This is the authors’ final peer reviewed (post print) version of the item published as:


Available from Deakin Research Online:

http://hdl.handle.net/10536/DRO/DU:30074635

Reproduced with the kind permission of the copyright owner

Copyright : 2015, Human Kinetics
Parent and preschoooler physical activity and TV

Cross-sectional and longitudinal associations between parents’ and preschoolers’ physical activity and TV viewing: The HAPPY study

Gavin Abbott¹*, Jill Hnatiuk¹, Anna Timperio¹, Jo Salmon¹, Keren Best¹, and Kylie D Hesketh¹

¹Centre for Physical Activity and Nutrition Research, Deakin University, 221 Burwood Highway, Burwood, Australia.

* Corresponding author

Dr Gavin Abbott
Centre for Physical Activity and Nutrition Research
School of Exercise and Nutrition Sciences
Deakin University
Melbourne, Australia

Phone  +61 3 9244 5503
Fax  +63 3 9244 6017
Email  gavin.abbott@deakin.edu.au
Abstract

Background: Parental modelling has been shown to be important for school-aged children’s physical activity (PA) and television (TV) viewing, yet little is known about its impact for younger children. This study examined cross-sectional and three-year longitudinal associations between PA and TV viewing behaviours of parents and their preschool children.

Method: In 2008-9 (T1), parents in the HAPPY cohort study (n=450) in Melbourne, Australia self-reported their weekly PA and TV viewing, and proxy-reported their partner’s PA and TV viewing, and their 3-5 year-old preschool child’s TV viewing. Children’s PA was assessed via accelerometers. Repeat data collection occurred in 2011-12 (T2).

Results: Mothers’ and fathers’ PA were associated with PA among preschool girls at T1, but not boys. Parents’ TV viewing times were significant correlates of girls’ and boys’ TV viewing at T1. Longitudinally, mothers’ PA at baseline predicted boys’ PA at T2, while sex-specific associations were found for TV viewing, with mothers’ and fathers’ TV viewing at T1 associated with girls’ and boys’ TV viewing respectively at T2.

Conclusions: The PA and TV viewing of both parents are significantly associated with these behaviours in preschool children. The influence of the sex-matched parent appears to be important longitudinally for children’s TV viewing.
**Introduction**

Early childhood is a key time for the development of physical activity (PA) and sedentary behaviours such as television (TV) viewing. Patterns of these behaviours are established early, tracking moderately from early childhood into later childhood and adolescence.\(^1\)-\(^4\) Low levels of PA and high TV viewing are linked with a range of adverse outcomes including poorer motor skill development, psychosocial health, and cardiometabolic health indicators, and increased adiposity among both preschoolers\(^5\),\(^6\) and school-aged children.\(^7\),\(^8\) Nonetheless, a considerable proportion of children are insufficiently active and engage in excessive TV viewing and other screen behaviours. For example, a recent health survey\(^9\) found only 72% and 26% of children aged 2-4 years met PA or screen-time recommendations, respectively, and just 20% of children met both sets of guidelines. Thus it is important to identify modifiable influences on young children’s PA and TV viewing behaviours.

As a child’s first and most proximal influence,\(^10\) parents play a key role in shaping their child’s physical activity and sedentary behaviours. Parents play the role of “gatekeeper” by providing instrumental support (e.g., access to sporting equipment or televisions/DVDs) and opportunities (e.g., taking the child out to a park), as well as being instrumental in encouraging or limiting certain behaviours.\(^11\) Additionally, according to Social Learning Theory,\(^12\) the amount of time parents themselves engage in PA and TV viewing may be especially important as they model and create opportunities to co-participate in these behaviours with their child.

In school-aged children there is strong evidence of positive cross-sectional associations between parent and child PA\(^13\),\(^14\) and TV viewing.\(^15\),\(^16\) Furthermore, longitudinal studies indicate that parental PA predicts changes in primary-school aged children’s PA over time, such that parents with high PA levels have children whose PA declines less over time than their peers.\(^17\) In contrast, relatively little research has examined the relationship of parent modelling of PA and TV viewing and these behaviours in the preschool population; particularly prospectively across the transition from pre- to primary school. Understanding influences during this transitional period is important given preschool- and school-aged children have distinctly different environments (e.g., parents may have a larger
Parent and preschooler physical activity and TV

impact during preschool years when children spend more time in the home) and PA typically declines
during the primary school years.\textsuperscript{18}

Previous cross-sectional studies in the preschool population have shown positive associations between
parents’ and children’s PA\textsuperscript{19-25} and parents’ and children’s TV viewing.\textsuperscript{26,27} Only one previous
longitudinal study has been reported and this showed associations between parents’ PA and children’s
PA after one (but not two) years,\textsuperscript{25} suggesting parents’ early PA modelling may be less influential as
preschoolers get older. No longitudinal studies of TV viewing in this population have been reported to
date.

Despite some preliminary evidence that parents’ PA and TV viewing may influence their
preschoolers’ behaviours, at least in the short term, there is limited understanding as to whether these
relationships vary by sex of the parent and/or child. Within older children there is little or inconsistent
evidence of whether parental influences on children’s PA and TV viewing vary by sex of the child,\textsuperscript{28-30} yet it is feasible that sex-specific influences may be more pronounced in younger children. Early
evidence that there may be sex-specific effects in this age group comes from a study showing an
association between the weekend MVPA of fathers and preschool boys, but not girls.\textsuperscript{20} No studies
have investigated sex disparity in associations between parent and child TV viewing in preschoolers.

Despite known differences in boys’ and girls’ PA\textsuperscript{31,32} and some evidence of sex differences for TV
time,\textsuperscript{15} few studies have examined parental influences on boys and girls separately. Specific
examination of the influences on boys and girls may lead to better understanding of whether
differential approaches are needed for promoting PA and limiting TV viewing in the two sexes. The
present study examined whether mothers’ and fathers’ PA and TV viewing were associated cross-
sectionally with boys’ and girls’ PA and TV viewing at 3-5 years of age, and longitudinally with
children’s PA and TV viewing at 3-years follow-up.
Methods

Sample

This study used baseline and follow-up data provided by 450 parent-child dyads from the Healthy Active Preschool and Primary Years (HAPPY) cohort study. Details of this study have been published previously.33 In brief, using a two-stage stratified random sampling procedure families were recruited from 65 preschools and 71 child care centres (47% and 46%, respectively, of those invited) across socioeconomic areas in the Melbourne metropolitan area. During August-December 2008 and June-November 2009 all families with children aged 3-5 years attending participating centres were invited to participate and 1002 (10.5%) parents/guardians provided written informed consent to do so. All participating children provided their assent at the visit.

While initially a cross-sectional study, 766 participants (77%) provided contact details and consent to be recontacted. Follow-up of participants took place approximately three years post-baseline from August 2011 to March 2012, and June 2012 to April 2013. A total of 567 participants (74% of those invited to participate in the follow-up and 57% of the original sample) provided written informed consent to take part. Of those who provided data at both baseline and follow-up (n=565), participants were excluded from these analyses if the child did not live predominantly with the survey respondent (n=22), it was a single-parent household (n=49), and/or there was missing data for key sociodemographic measures (n=77), leaving 475 participants. The final study sample consisted of 450 parent-child dyads (203 girls) who had complete child, mother, and father data for PA and/or TV behavioural measures (321 participants [148 girls] with complete PA data and 432 participants [195 girls] with complete TV data). The study was approved by Deakin University’s Human Research Ethics Committee and relevant education departments, and all participants gave their informed consent.
Measures

Physical activity. Children’s PA was objectively assessed at baseline and follow-up using ActiGraph GT1M uniaxial accelerometers (15 second epochs) worn during waking hours for eight consecutive days. Consecutive zero counts of $\geq 20$ minutes were recorded as non-wear time. For inclusion in PA analyses, children were required to have $\geq 4$ valid days of accelerometer data, including a weekend day. Due to greater sleep among younger children, a valid day was defined as $\geq 6$ hours at baseline, and $\geq 8$ hours at follow-up. Light-moderate-vigorous-intensity PA (LMVPA) was defined as $>100$ counts/minute, and MVPA as $\geq 2296$ counts/minute. Given that PA recommendations for preschool children include all intensities of physical activity (LMVPA), while recommendations for school-age children specifically relate to MVPA, our analyses used LMVPA as the PA outcome at baseline (when the sample children were aged 3-5 years) and MVPA as the outcome at follow-up (when children were 6-8 years).

Parental PA was assessed using questions adapted from the validated Active Australia Survey for the CLAN study. The self-nominated main carer of the child (95.6% mothers) was asked to complete all survey measures. Respondents reported their typical weekly time engaged in physical activities of moderate- (e.g., walking, gardening, golf) and vigorous-intensity (e.g., jogging, cycling) during their free time and proxy-reported their partner’s MVPA. Consistent with the scoring protocol, parent’s total MVPA was calculated as their moderate-intensity PA plus double their vigorous-intensity PA, and this was converted to average minutes per day.

Television viewing. Respondents reported the amount of time spent watching TV and DVDs/videos during a typical week for themselves and their partner, which was subsequently converted into minutes per day. They reported the amount of time their child usually spent watching TV and DVDs/videos from Monday-Friday and on the weekend during a typical week, and these values were summed and divided by seven to give their child’s average daily TV viewing time.

Sociodemographic characteristics. Respondents reported their age and the age of their partner, the age and sex of their child, and the highest level of education of the child’s mother, categorised as ‘did not
Parent and child TV viewing variables were non-normally distributed. Consequently these were square-root transformed and converted to standard scores. Linear regression models were used to examine sex differences and cross-sectional associations between parents’ behaviours and the corresponding child behaviours (e.g., association between mothers’ PA and children’s PA) at baseline (T1). Longitudinal associations were then investigated between baseline parent behaviours and children’s corresponding behaviours at follow-up (T2) using linear regression, adjusting for children’s baseline behaviours. This approach, sometimes known as the ANCOVA or conditional change approach, is a common and acceptable method for assessing longitudinal associations between a baseline exposure and a later outcome within data with only two time points. All cross-sectional and longitudinal analyses were conducted separately for girls and boys, and adjusted for child and parent age, and maternal education. Accelerometer wear time was adjusted for in PA models. Initially, maternal and paternal behavioural predictors (e.g., mothers’/fathers’ MVPA) were included in separate models; where both were significantly associated with the child behavioural outcome, a further model was tested in which both variables were entered together. Correlations between mothers’ and fathers’ behaviours were r=0.31 (VIF=1.11) for PA and r=0.56 (VIF=1.46) for TV viewing, and thus not indicative of excessive multicollinearity. Robust standard errors were computed to account for potential clustering within preschools and child care centres from which children were recruited. All analyses were conducted in Stata 12.0 (StataCorp, TX).
Results

Descriptives

Children were, on average, 4.6 years of age at baseline and 7.6 years at follow-up (see Table 1).

About two-thirds of children had tertiary educated mothers, and almost all survey respondents were the child’s mother.

On average children spent just under six hours per day in LMVPA at baseline and about one hour in MVPA at follow-up (see Table 2). No sex differences were evident at baseline but boys engaged in more MVPA at follow-up compared to girls. Children watched roughly an hour and a half of TV per day at baseline, and slightly less at follow-up. Parental PA and TV behaviours did not differ between boys and girls.

Cross-sectional associations between parent and child behaviours

At baseline, MVPA of both mothers and fathers were associated with girls’ LMVPA (see Table 3); however, when mothers’ and fathers’ MVPA were considered simultaneously, only fathers’ MVPA (B=0.14; 95% CI=0.04, 0.25) remained a significant predictor of girls’ LMVPA. No cross-sectional associations were seen for boys with regard to PA. Mothers’ and fathers’ TV time were both bivariably associated with TV viewing for girls and boys, but only mothers’ TV viewing remained a significant predictor for girls (B=0.27; 95% CI: 0.13, 0.41) and boys (B=0.34; 95% CI: 0.20, 0.48) when both parents were included in a single model (see Table 4).
Longitudinal associations between parent and child behaviours

Mothers’ MVPA at baseline was associated with boys’, but not girls’, MVPA at follow-up (see Table 3). Mothers’ TV viewing at baseline was associated with girls’ TV viewing at follow-up, while fathers’ TV viewing at baseline was associated with boys’ TV viewing at follow-up (see Table 4).

Discussion

This is the first study to examine the influence of maternal and paternal PA and TV time on children’s behaviours during the transition from preschool to primary school, and importantly one of few studies to assess sex differences. In the present study, we found that while both parents’ TV behaviours were individually associated with children’s TV viewing, mothers’ TV viewing was related to both boys’ and girls’ TV viewing independently of fathers’ (but not vice-versa). Previous studies have found positive associations between parents’ and preschoolers’ TV viewing, however, these studies did not examine these relationships separately by sex of the child and the parent, and primarily included only mothers’ TV viewing. Mothers tend to be the main carers, and spend a greater amount of time with their preschool child than fathers, especially during the day. This may explain why mothers appear to have a greater influence on preschoolers’ TV viewing, a behaviour that usually happens at home. While fathers tended to watch more TV than mothers, it is probable that fathers’ viewing primarily occurs in the evenings when preschool-aged children are in bed, hence such viewing would not contribute to modelling.

In contrast to our cross-sectional results, longitudinally we found that the TV viewing of parents of preschool children predicted only that of their sex-matched child three years later. Given our cross-sectional results indicated that mothers’ PA and TV viewing were a stronger influence than fathers’ on both boys’ and girls’ TV viewing time during the preschool years, our longitudinal findings suggest that, among boys specifically, there is a transition to being primarily influenced by the father as they get older. Accordingly, in the time from preschool to early primary school, children may come to see the same-sex parent as their primary role model.
Consistent with previous research\textsuperscript{19,21,22,25} we found some associations between parents’ and preschoolers’ PA. However, in contrast to our findings with regard to children’s TV viewing, our results for PA neither supported the primacy of maternal influence for very young children, nor sex-specific influences across the pre-primary school transition. We found cross-sectional associations between parents’ PA and preschool girls’ PA only, with the PA of the father emerging as the dominant influence. This is somewhat consistent with findings among children generally, where fathers’ PA has been found to be a more stable correlate of children’s PA than mothers’ PA.\textsuperscript{42} This may be reflective of a greater tendency for fathers to be involved in active play with their children in the early years, with mothers more likely to engage their child in cognitive and creative play activities.\textsuperscript{43} It is not clear, however, why these associations were seen for girls but not boys in our sample. Similarly, it was surprising that mothers’ PA predicted boys’ PA three years later, while no relationships were seen for fathers (in light of the previous discussion) or between mothers and daughters. In light of these ambiguous findings, it is clear that more research is warranted to examine sex-specific parental influences on young children’s PA, ideally within longitudinal designs and using objective assessment of both parent and child PA.

\textit{Study strengths and limitations}

The inclusion of objective physical activity data for children and the longitudinal design are important strengths of this study, as is the inclusion of data for both mothers and fathers. There were also some limitations, for example main carer PA and TV viewing were self-reported, while proxy-reports were used for children’s TV viewing and partners’ PA and TV viewing. Given that most survey respondents were mothers the majority of fathers’ data were proxy-reported. Participants were recruited from a large number of preschools and childcare centres across differing socioeconomic areas in Melbourne; however, the relatively low participation rate and sample attrition between time points may limit the generalisability of our findings to the broader population. A further limitation of
the study was that, in light of different physical activity recommendations for preschool and school-aged children, the PA outcomes for the two measured time points represented different activity levels.

Conclusions

Understanding the influences on young children’s PA and TV viewing time is essential as we seek ways to modify these behaviours while children are still establishing behavioural patterns. It is important to determine if parental influences on children’s behaviours vary by the sex of the parent and child as this may allow for more tailored intervention approaches. Our findings indicate that parent-focused interventions aimed at reducing young children’s TV viewing may benefit from targeting reductions in TV viewing among mothers of preschoolers, and among the sex-matched parent as children move into primary school. With regard to young children’s PA, more research is needed to understand sex-specific parent-child relationships.

Acknowledgements

We would like to thank the HAPPY study project staff for their hard work, and the parents and children who participated in this study. The HAPPY study was funded by Deakin University and an Australian Research Council Discovery Grant (ID DP110101434). KDH is supported by an Australian Research Council Future Fellowship (ID FT130100637) and an Honorary National Heart Foundation of Australia Future Leader Fellowship. JS is funded by a NHMRC Principal Research Fellowship (ID 1026216). JH is funded by a Deakin University International Postgraduate Research Scholarship. AT is supported by a National Heart Foundation of Australia Future Leader Fellowship (ID 100046).
References


### Table 1. Sociodemographic characteristics of preschool children and their parents, Melbourne 2008/9 (n=450)

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>(SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 child age</td>
<td>4.6</td>
<td>(0.7)</td>
</tr>
<tr>
<td>T2 child age</td>
<td>7.6</td>
<td>(0.7)</td>
</tr>
<tr>
<td>T1 mother age</td>
<td>37.6</td>
<td>(4.4)</td>
</tr>
<tr>
<td>T1 father age</td>
<td>39.3</td>
<td>(5.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not complete high school</td>
<td>5.1</td>
<td>23</td>
</tr>
<tr>
<td>Diploma/certificate</td>
<td>28.0</td>
<td>126</td>
</tr>
<tr>
<td>Tertiary</td>
<td>66.9</td>
<td>301</td>
</tr>
<tr>
<td>Child’s sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>45.1</td>
<td>203</td>
</tr>
<tr>
<td>Male</td>
<td>54.9</td>
<td>247</td>
</tr>
<tr>
<td>Child’s main carer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mother</td>
<td>95.6</td>
<td>430</td>
</tr>
<tr>
<td>Father</td>
<td>4.4</td>
<td>20</td>
</tr>
</tbody>
</table>
Table 2. Physical activity and TV viewing of preschool children and their parents, Melbourne 2008/9 – 2011/12

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
<th>p^a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td></td>
</tr>
<tr>
<td><strong>T1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child’s accelerometer wear time (mins/day)</td>
<td>665.9 (66.8)</td>
<td>684.7 (78.2)</td>
<td>.039</td>
</tr>
<tr>
<td>Child’s LMVPA (mins/day)^b</td>
<td>339.4 (54.0)</td>
<td>352.4 (45.3)</td>
<td>.235</td>
</tr>
<tr>
<td>Mother’s MVPA (mins/day)</td>
<td>60.6 (47.5)</td>
<td>60.2 (41.0)</td>
<td>.948</td>
</tr>
<tr>
<td>Father’s MVPA (mins/day)</td>
<td>65.8 (59.5)</td>
<td>57.9 (53.2)</td>
<td>.264</td>
</tr>
<tr>
<td>Child’s TV viewing (mins/day)</td>
<td>90.1 (51.4)</td>
<td>97.0 (52.3)</td>
<td>.195</td>
</tr>
<tr>
<td>Mother’s TV viewing (mins/day)</td>
<td>77.0 (50.6)</td>
<td>73.7 (51.2)</td>
<td>.503</td>
</tr>
<tr>
<td>Father’s TV viewing (mins/day)</td>
<td>84.2 (52.8)</td>
<td>85.5 (53.7)</td>
<td>.820</td>
</tr>
<tr>
<td><strong>T2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Child’s accelerometer wear time (mins/day)</td>
<td>723.0 (54.0)</td>
<td>734.3 (64.7)</td>
<td>.057</td>
</tr>
<tr>
<td>Child’s MVPA (mins/day)</td>
<td>58.7 (18.7)</td>
<td>73.9 (21.8)</td>
<td>&lt;.0005</td>
</tr>
<tr>
<td>Child’s TV viewing (mins/day)</td>
<td>74.6 (48.6)</td>
<td>81.5 (53.2)</td>
<td>.139</td>
</tr>
</tbody>
</table>

^a Sex differences assessed using linear regression models, adjusted for clustering by recruitment centre. The models in which child PA variables were outcomes included accelerometer wear time as a covariate.

^b Children’s physical activity was objectively assessed using accelerometers. All other measures were reported by parents.

LMVPA=light-moderate-vigorous physical activity; MVPA=moderate-vigorous physical activity
Table 3. Cross-sectional and longitudinal associations between parents’ and children’s PA, Melbourne 2008/9 – 2001/12

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B (95% CI)</td>
<td>p</td>
<td>B (95% CI)</td>
<td>p</td>
</tr>
<tr>
<td>T1 mother’s MVPA</td>
<td>0.17 (0.02, 0.33)</td>
<td>.028</td>
<td>-0.09 (-0.22, 0.04)</td>
<td>.169</td>
</tr>
<tr>
<td></td>
<td>0.04 (-0.04, 0.12)</td>
<td>.289</td>
<td>0.07 (0.00, 0.14)</td>
<td>.047</td>
</tr>
<tr>
<td>T1 father’s MVPA</td>
<td>0.17 (0.08, 0.26)</td>
<td>&lt;.0005</td>
<td>0.01 (-0.11, 0.13)</td>
<td>.918</td>
</tr>
<tr>
<td></td>
<td>0.01 (-0.05, 0.07)</td>
<td>.787</td>
<td>-0.01 (-0.06, 0.05)</td>
<td>.853</td>
</tr>
</tbody>
</table>

All models adjusted for accelerometer wear time, child age, parent age, maternal education, and clustering by recruitment centre. Longitudinal models adjusted for children’s baseline PA time.

LMVPA=light-moderate-vigorous physical activity; MVPA=moderate-vigorous physical activity

Table 4. Cross-sectional and longitudinal associations between parent and child TV viewing, Melbourne 2008/9 – 2011/12

<table>
<thead>
<tr>
<th></th>
<th>Girls</th>
<th>Boys</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B (95% CI)</td>
<td>p</td>
<td>B (95% CI)</td>
<td>p</td>
</tr>
<tr>
<td>T1 mother’s TV</td>
<td>0.32 (0.17, 0.46)</td>
<td>&lt;.0005</td>
<td>0.36 (0.24, 0.47)</td>
<td>&lt;.0005</td>
</tr>
<tr>
<td>viewing</td>
<td></td>
<td></td>
<td>0.16 (0.03, 0.29)</td>
<td>.020</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.05 (-0.07, 0.17)</td>
</tr>
<tr>
<td>T1 father’s TV</td>
<td>0.23 (0.06, 0.40)</td>
<td>.010</td>
<td>0.23 (0.08, 0.37)</td>
<td>.002</td>
</tr>
<tr>
<td>viewing</td>
<td></td>
<td></td>
<td>0.07 (-0.05, 0.20)</td>
<td>.246</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.15 (0.01, 0.28)</td>
<td>.032</td>
</tr>
</tbody>
</table>

All models adjusted for child age, parent age, maternal education, and clustering by recruitment centre. Longitudinal models adjusted for children’s baseline TV time.