# Household level correlates of children's physical activity levels in and across twelve countries

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**What is already known about this subject:**

- Household-level characteristics can directly influence children's moderate- to vigorous-intensity physical activity (MVPA) levels.
- Few studies have explored the relationship between household-level factors and MVPA levels that include low- and middle-income countries.

**What this study adds:**

- Across 12 socially, economic, and environmentally diverse countries, results showed that children with electronic media in their bedroom had significantly lower MVPA than those who did not, while being active more in the home and yard was associated with more MVPA with consistent findings across a diverse group of countries.
- Across all countries, ownership of play equipment was not related to MVPA but ownership of play equipment that is more frequently used was associated with more MVPA in most sites.
- Higher social support for PA was associated with higher MVPA yet the strength of association varied across countries.

## Abstract

Objective: Household factors (electronic media equipment, play equipment, physical activity in the home and social support) have been associated with childhood MVPA but little is known about how these factors differ across diverse countries. The objective was to explore household correlates of objective MVPA in children from 12 countries.

Methods: Overall, 5,859 9-11 year old children from 12 countries representing a range of human and socioeconomic development indicators wore an accelerometer for 7 days and parents reported on household factors. Multilevel general linear models explored associations among household factors and MVPA variables controlling for age, sex and parental education.

Results: Across sites, children with at least one piece of bedroom electronic media had lower MVPA (~4 minutes/day; $p<0.001$) than those who did not. More frequent physical activity in the home and yard, ownership of more frequently used play equipment and higher social support for physical activity were associated with more MVPA (all $p<0.001$). The association between play equipment ownership and MVPA was inconsistent across countries (interaction $p<0.01$).

Conclusions: With the exception of play equipment ownership, modifiable household factors showed largely consistent and important associations with MVPA across high, mid, and low-income countries.

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## Introduction

Higher levels of moderate- to vigorous-intensity physical activity (MVPA) are positively associated with cardiorespiratory and metabolic health[1] and a more favorable body weight[2] yet, globally, childhood MVPA falls below optimal levels.[3,4] Inactivity[5] accompanies elevated obesity levels[6] in Europe, Canada and the US, and evidence that physical activity (PA) is declining in low income countries is concerning.[7] An understanding of factors influencing children's MVPA is a necessary precursor to designing effective global PA promotion[8] and obesity prevention strategies as PA remains a cornerstone of obesity prevention[9].

Children's PA is influenced at different levels by a range of individual and social factors, as well as community, environmental and policy-level factors.[10] The home is one setting in which these factors may directly impact children's PA as parents provide the opportunity, means and support for their children to be active through providing, for example, equipment, transport and encouragement for PA. The existing evidence base does not provide a comprehensive account of the association between household factors and children's PA globally and differences between countries may exist. Associations between the home environment characteristics and children's PA are not consistent[8,11-14] potentially as a result of both contextual differences and methodological variation which are hard to separate. Few studies report on findings from middle or low income countries;[8,11] countries where some household correlates may not be as important, or may not be related at all, to children' PA levels.

This paper aims to address current limitations in the literature by exploring household level correlates of objectively measured MVPA in a large sample of children from 12 socially, economic, and environmentally diverse countries spanning five world regions (Europe, Africa, the Americas, South Asia, and the Western Pacific). To facilitate direct comparisons between sites a common, standardized protocol was used. Understanding the correlates of children's PA in diverse sites can aid in the tailoring of PA promotion efforts locally and worldwide.

## Methods

*ISCOLE*

The aim of the International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) was to determine relationships between lifestyle behaviours and obesity in school-aged children in 12 countries representing a range of socioeconomic indicators (World Bank classification and Human Development Index).[15] The Institutional Review Board at Pennington Biomedical Research Center (coordinating center) approved the central protocol, and the Institutional/Ethical Review Boards at participating institutions approved local protocols. Between 2011 and 2013 children who were in the grade level of 10-year olds from schools that agreed to be in the study were provided with information packets to be brought home. Each parent/guardian provided informed consent and completed questionnaires on behalf of their household. Participating children provided assent and completed self-report questionnaires at school. Technicians administering the questionnaires were trained to provide standardized answers to queries within and across sites. Detailed descriptions of ISCOLE methods are available elsewhere[15] including accelerometer preparation, distribution and data handling details.[16] Within the ISCOLE sample, MVPA has been confirmed as a significant predictor of obesity.[17]

*Participants*

Overall, 13,015 consent forms were distributed to children in eligible schools. A total of 7806 signed consent forms were returned to the research staff, and the total ISCOLE sample was 7,372 nine to 11 year-olds.[17] The analytical sample in the present analysis was 5,859 due to exclusion of participants not providing valid accelerometry data (n=819) and those missing potential correlates (n=399) or highest parental education (n=295). There was a significant difference in the amount of missing data attributed to each site ($\chi^2$ <0.001). Children with missing data were 0.06 years older ($p<0.001$) and had BMI 0.4 kg/m$^2$ higher ($p<0.001$) than those in the analytical sample.

*Outcome measures*

Participants were given an Actigraph GT3X+ (ActiGraph LLC, Pensacola, FL, USA) accelerometer along with wear instructions.[16] The device was attached to an elastic waist belt worn over the right mid-axillary line. Participants wore the device 24 hours/day for up to 7 consecutive days, removing only for water-based activities. Data were collected at an 80Hz sampling rate, downloaded in 1 second epochs and aggregated to 15 second epochs. An MVPA cut-point of ≥574 counts/15 seconds was applied.[18] After exclusion of nocturnal sleep episodes,[19,20] participants providing ≥4 days (including ≥1 weekend day) of valid data (≥10 hours/day of waking wear time) were included in the analysis.[21,22] Mean MVPA (min/day) was calculated for the overall sampling period and for weekdays, weekend days and the after-school period separately, using school finishing times for each participating school.

*Self-reported correlates*

*Availability of household electronic media equipment:* Parents reported the number of household TVs ('≤1'; '2' and '≥3'), whether their child had electronic media equipment (TV, computer or non-hand held video game system) in their bedroom, and whether their child had access to personal electronics (mobile phone or 2-way radio, hand-held videogame player or music system) for their own use (yes/no). Each child also reported whether they had a bedroom TV (yes/no).

*Availability and use of household play equipment:* Parents reported how often their child used play equipment (active video games; basketball hoop; bike; fixed play equipment; jump rope; roller skates/skateboard/scooter; sports balls/racquets/bats/sticks; swimming pool) at or around the home during the last year. Options included 'not available (don't have)'; 'available but never use'; 'once a month or less', 'once every other week' and 'once a week or more'. The sum of household play items (regardless of usage) and sum of regularly used (i.e. 'once a week or more') play items were used herein.

*Household physical activity:* Parents reported items from the Neighborhood Impact on Kids survey[23] 'how often during the past year has your child been physically active inside your home?' and 'how often during the past year has your child been physically active in your yard or common area or in your driveway?' Responses were categorized as 'never'; 'less frequent (once a week or less)' and 'frequently (more than once per week)' for analysis.

*Household support for physical activity*: Parents responded on four items[23] asking how often they do sports or PA with their child, and how often they provide transport for, watch or encourage their child to play sports in a typical week. Response options ranged from 'never' to 'every day', and the mean score of the 4 items was spilt into tertiles representing 'low', 'medium' and 'high' social support for analysis.

*Covariates*

Child sex and age (months), parent-reported highest education (from 'less than high school' to 'postgraduate degree'; to represent socioeconomic status) and accelerometer wear time were included as covariates.

*Statistical analysis*

Analyses were undertaken using SAS 9.4 (SAS Institute Inc., Cary, NC, USA) and results presented for the pooled sample and per site. Accelerometer variables (overall, weekday, weekend day and after-school MVPA) were non-normally distributed so were square-root transformed. Given the hierarchical nature of the data, a series of single predictor multilevel general linear models (GLM), adjusted for covariates and a site interaction were used to explore the relationships between the independent household-level variables and the dependent MVPA variables. Sites were considered to have fixed effects and schools nested within sites were considered to have random effects. Site-by-variable interactions were included in all models and were retained even if not significant. The denominator degrees of freedom for statistical tests pertaining to fixed effects were calculated using the Kenward-Roger approximation. GLM results are presented as unstandardized coefficients, standard errors and p-values. Least squared means were calculated for each level of the dependent variables within sites and were then back transformed. Differences in the back transformed least squared means are used for presentation.

Bonferroni corrections were applied for main effects ($p<0.005$) and interaction ($p<0.01$) significance levels.

## Results

Participant characteristics are presented in Table 1 and household level variable values are presented in Table 2. For the sample as a whole mean MVPA was 60 min/day and 6 of the 12 sites met global PA recommendations.

<Table 1 here>

<Table 2 here>

*Children's physical activity and electronic media equipment*

Significant (negative) main effects were found for the presence of electronic media equipment in the child's bedroom (parent report) for overall, weekday, weekend (all $p<0.001$) and after-school ($p=0.001$) MVPA. Although effect sizes were small, children with at least one piece of bedroom electronic media equipment had significantly lower MVPA than those who did not across all ISCOLE sites (Table 3). This equated to 3 (61 vs. 58), 3 (63 vs. 60), 4 (55 vs. 51) and 1 (29 vs. 28) fewer min/day of overall, weekday, weekend day and after-school MVPA respectively for those with bedroom electronic media. This effect was not seen for children specifically reporting a bedroom TV (all $p>0.05$), nor was there a significant effect of children reporting ownership of personal electronic devices not restricted to the bedroom ($p>0.03$ for all MVPA variables). Those with more TVs in the household had higher MVPA on the weekend only ($p=0.002$).

<Table 3 here>

*Children's physical activity and the physical environment (play equipment and location)*

More frequent PA in the yard ($p<0.001$) was associated with higher weekend MVPA while in the home ($p=0.031$), and both yard and home-based PA frequency were associated with higher overall, weekday and after-school MVPA across all sites (all p<0.001). Regardless of whether or not they were used, the total number of play items in the household was positively associated with after-school MVPA only (p=0.001). While there was no main effect for MVPA at other times, a significant site-by-variable interaction was found for overall and weekday MVPA (both p<0.01) with ownership of 8 or more play equipment items in Australia, Canada and Finland being associated with children undertaking more MVPA (8, 7 and 10 min/day, respectively). Conversely, in Portugal, Kenya and Brazil similar equipment ownership was associated with less MVPA (-8, -8 and -7 min/day, respectively) compared to those with no items. A significant positive main effect was observed for regularly used play equipment for all MVPA variables (all p<0.001). Ownership of 8 or more frequently used play equipment items in Australia, Finland and Colombia was associated with children undertaking 23, 22 and 22 min/day, respectively, more of MVPA, while in Kenya and South Africa similar equipment ownership was associated with children undertaking 1 min/day less of MVPA compared to those with no items.

*Children's physical activity and the social environment*

Social support for PA from adults in the household was associated with significantly greater MVPA (all variables p<0.001). A site-by-variable interaction for overall, weekday and after-school MVPA indicated that social support had a stronger influence in some sites (Figure 1), namely Australia and Finland, although all sites, except Kenya, demonstrated a positive trend.

<Figure 1>

## Discussion

This study provides insight into consistencies and differences in the associations between the home environment and objectively measured MVPA using a standardised protocol across economically and culturally diverse sites. Such information could be useful in targeted public health messages (e.g. "take electronic media out of the bedroom") that have local and global relevance.

*Household physical factors conducive to physical activity*

Across all sites, children reporting regular PA within the home and yard had higher objectively measured MVPA across the week (including after-school), confirming the importance of studying PA in the home. Similar to previous review findings,[11,12] we detected no overall association between the availability of play equipment and overall MVPA for the whole sample except for the after-school period. However, this overall finding masked an interaction effect indicating an association in some countries; Australia, Canada and Finland showed play equipment to be associated with 7-10 min/day more MVPA, while Portugal, Kenya and Brazil showed 7-9 min/day less. Such differences do not appear to relate to systematic wealth differences as a mix of low to high income sites display both directions of effect. Differences may relate to regional (e.g., weather, safety), or cultural (e.g., freedom to play outdoors, free time) differences, or the need for more specificity in describing play equipment (e.g., possible to use alone, condition). The difference in impact may also reflect the alternatives open to children when bespoke play equipment is not available.

Despite the absence of an overall effect of play equipment ownership, regularly used play equipment was associated with greater MVPA for the whole sample. This finding supports past research[24,25] which suggests that differences in findings may depend on the nuances of measurement, for example in studies that specify the number of items ’in plain view’ vs. ‘put away and difficult to get to.’[25] Given the cross-sectional nature of these studies it is difficult to ascertain whether children are more active due to the presence of the equipment or those who are more active tend to accumulate more equipment.[24] However, findings that the provision of play equipment alone is not associated with greater overall MVPA suggests that the role of play equipment is complex, and that social support or other factors in combination with provision[26] may be required to promote overall PA.

*Household social influences*

Our finding that higher social support is related to higher PA across all sites is consistent with much literature.[11,13,26-29] Past work reported parents' direct involvement (i.e., instrumental support like providing transport) and encouragement (i.e., motivational support) are linked to children's overall and leisure-time PA.[28] Parent social support has been found to directly and indirectly (via self-efficacy) relate to PA in a sample of older US children[27], with the potential to increase MVPA by up to 12 min/day.[26] The impact of social support in the ISCOLE sample ranged from an additional 0.4 to 18.6 min/day of MVPA, and its impact was strongest in the Australia and Finland sites. Children in these countries may be more dependent on, or responsive to, facilitated PA (e.g., reliant on parents as drivers to access team sport venues) rather than unassisted active play. Although inconsistencies in the association between social support and PA in review papers[11] may stem from variation in the indicators and measures used, this was not the case in the ISCOLE sample. Instead, the variation in the strength, or lack, of association suggests that practices such as verbal encouragement, the provision of instrumental support and direct engagement with a child may have differential effects in different cultures and contexts.

*Home physical factors less conducive to physical activity*

The presence of electronic media in the bedroom has been associated with higher sedentary time in the ISCOLE sample[30] while, herein, the presence of at least one bedroom electronic media equipment item was associated with lower MVPA across all sites. This adds to cross-sectional evidence on the negative effects of bedroom electronic media on health indicators.[31] A previous review reported an association between media equipment (owned, but not confined to the bedroom) and PA[11] which was not found in our sample. The inconsistencies may reflect differences in who is reporting or differences in terminology used. Even herein, the presence of a bedroom TV reported by children themselves was not associated with MVPA, whereas the parent question on bedroom electronic media capturing all devices showed a significant negative association. It remains to be established whether this results from differences in the reliability of parent and child reports, different effects for TVs compared with other electronic media,[32] or whether this is a proxy indication of socio-economic status. By querying bedroom electronic media two different ways the present study demonstrates the impact that alternative measurement approaches can have on findings.

*Implications*

Overall, there is homogeneity in the association between a child's home environment and their PA across ISCOLE sites: children who are active at home, who have less access to bedroom electronic media, who have more parental social support, and who frequently use available play equipment undertake more MVPA. While the strength of these effects differed between countries in some cases (e.g., a stronger association of social support in Finland and Australia), the only difference in direction was observed for play equipment ownership. There was no clear differentiation between sites grouped according to positive or negative associations as a factor of national wealth, geographic region, or other *a priori* attributes of the study sites. While the ISCOLE sample was not representative of whole nations,[33] the identification of differences in associations between multiple sites rather than single outliers, suggests more work is needed to fully understand correlates of childhood PA globally. Only then can obesity prevention strategies that have global relevance be designed and implemented.

*Strengths and limitations*

Reviews of the home environment and children's PA demonstrate how few studies have been conducted outside high-income, westernized nations.[8,11] Even studies conducted within the same country are difficult to compare due to the lack of consistency in the variables measured. To our knowledge, this is the first study to investigate differences in association between factors within the home environment and children's PA levels in economically and culturally diverse contexts using standardized methods. Further, the use of objectively measured PA provides greater confidence in the accuracy and reliability of these findings than studies reliant on self-reported PA.[13] Future work could enhance the insight gained from objective assessments by differentiating between the purposes of home-based PA; it is likely that understanding the different types of household PA such as active play, active video gaming and household chores could help explain the observed differences between countries.[11]

Although this is standard in similar studies,[11,13] limitation of the present study was the self- and parental-report of household contextual factors and the absence of parental PA levels. The study was also cross-sectional, so no causality of the direction of effects between factors can be inferred. Further research to confirm the longitudinal effects of key correlates identified would be valuable. A number of associations may be as likely to stem from reverse causality (i.e., children's activity shaping their environment) rather than vice versa; for example, parents of inactive children would have no need to drive them to sports facilities so social support would be lower, and active children may choose play equipment over other sedentary alternatives offered by parents. Although some of the relationships may seem obvious (i.e., children with more frequently used play equipment do more MVPA at home) we are interested in factors that are open to change and whether this relationship holds true in non-Western countries. Finally, while we included data from 12 sites from 5 geographic regions of the world, we did not include countries representative of all regions, and the data obtained within each country was from a narrow age range within a single site which may not represent that whole country;[33] notably most sites did not include participants from rural communities. As such, while our findings provide a considerable extension of knowledge, they cannot be generalized beyond the settings in which the data were obtained.

## Conclusion

The between-site comparisons facilitated by this study suggest that most associations between the home environment and PA are consistent across 12 sites regardless of Human Development Index, although the strength of association differ. Such information could be useful in targeted obesity prevention initiatives, for example in setting priorities and ascertaining in which countries or contexts public health messages (e.g., "take the electronic media out of the bedroom") may have more impact. The identification of factors which may have opposing effects in different countries serves to emphasise the importance of ensuring that local research is conducted, and that we do not rely on assumptions that all household correlates of children's PA will have the same effect in different contexts.

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## Table headings

Table 1. ISCOLE participant characteristics by study site.

Table 2. Proportion of participants with household level characteristics across ISCOLE sites.

Table 3. Associations between household level characteristics and physical activity outcomes.

## Figure headings

Figure 1. Overall MVPA of children receiving lower (bottom tertile) versus higher (top tertile) levels of physical activity social support for each ISCOLE site. Note: a higher value indicates that study children with higher physical activity social support have higher MVPA.

Table 1. ISCOLE participant characteristics by study site

| ISCOLE site (city) | World Bank ranking | Participants (*n, % male*) | Age (years) | Parent educational attainment (%)[a] | MVPA (min/day)[b] | Weekday MVPA (min/day)[b] | Weekend MVPA (min/day)[b] | After school MVPA (min/day)[b] |
|---|---|---|---|---|---|---|---|---|
| Australia (Adelaide) | High | 459, 45.5 | 10.7 | 79.5 | 65.5 | 69.4 | 55.5 | 28.0 |
| Brazil (Sao Caetano do Sul) | Upper-middle | 433, 49.0 | 10.4 | 41.3 | 59.3 | 61.5 | 53.8 | 26.2 |
| Canada (Ottawa) | High | 508, 41.7 | 10.5 | 91.1 | 58.8 | 62.3 | 49.7 | 26.5 |
| China (Tianjin) | Upper-middle | 488, 52.2 | 9.9 | 49.6 | 45.2 | 46.5 | 41.9 | 16.2 |
| Colombia (Bogotá) | Upper-middle | 854, 49.4 | 10.5 | 33.9 | 68.1 | 70.7 | 62.0 | 40.5 |
| Finland (Helsinki, Espoo, Vantaa) | High | 460, 46.5 | 10.5 | 72.8 | 71.1 | 75.6 | 61.7 | 45.3 |
| India (Bangalore) | Lower-middle | 538, 45.7 | 10.4 | 83.1 | 45.5 | 49.3 | 46.7 | 23.0 |
| Kenya (Nairobi) | Low | 467, 46.5 | 10.2 | 63.8 | 71.7 | 70.4 | 74.6 | 26.9 |
| Portugal (Porto) | High | 526, 42.8 | 10.4 | 21.7 | 55.7 | 60.0 | 44.9 | 24.9 |
| South Africa (Cape Town) | Upper-middle | 270, 38.9 | 10.1 | 31.1 | 62.9 | 63.2 | 62.0 | 41.0 |
| UK (Bath, North East Somerset) | High | 405, 44.2 | 10.9 | 71.9 | 64.7 | 67.3 | 58.2 | 31.0 |
| US (Baton Rouge) | High | 451, 41.0 | 9.9 | 73.8 | 49.9 | 47.5 | 56.1 | 26.2 |
| **All sites** | | **5859, 45.8** | **10.4** | **58.7** | **60.3** | **62.2** | **55.5** | **29.8** |

All are means unless otherwise stated; [a]Values refers to % of participants having at least one parent attaining some college/associates degree or higher; [b]Based on Evenson cut-point of 574 counts/15 seconds[18]; MVPA, moderate- to vigorous-intensity physical activity

Table 2. Proportion of participants with household level characteristics across ISCOLE sites

| ISCOLE site (city) | TV in bedroom[a] | ≥ 2 household TVs | Electronics in bedroom[b] | Personal electronics[b] | Sports equipment[c] | Frequently used sports equipment[c] | Active at home[d] | Active in the yard[d] | Family Social support [e] |
|---|---|---|---|---|---|---|---|---|---|
| Australia (Adelaide) | 32.9 | 88.4 | 57.3 | 7.6 | 6 | 2 | 65.8 | 79.1 | 35.5 |
| Brazil (Sao Caetano do Sul) | 73.7 | 76.9 | 17.3 | 20.3 | 4 | 1 | 49.2 | 49.0 | 14.8 |
| Canada (Ottawa) | 15.2 | 73.0 | 77.4 | 11.0 | 6 | 2 | 66.5 | 70.1 | 34.4 |
| China (Tianjin) | 33.8 | 37.3 | 37.7 | 52.2 | 5 | 1 | 42.0 | 36.7 | 23.2 |
| Colombia (Bogotá) | 76.5 | 65.0 | 30.4 | 48.1 | 5 | 2 | 64.5 | 44.3 | 13.3 |
| Finland (Helsinki, Espoo, Vantaa) | 28.9 | 67.4 | 52.4 | 0.4 | 6 | 2 | 59.8 | 76.5 | 20.2 |
| India (Bangalore) | 21.4 | 34.8 | 58.0 | 53.5 | 4 | 1 | 68.2 | 54.5 | 42.0 |
| Kenya (Nairobi) | 17.1 | 28.3 | 78.8 | 65.3 | 3 | 1 | 75.4 | 63.0 | 24.2 |
| Portugal (Porto) | 70.0 | 91.6 | 18.1 | 5.1 | 5 | 2 | 36.5 | 41.1 | 21.9 |
| South Africa (Cape Town) | 57.8 | 52.2 | 48.5 | 44.8 | 3 | 1 | 70.0 | 77.0 | 31.5 |
| UK (Bath, North East Somerset) | 44.4 | 78.8 | 52.1 | 3.5 | 6 | 2 | 71.8 | 76.5 | 23.5 |
| US (Baton Rouge) | 70.1 | 95.3 | 28.6 | 12.9 | 6 | 2 | 78.9 | 78.3 | 39.7 |
| **All sites** | **46.3** | **65.7** | **45.4** | **28.3** | **5** | **2** | **62.0** | **60.0** | **26.0** |

All values are percentages unless otherwise stated; [a] from child report; [b] percentage of children with at least one item; [c] mean number of items [d] refers to parents who reported their child being active in the home/yard (as appropriate) more than once per week; [e] percentage of participants in the top tertile of parental support based on the mean of three questions;

Table 3. Associations between household level characteristics and physical activity outcomes

| | Mean MVPA (min/day) | | | Weekday MVPA (min/day) | | | Weekend MVPA (min/day) | | | After school MVPA (min/day) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Less conducive to physical activity** | **B coefficient** | **SE** | **p** | **B coefficient** | **SE** | **p** | **B coefficient** | **SE** | **p** | **B coefficient** | **SE** | **p** |
| Child has a TV in bedroom | -0.08 | 0.14 | 0.313 | -0.04 | 0.14 | 0.744 | -0.15 | 0.20 | 0.024 | 0.04 | 0.13 | 0.917 |
| Child has electronics in bedroom | -0.12 | 0.14 | **<0.001** | -0.08 | 0.14 | **<0.001** | -0.18 | 0.20 | **<0.001** | -0.007 | 0.13 | **0.001** |
| Child has personal electronics | -0.19 | 0.18 | 0.218 | -0.04 | 0.19 | 0.609 | -0.57 | 0.27 | 0.031 | -0.06 | 0.18 | 0.917 |
| Number of TVs | 0.23 | 0.11 | 0.050 | 0.21 | 0.11 | 0.195 | 0.25 | 0.16 | **0.003** | 0.21 | 0.11 | 0.390 |
| **Supportive of physical activity** | | | | | | | | | | | | |
| Availability of play equipment | 0.04 | 0.03 | 0.179[b] | 0.05 | 0.03 | 0.406[b] | 0.03 | 0.05 | 0.128 | 0.08 | 0.03 | **0.001** |
| Frequently used play equipment | 0.08 | 0.03 | **<0.001** | 0.07 | 0.03 | **<0.001** | 0.12 | 0.05 | **<0.001** | 0.10 | 0.03 | **<0.001** |
| Physical activity in the home | 0.17 | 0.12 | **<0.001** | 0.24 | 0.12 | **<0.001** | -0.04 | 0.17 | 0.029 | 0.19 | 0.11 | **<0.001** |
| Physical activity in the yard | 0.34 | 0.12 | **<0.001** | 0.24 | 0.12 | **<0.001** | 0.53 | 0.17 | **<0.001** | 0.32 | 0.11 | **<0.001** |
| **Social support** | | | | | | | | | | | | |
| Physical activity social support | 0.05 | 0.08 | **<0.001**[a] | 0.05 | 0.08 | **<0.001**[b] | 0.09 | 0.11 | **<0.001** | 0.07 | 0.07 | **<0.001**[a] |

Note: Type 3 test of fixed effects, presenting unstandardized coefficients for the square root transformed MVPA variables. Significance for main effects for all sithes pooled set at P <0.005 (Bonferroni correction) and bolded when significant. Significant site-by-variable interactions [a]p <0.001, [b]p <0.01; MVPA, moderate- to vigorous-intensity physical activity.