Author's response to reviews

Title: The effects of individual, family and environmental factors on physical activity levels in children: a cross-sectional study

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Author's response to reviews: see over
31/01/14
Dear Dr. Parkinson,

Thank you for considering the revised version of our manuscript entitled “The effects of individual, family and environmental factors on physical activity levels of children” for publication in BMC Pediatrics. All authors have approved the revised manuscript and fulfilled conditions required for authorship and have no stated conflicts of interest.

We are grateful to the referees and the Editor for identifying some important clarifications and changes needed in the paper. We have thoughtfully taken into account these comments and have addressed the reviewers’ concerns point by point in the following pages.

We hope all these changes fulfil the requirements to make this manuscript acceptable for publication in BMC Pediatrics.

We look forward to hearing from you.

Sincerely,

Sharon Cadogan, Eimear Keane, Patricia Kearney
Response to reviewer comments for:

**Title:** The effects of individual, family and environmental factors on physical activity levels in children: a cross-sectional study

Authors: Sharon L Cadogan, Eimear Keane and Patricia M Kearney

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**Editor's comment:** "The reviewers have recognized the value of your manuscript but have provided several comments that need to be addressed. Please revise your manuscript accordingly."

**Response:** Thank you, we have addressed each of the reviewers comments below with reference to the revised manuscript.

**Reviewer #1: Amy Lampard**

**Comment:** This manuscript seeks to identify the individual, family and environmental factors associated with child physical activity, using data collected in a population-based sample. This research fits well within the current paradigm recognizing the potential importance of a child’s contextual environment in supporting physical activity. The paper is well-written. The introduction clearly outlines the rationale for the current study. The sampling methods are appropriate for the research question. I have the following major and minor recommendations for revision.

**Response:** Thank you

**Comment:** It is unfortunate that the dependent variable in analyses was based on the parent-reported PA measure of “days of hard exercise of 20 minutes” as this does not map onto the WHO PA guidelines – 60 minutes of MVPA per day. The authors need to make this limitation more explicit.

**Response:** Thank you. Unfortunately, the Growing Up in Ireland study only asked the children about achieving 60 minutes of MVPA per day. Using this variable, 25% of nine year olds meet the recommendation (29% of boys versus 21% of girls). However, research has shown that children under the age of 10 are not reliable sources for recalling their physical activity, particularly in terms of intensity [1]. Validity studies have concluded that studies should use objective measures of PA, or if this is not feasible, rely on parental reports of child PA[2]. Because of the lack of reliability, we opted to use the parent (primary caregiver) reported physical activity for the study child. The primary caregiver reported PA was based on how many days in the last 14 the study child had achieved at least 20 minutes of hard physical activity. This self-report question was found to be reliable with acceptable validity when compared with accelerometer data[3]. We agree that this is a limitation and
have added a paragraph into the discussion outlining this limitation and clarifying the validity of the dependent variable used:

**Line 322-331:** “Further, the nature of the PA data collected does not correspond with WHO guidelines – 60 minutes of MVPA per day [4]. Further, the nature of the PA data collected does not correspond with WHO guidelines – 60 minutes of MVPA per day [4]. While self-report (by child) of the WHO PA levels was available, the data were not used for the dependent variable as it has been found that children under 10 are not reliable at recalling PA patterns, in particular PA intensity [1]. Validity studies have concluded that studies should use objective measures of PA, or if this is not feasible, rely on parental reports of child PA [2]. The PA data available for this research was primary caregiver reported as opposed to objectively measured data. The primary caregiver reported PA based on how many days in the last 14 the study child had achieved at least 20 minutes of hard physical activity. This self-report question was found to be reliable with acceptable validity when compared with accelerometer data[3]. Also, using this question, other Irish research has constructed PA categories in the same way[5].”

**Comment:** The authors also need to justify the use of this measure of child PA, particularly the classification of children into low, medium and high PA groups. Some evidence of the reliability and validity of this approach must be provided. Showing that this measure and this classification is valid is central to the whole study and validity of results.

**Response:** Thank you for highlighting the need to describe the categories of PA in more detail. We agree that this needs to be clearer for the reader. We have included further information in the revised methods section:

**Line 113-116:** “Study child’s PA was re-coded into a three level variable based on previous research[6]: low “0-4 days”, moderate “5-8 days” and high “>9 days” PA groups. Nine or more days out of previous 14 was the highest possible value and corresponds closest to the recommended PA guidelines. This is also consistent with other Irish research using the same wave of the GUI data[5].VALIDITY”

**Comment:** In the Methods, more details need to be provided regarding measurement in general. This is particularly the case for parenting style, screen time, and all environmental-level variables. Please provide information about the reliability and validity of these measures.

**Response:** Thank you for your comment suggesting further details on measurements used. Additional information has been provided on reliability and validity:

**Screen time:**

**Line 125-131:** “TST was categorised based on the recommendations of the American Academy of Paediatricians [7]. This variable was created by combining three screen time variables; hours spent watching TV/videos, playing video games and using a computer
(<1 hour, 1-3 hours, >3 hours). This resulted in a seven level response variable, classified as: “adhering to (<) the recommended maximum two hours/day” or “exceeding the recommended two hours/day”. Adhering to the recommended TST was defined as, the study child only exceeding one hour of screen time in one of the screen time variables (giving a potential for maximum two hours TST).”

Child’s favourite hobby

**Line 132-136:** “The study child’s favourite hobby variable was created using 32 hobbies listed by the child, classified into a two level response “active” or “inactive” (16 hobbies in each group). A hobby was considered active if it required the child having a physically active participatory role and inactive if the child had a permissive role or remained sedentary. Active hobbies included: basketball, football, hockey and gymnastics. Inactive hobbies included: reading, listening to music and watching TV”.

Weight status (child)

**Line 137-142:** “Trained interviewers were responsible for height and weight measurements of each study child and each adult respondent. Height data was recorded to the nearest millimetre using a Leicester portable height stick [8]. Weight was recorded using a SECA 761 flat mechanic scales to the nearest 0.5 kilogram [8]. Children’s body mass index (BMI) were classified as normal weight, overweight (BMI of 19.46 for boys and 19.45 for girls) or obese (BMI of 23.39 for boys and 23.46 for girls) using age (9.5 years) and gender specific International Obesity Taskforce (IOTF) cut off points [9].”

Transport to/from school

**Line 160-163:** “The school transport variable (caregiver reported) was created using questions on how the study child travelled both to and from school (walks, by public transport, school bus/coach, car, cycles or other). Responses were combined and re-coded as “active both ways”, “active one way, inactive one way” and “inactive both ways.”

School sports facilities/neighbourhood facilities

**Line 164-167:** “The school playground and sports facilities data were obtained from the school principal questionnaire while data on neighbourhood facilities were primary caregiver reported. Responses for school facilities were re-coded as “very good/excellent” or “fair/poor”. Responses to both neighbourhood facilities were re-coded as “agree” or “disagree.”

In addition to adding these paragraphs, a sentence directing readers to information on sources and validity of these questions has been provided:

**Line 100-101:** “Sources and validity of each of the questions used for this research is available elsewhere [8].”
Minor comments

Comment: Line 101. How was the decision to classify total screen time into <2 hours and > 2 hours made? I assume this was based on a specific screen time recommendation, for example, that by the American Pediatric Association, so please provide a reference here.

Response: Thank you for your comment about this missing reference. Yes, this was based on American Pediatric Association, which has now been referenced in the text:

Line 125: “TST was categorised based on the recommendations of the American Academy of Paediatricians [7].”

Comment: Line 123 – please say “alpha” or p, not just “values” when stating the significance level.

Response: Thank you. This sentence now reads:

Line 169/170: “P-values less than 0.05 were considered statistically significant.”

Comment: Line 161 – please make it clear that after this point, results are from multivariate models (e.g., in headings)

Response: A new heading has been added: “Multivariate logistic regression findings”. The following statement has also been added under this heading

Line 212: “Figure 1 illustrates the findings (final model) of the multivariate multinomial logistic regression analyses.”

Comment: The results are presented in atypical fashion for the multivariate regression. Please structure the results section so that it presents the results as, model 1 (individual), then model 2 (family added; interpret family estimates) and then model three (environmental added; interpret environmental estimates). When using block entry, it is not typical, for example, to compare individual-level estimates from model 1 and model 2. That is not the point of this type of analysis, which is more often used to answer questions like, “what do family level factors contribute after individual-level factors are accounted for…?”

Response: Thank you. The structure of the results section now includes the headings “Model one (individual level factors)”, “Model two (Individual and family level factors)” and “model three (fully adjusted model)”.

Under these headings, the focus has been shifted towards reporting on individual level factors first, followed by family level factors, having accounted for individual; level factors, and subsequently environmental factors having adjusted for both individual and family level factors.
Comment: Line 232 – as this previous finding is about the prevalence of screen time, it does not, in fact, “support” the current result regarding the relationship between screen time and PA. Please revise the wording.

Response: Thank you. The wording has been revised and now states:

Line 289-290: “Previous Irish research reported that over 99% of children and youth exceeded the recommended maximum two hours sedentary screen time per day [10].”

Comment: Line 234 – consider providing a reference for the displacement theory

Response: Thank you for your comment. A reference has been added for the displacement theory with respect to physical activity.

Comment: Line 235 to 237 – please tone down this statement. These cross-sectional results are only suggestive.

Response: Thank you. This statement has been replaced with:

Line “Remarkably, individual behaviours appear to predict PA levels when considered in the multiple domains. Future research should aim to use more robust objective measures to explore the usefulness of the interconnect that exists across these domains. In particular how the family and environmental settings could be useful facilitators for consistent individual level factors such as sports participation”.

Comment: The family and environmental-level factors included in this study are not a comprehensive list of all possible relevant factors. Please include this as a limitation in the discussion.

Response: Thank you, this has been added to the limitation section of the paper:

Line 335/338: “Finally, this research provides a comprehensive list of individual level factors; however, some family and environmental level factors were not available such as the primary caregiver’s PA patterns. However, the family and environmental factors available include some of the most studied in the literature.”
Reviewer #2: April Oh

Thank you for your much valued comments. We have adapted the manuscript accordingly. We have found them very useful, and, feel our revised manuscript has benefited significantly as a result.

Comment: Background – More of a literature review justifying the multilevel approach would strengthen the manuscript. In addition a theoretical framework would guide the authors hypotheses and selection of the domains within their multilevel framework. This inclusion would strengthen the paper’s scientific merit. By including a framework and stronger conceptualization of the constructs/ measures could be specified in the paper.

Response: Thank you. A theoretical framework has been incorporated into the introduction section of the paper:

Line 53-59: “In order to structure the factors that are relevant, the conceptual framework for this research adopted Bronfenbrenner's ecological model of child development and well-being [11, 12]. This model proposes that a child's development is affected by multiple levels of influencers including the micro-system which includes direct influencers such as family, school and neighbourhood [12]. Bronfenbrenner's model advocates the need to address factors at multiple levels in order to understand and change PA behaviours. Multilevel approaches derived from these ecological models have been recommended to examine PA determinants [13].”

Comment: Discussion – The authors make conclusions and recommendations beyond the reach of what their data and results describe. This was a cross-sectional study of 9 year olds. Thus, making broader generalizations of findings to “children” seems beyond the scope of what the data results indicate. “Children” can encompass ages 5-11 and if including adolescent children, up to the age of 18. Thus, making statements about interventions for children are beyond the scope.

Response: Thank you. We have clarified that the results are generalizable for nine year old children.

Comment: The recommendations regarding interventions should be revised substantially. Given the limitations in measurement (especially with parent report physical activity), can these intervention suggestions be made? The authors should discuss potential research directions. It appears that one of the strengths of this study is inclusion of multiple domains and factors within them. Some discussion regarding these factors within the broader context of the environments in which the 9 year olds are embedded would be important.

Response: The recommendation for interventions has been removed and potential research directions have also been added:

Line 300-304: “While this research did not identify environmental factors as major determinants of PA, more research is needed. In particular, the importance of built environments in developing policy for PA and other health behaviours has emerged in the literature[14, 15]. Hence, applying the social-ecological theory, objective measures of PA, along with more robust environmental level factors should be considered for modelling PA.”
**Comment:** The authors should discuss their findings particularly the key findings stated 235-237 within the context of the extant literature. How are findings similar? How do they contrast?

**Response:** Thank you. In the revised manuscript, we have discussed our findings in relation to the findings of previous research in terms of contrasts and conflicts:

**Line 262-275:** “Consistent with both extensive reviews by Sallis et al[16] and van der Horst et al [17], boys were more likely to have high PA levels. Literature suggests that differences in organised sports participation may be responsible for some of gender disparities in PA levels. In this research, over 75% of the children were members of a sports or fitness group (84% of boys versus 67% of girls). In the fully adjusted model (controlled for gender), this research found children who were members of a sports or fitness group were almost twice as likely to be in the high PA group compared to children who were not. This is consistent with findings of the review by Sallis et al which concluded that community sports participation [16] was positively associated with higher PA levels. Despite generally higher sports participation among boys, a review of PA correlates among girls aged between 10 and 18 also found that organised sports participation had a consistent positive association with higher PA levels[18]. Moreover, longitudinal studies have reported that participation in organised sports during childhood may be associated with long-term participation in PA in both adolescence and adulthood [19, 20]. The promotion of sports and other high intensity activities may therefore provide an opportunity to increase PA among school children, specifically nine year olds.”

**Comment:** Line 226 – the authors discuss the BMI and PA literature but then in this paper, uses weight status in the model. Why weight status and not BMI if measured BMI was available?

**Response:** Thank you. BMI was categorised for the purpose of the multinomial multivariate logistic regression. Literature pertaining to weight status is now referred to in the discussion.

**Line 305-311:** “While two large reviews [16] [17] have reported inconclusive or no relationship between weight status and PA levels, this research found that the weight status of the child was negatively associated with PA levels. Using objectively measured BMI data, being overweight or obese was associated with lower levels of PA. A possible explanation for this contrasting finding could be the use of measured BMI for categorising weight status as opposed to self-report.”

**Comment:** Methods – It is not clear whether the data were collected in a survey or in person interview. Authors need to state the time period of data collection. Were data all collected during the school year?

**Response:** Thank you. The methods section now includes the following information:

**Line 98-100:** “The main interviews were completed on a Computer Assisted Personal Interview (CAPI) basis and there was also a self-complete paper-based module for all respondents, which included some potentially sensitive questions.”
Line 84-86: “Fieldwork for the school-based component was carried out between March-November 2007, while fieldwork for the home-based phase of data collection ran from July 2007-July 2008”.

Comment: The audience of the journal is an international one. Information regarding the nature of elementary physical education or recess time would be important for the reader to know as this could also impact the outcome variable.

Response: Thank you. We have provided following information:

Line 277-279: “The Irish primary school day typically lasts five hours and 40 minutes, starting around 9am and finishing around 3pm. The curriculum recommends one hour of physical education per week, however, it has been suggested that many schools do not provide this[10]”.

Comment: What is the rationale for including child’s favorite hobby in the model?

Response: We decided to include this in the research because a previous extensive review of the literature concluded a positive association between child’s preferences for active pastimes and higher PA levels:

Line 283-286: “Similarly, in their review of previous research, Sallis et al [16] concluded that children's preference for physical (rather than sedentary) activity was one of the factors most consistently associated with their participation in such activity.”

Comment: More detail on how “active” or “inactive” were coded is needed to interpret the results. It is unclear why this variable is important to the model since it appears the authors don’t have information on how often the child participates in this hobby or if it occurred during the 14 day recall for exercise. The way the description reads now it is possible for a child to have reading as a hobby and be active in this hobby, but how is this associated with PA behavior?

Response: We agree that the coding description of how active/inactive PA was unclear. We have rephrased the paragraph and added additional information regarding the coding. For example: reading, writing, listening to music were categorised as inactive while sports including basketball, hockey, soccer and gymnastics were categorised as active:

Line 132-136: “The study child’s favourite hobby variable was created using 32 hobbies listed by the child, classified into a two level response “active” or “inactive” (16 hobbies in each group). A hobby was considered active if it required the child having a physically active participatory role and inactive if the child had a permissive role or remained sedentary. Active hobbies included: basketball, football, hockey and gymnastics. Inactive hobbies included: reading, listening to music and watching TV.”
Comment: Were any of the variables missing data? How was this treated? The reference category needs to be stated in the OR reporting of results.

Response: Thank you. A footnote highlighting reference category has been added to the tables. Information on missing data has been included in the revised manuscript:

Line 172-175: “Missing data levels were very low for the majority of the variables used, and where missing values were identified (e.g. 5.2% of PCG BMI measurements) it was found not to be missing at random and hence, data could not be imputed. Primary caregiver reported PA data was available for 99.9% of the study children, giving an effective case base of 8,566 children for analysis.”

Comment: The variables listed as family variables are caregiver factors, not family variables. Please revisit and/or justify this conceptualization and the measures used.

Response: Thank you for this comment, many of family variables available were parent related. However, primary caregiver’s education was included as a proxy for socio-economic status, while other variables including having siblings and household type are described as family level variables. This is similar in existing research also where it has been suggested that parent influencers are the main family related factors that affect children’s behaviours.

Comment: Include the exclusion criteria for the study in the results. Did you include all 9 year olds, were some excluded with disabilities or other health problems that may limit their physical activity?

Response: Thank you. All mainstream, special and private schools were included in the sampling. This information has been added to the methods section:

Line 77-78: “The sample was selected using a two-stage clustered sampling method within the Irish primary school system (all mainstream, special and private schools)”

Comment: In the measures, the authors must specify that these are parent reported measures.

Response: Thank you for highlighting this problem. We have clarified the source of data (primary caregiver, child, school principal or objectively measured by trained interviewers) for each of the variables in the text.

Comment: Were there any data captured on the amount of time the child lived with the caregiver? How was this defined? Was this included in the inclusion/exclusion criteria? What if the child’s primary caregiver was another family member? (aunt, uncle, grandmother).

Response: Thank you for your comment. There was no information on how long the child lived with the caregiver, however, parents were asked to nominate the primary caregiver based on who spent the most time with the child. In 98% of cases this was the child’s biological mother. The text now states
who the primary caregiver was. It was defined as the parent who spends most time with the study child. Parents were asked to identify the primary caregiver. The methods section now includes the following statement:

**Line: 96-98:** “Parents nominated a primary caregiver (the parent who spent most time with the study child) who was the primary respondent. In 98% of cases, this was the study child’s biological mother”.

**Comment:** Occasionally “PCG” is used. Please state for the reader what this stands for.

**Response:** Thank you. PCG stands for primary caregiver and this abbreviation has since been removed from the revised manuscript and replaced with the full title “primary caregiver”.

**Comment:** Line 162-163: Is this result in combination of the variables?

**Response:** Thank you. The results section has been readjusted based on the second reviewer’s comments and in line with standard reporting of multilevel analysis where results are reported by model. The structure of the results section now includes the headings “Model one (individual level factors)”, “Model two (Individual and family level factors)” and “model three (fully adjusted model)”.

Under these headings, the focus has been shifted towards reporting on individual level factors first, followed by family level factors, having accounted for individual; level factors, and subsequently environmental factors having adjusted for both individual and family level factors.

**Comment:** Table 1 needs a footnote to explain what “Favourite” means and how this was scored.

**Response:** Thank you, the following footnote has been added to explain the response ‘favourite’:

**Table 1:** “Favourite refers to the study child reporting the activity as being their favourite thing to do.”

**Comment:** Table 2 has typos with extra “1” and missing “0”s before decimals.

**Response:** Thank you for highlighting these typos. They have now been corrected and the tables have been checked for further typos.

**Comment:** Tables should be consistent in formatting of decimals.

**Response:** Thank you for your comment. Tables have been reformatted to ensure consistency.
Comment: The tables need to state the reference category for the outcome variables. Is it Moderate versus Non active?

Response: Thank you. The reference category for the outcome variables has been added to the tables. Both high and moderate PA groups are compared to low PA groups (high versus low, moderate versus low).

Comment: The tables should be able to stand on their own. More explanatory text with footnotes for the variables are needed. Also, note the significant values.

Response: Thank you. Footnotes have been added to the table and significant variables have been emphasised.

Table 1: • all data is primary caregiver reported unless indicated otherwise
* child-reported variable
** weight status defined as BMI classified according to International Obesity Taskforce on Obesity age and gender specific guidelines using objectively measured height and weight data
*** weight status defined as BMI classified according to World Health Organisation guidelines using objectively measured height and weight data.
^ school principal reported data
# favourite refers to the study child reporting the activity as being their favourite thing to do

Comment: Line 229 – This sentence should be revised. It gives the impression the recommendation is that children should watch 2 hours.

Response: Thank you. This sentence has been rephrased and now reads:

Line: 288-289: “The American Academy of Paediatricians recommends that children do not exceed two hours of sedentary screen time per day”.

Comment: Line 236 – The recommendation to improve facilities is out of place, given the quality of facilities were not addressed in the study.

Response: Thank you. This recommendation has been removed.
References for responses to reviewers comments


