PA and then those relationships with obesity (lines 281-286).

3. Further, only BMI is examined and not percent body fat, though body composition was listed as a variable of interest and BIA was used to examine adiposity (since BMI is a crude measure of adiposity). The manuscript should either be revised to expand upon the primary aim, or the aims need to be re-written to more accurately describe the results and emphasis of the paper.

This is a great point by the reviewer and indeed, presenting the changes in MVPA by %bf may be more accurate. We however, are reporting an ecological comparison of multi-country data, where in most cases the only adiposity field measurement available is BMI, as opposed to more accurate %bf measures. The hypothesis we are also testing is the relationship of PA with obesity, typically categorized as BMI. Furthermore, using the continuum of body fat, as opposed to categorical variables does not allow us to explore any logistic regression analyses. Finally, the term “obesity” has become synonymous with a BMI>=30 kg/m2. We have therefore chosen to use the original primary aim, stating our comparison of habitual PA levels with obesity.

Minor Essential Revisions:

Abstract

4. Background – Some key concepts need brief explanation, including “global PA movement,” “epidemiologic transition,” and “economic transition.” It should be clear early on that the authors are examining the decrease in PA across countries with increasing SES.

We have now clarified the key concepts:

“global PA movement”-we have changed the sentence in the abstract to now read “The difference in how populations living in low-, middle or upper-income countries accumulate daily physical activity (PA), i.e. patterns and intensity, is important for instituting international PA policy. We have also added the following
text to line 76-77: “e.g. WHO’s global strategy on diet, physical activity and health program [7]”

“Epidemiologic transition”- due to the abstract word limitations, we have added the following text, pg 4 lines 89-91: “The epidemiologic transition is characterized by changing patterns of population age distributions, life expectancy, and causes of death [16]”

“Economic transition”- we have changed sentence 43 (pg 2) to now read “Among the men, obesity prevalence reflected the Human Development Index of the country and was lowest in GH (1.7%) and SA (4.8%) and highest in the US (41%). SA (55%) and US (65%) women had the highest levels of obesity, compared to only 16% in GH.”

5. It should also be stated which countries are considered low, middle, and upper SES. Why are economic/national disparities in PA important to understand?

Due to the abstract word limitations, we have described the Human Development Index and SES countries on page 4, lines 104-107. The economic/national disparities are important to understand because large public health organizations are trying to simplify public health messaging, in an attempt to get more people active for improved health outcomes (this is a good idea). Unfortunately part of this process is allowing all forms of activity to count towards accumulating your daily physical goal, e.g. 30 min/d for 5 days/week or 10,000 steps/day. This may not be enough for improved health outcomes in that 30 min/day of occupation/transport activity may not equate to 30 min/day of purposeful exercise.

6. Methods – What do the authors mean that PA was examined by manual labor? Does this mean participants were stratified based on amount of manual labor performed, or was this a covariate?

We chose to stratify the participants according to whether they performed manual labor or not. This is an important concept to the paper since, the WHO PA guidelines state that whether PA is accumulated from work, transport or leisure time domains, they all count towards achievement of the daily 30 minute recommendations.

7. What does “explored ecologically” mean? Include the tools used to assess PA (i.e. accelerometer and self-report), SES (i.e. self-report), and anthropometrics/body composition (i.e. weight, height, bioelectrical impedance).

The ecological model of comparison was first introduced in the 1970’s by Urie Bronfenbrenner’s as the “Ecological Framework”, allowing for investigation of populations, within their own unique environments, so considering the individual, within the ecological environment. In our case, we are thus performing an ecological comparison of each site, both within their own site and then comparing our populations across sites.

We have added the methodologies used to capture our variables to the abstract.
Background


We have added the following text, pg 4 lines 89-91: “The epidemiologic transition is characterized by changing patterns of population age distributions, life expectancy, and causes of death [16].”

Methods

9. Page 6 – How was 7am to 11pm selected as the accelerometry range of wear time? Is this based on actual wear time? Could this skew results if some participants in some countries are more likely to engage in activity earlier in the day?

The reviewer is correct that there may be some biased introduced into our analysis by selecting the hours from 7am to 11pm. However, currently there is no international standard applied for accelerometer wear time and typically the analyses are restricted to daylight hours/waking hours. Furthermore, using our questionnaire data, we were able to capture the average sleep hours from each site, they ranged from 7 hours in the US, Jamaica and Seychelles, to 8 hours in Ghana and surprisingly an average of 10hrs in South Africa. We therefore feel that our 16hr protocol is sufficient to capture the habitual daily physical activity. However, we have added a limitation section to the manuscript and address this (pg 14 & 15, lines 448-457).

10. Did the individuals who had invalid or insufficient accelerometry data differ on major variables to those who were retained in the analysis?

No, only the individuals with valid wear time were included in the analysis, this is stated on page 6, lines 167-169. And we have the following sentence in the results section (pg 8, lines 224-225): “Overall, 93% of the METS participants provided complete accelerometry data as defined by having valid wear time for at least 10 hours per day on a minimum of 4 days of the measurement period.” We did not include the 7% without valid wear time.

Results

11. Page 9 – Comment on statistically significant differences in the descriptive statistics section (e.g. manual labor by site, obesity).

By study design, we expect that the sites will be different with regards to obesity, manual labor etc. and therefore have chosen not to present the p-values for these expected differences as they are not meaningful.

12. Page 10 – The comment “This might suggest real international differences…” needs to be moved to the discussion section and warrants further discussion.

We have moved this sentence to the discussion where the difference between the men from south Africa/Ghana vs. the other 3 sites with regards to week and weekend PA is discussed, please see pg 12, lines 357-370.
13. Page 10 – Specify direction of difference for significant differences (e.g. higher MVPA in Jamaica and Seychelles among women).

We have changed the sentence (pg 9, lines 249-251) to now read: “Amongst the women, it was only women in Jamaica and Seychelles who accumulated significantly lower amounts of MPVA during the weekends, with women in Jamaica losing approximately 5 min/d and Seychellois losing about 13 min/d of MVPA (1-min bouts) during weekend days.”

14. Page 11 – What statistical test was used to justify the statement “men were 22% less likely to be engaged in manual occupations if they were overweight and obese”? Add this statistical analysis test to the methods and clarify in the results.

We used logistic regression analysis to explore the categorical variables of overweight and obese by manual labor status. The statistics section (pg 6-7, lines 200-206) now reads: “Descriptive statistics including mean levels and distributions were used to summarize the characteristics of participants in each of the five study sites. For continuous measures, we calculated means and standard deviations (e.g. age, weight, % body fat, BMI, minutes of PA and activity counts), and proportions for categorical variables (overweight/obese, female gender, manual labor). To explore any associations in the outcome variables, we used multiple linear regression analysis for continuous variables and multiple logistic regression analysis for the categorical variables. Statistical significance was accepted at an alpha-p level of 0.05. Calculations were done by gender and site and across site using dummy variables.”

15. Tables – The tables provide a tremendous amount of information and the data are difficult to interpret. Use asterisks to denote significant differences among each country/site in order to make the significant differences more apparent. If the asterisks/notations are too cumbersome to read, then at least compare the countries to 1 standard (such as Ghana or the U.S.).

We have now highlighted significant differences in tables 2-4. Highlighting significant differences in tables 1a and b (participant characteristics) is not meaningful because differences are by design and recruitment strategy. We chose to include these populations because their differences allowed us to explore our physical activity outcomes.

16. Figures – Likewise, the figures would benefit from including p values to notate significant differences within and between countries – for instance, differences among BMI groups within each country and across all 5 countries.

We have added statistical differences to the within site differences for week vs. weekend day PA.

Discussion

17. The discussion is well balanced and adequately supported by the data.

18. Several grammatical errors throughout the manuscript.
We have corrected any grammatical errors.

Reviewer 2

This paper reports on an analysis of data from the METs study. This study collected a variety of data, including accelerometer and self-report physical activity data, from over 2500 adults in 5 countries across the epidemiological transition. The main aims of METS (as taken from the protocol document of Luke et al 2011) is to investigate the population mean levels of PA and how they related to population mean levels of obesity and relative weight. Please comment on the different sampling strategies for each site and whether it is considered a limitation. For example, in the US site recruitment was done through randomly selecting at the city block level, Jamaica sampled at a district level. While Seychelles stratified individuals to represent the age and sex breakdown of the whole country, Ghana and South Africa also stratified by age and sex but only to represent the locality. All these strategies are robust but limit readers from making direct comparisons between countries involved i.e. saying that the US had a higher obesity rate than Ghana. However, it is fine for comparing relationships i.e. physical activity on the weekend was associated with adiposity in one country but not in another.

Thank you for this observation. While in METS we are performing a multi-country study per se, our samples are not meant to be representative of the countries as a whole, but instead characteristic of broad lifestyle patterns, both common and unique to each site. We have added the following sentence to page 4, lines 114-116: “It should be noted that the samples are not meant to be representative of the countries as a whole but are, however, characteristic of broad lifestyle patterns both common and unique to each site.”

The paper is very well written and is a lot of work has gone in to all aspect of the study and the analysis. Well done. The paper itself (results section especially) is very text and number heavy and was difficult to get through. However, when seeing the figures the differences within each country and between countries are extremely clear. This needs to be capitalised upon. For example, Figure 3 for women it seems very obvious that in Seychelles women need to be intervened upon on the weekend days (regardless of BMI status) while in South Africa weekday/weekend are so similar while in the US OW and OB women on both weekdays and weekend days are a target for intervention. These differences take a little while longer to pull out from the text.

We have altered the text in the results section, tables and figures in an effort to capitalise upon the stark contrasts.

*Minor essential revisions

Line 74- mention context/setting as well as pattern and intensity of physical activity

We have added the context/setting to line 75.
Line 113 - how were data on infectious disease etc collected and at what stage? Before other measures were taken during the screening process? Self-reported?

The infectious disease data was collected by self-report. We have changed the sentence (lines 117-118) to now read as follows: “Individuals were excluded if they self-reported that they were diagnosed with infectious disease (e.g. HIV-positive), were pregnant or lactating, or were unable to participate in normal physical activities.

Line 128 – How many times were height, weight etc measured? Doesn’t say in the protocol document.

We measured the height and weight twice and if the measurements differed by more than 0.1kg for weight and 0.1cm for height, we completed a 3rd measurement. We have added the following information to the text (lines 134-136): ‘We repeated both the height and weight measurements twice and if they differed by more than 0.1kg for weight and 0.1cm for height, completed a third measurement.”

Line 150 – Was the SAS macro specially developed for this study? Freely available for others to use?

The activity monitor program is freely available through the NHANES website; http://appliedresearch.cancer.gov/nhanes_pam/. We have referenced this website, line 156.

Line 191 - where was the data entry done? At the one central location in Chicago?

Loyola University Chicago is the coordinating center for METS and all data is centralized here. The data is double-data entered and then undergoes several logic checks by the study data manager.

Line 203 – middle HDI is mentioned twice and very high not mentioned. Be consistent with the protocol document that says ‘Ghana is defined as a low HDI country, South Africa as middle HDI, Jamaica and Seychelles as high HDI and the US as a very high HDI country’ (Luke et al., 2011).

Thank for this oversight. We have rectified our text to be consistent with our protocol paper. Lines 104-107 now reads as follows: “These sites were selected as they represent a broad range of socio economic development, as defined by the UN Human Development Index (HDI), i.e. Ghana is a low HDI country, South Africa is a middle, Jamaica and the Seychelles as high, and the US as a very high HDI country [18].

Line 252- Since there is a separate heading for ‘self-reported PA by adiposity’ and since the PA-adiposity relationship is a main aim of METS, suggest to have a heading for ‘weekday and weekend day PA by adiposity’ or similar for line 252 to 259 and also 272 to 277. Also complete this analysis for within each country
rather than just all countries combined. What about total MVPA from accelerometer by adiposity within each country?

We have added the following heading to lines 260: “Weekly physical activity patterns by adiposity.”

Line 262- state that this part of the analysis is for all countries combined.

We have now added the following text to lines 281: “Overall, and combining sites, lean men accumulated significantly more MPA on weekday’s than overweight and obese men (40.7 ± 28.4, 32.7 ± 25.7, and 26.9 ± 22.7 min/d, p<0.001), while amongst the women differences were much smaller, but remained significant (24.7 ± 17.4, 23.0 ± 17.9 and 18.8 ± 17.2 min/d, p<0.05) for weekdays.”

Line 266 – are the differences in MPA based on occupation true for all countries?

The differences in moderate MPA are only applicable to Jamaica, Seychelles and the US.

Line 280 – in this paper we have METS (study name) and MET (for metabolic equivs) which may be a little confusing. Consider not using MET when describing the outputs from the GPAQ or state it differently. Alternatively, perhaps put the study name METS into italics.

We have put the study name in italics.

Table 1- waist, hip and blood pressure are reported but not used anywhere. Delete.

We have deleted waist, hip and blood pressure measurements from the table.

Table 1 - state in the footnote examples of what ‘manual laborer’ were for context

We have added the following footnote to Table 1a & b: “*Education, employment status and manual labor were captured using an occupation questionnaire from the U.K. National Statistics Socio-economic Classification (NS-SEC), 2000 edition [25].”

Table 3a and b – consider highlighting significant differences between BMI categories within each country

We have now highlighted significant differences in tables 2-4.