Children who meet recommendations for physical activity and screen-time despite socioeconomic disadvantage

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C–PAN
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Summary report

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## Executive summary

### 1. Background and study aims

1.1 Physical activity, screen-time and health  
1.2 Factors influencing physical activity and screen-time  
1.3 Study aims

### 2. Study design and methods

2.1 Study design  
2.2 Study participants  
2.3 Mothers’ survey  
2.4 Children’s physical activity  
2.5 Children’s screen-time  
2.6 Meeting physical activity and screen-time recommendations  
2.7 Children’s height and weight

### 3. Study findings

3.1 Characteristics of study participants  
3.2 Physical activity and screen-time  
3.3 What are the characteristics of boys who are resilient to low physical activity and high screen-time?  
3.4 What are the characteristics of girls who are resilient to low physical activity and high screen-time?

### 4. Study conclusions

### 5. References
List of figures

Figure 1. Location of residence by sex 9
Figure 2. Weight category by sex 9
Figure 3. Physical activity and screen-time of children in the READI study 10
Figure 4. Proportions of girls and boys meeting physical activity and screen-time recommendations 11

List of tables

Table 1. Characteristics of children in the READI study 8
Table 2. Physical activity and screen-time of children in the READI study 10
Table 3. Boys’ likelihood of meeting recommendations despite living in disadvantaged areas of Victoria 13
Table 4. Girls’ likelihood of meeting recommendations despite living in disadvantaged areas of Victoria 15
Executive summary

Based on evidence of the health benefits of physical activity and the detrimental impacts of sedentary screen-based past-times, current recommendations identify that:

- Children and young people should participate in at least 60 minutes (and up to several hours) of moderate- to vigorous-intensity physical activity every day.

- Children and young people should not spend more than 2 hours a day using electronic media for entertainment, particularly during daylight hours.

It has been suggested that children experiencing socioeconomic disadvantage, such as those living in socioeconomically disadvantaged areas, are less physically active and spend more time in screen-based behaviours; however evidence is inconsistent.

In order to inform interventions to support healthy behaviours, the READI (Resilience for Eating and Activity Despite Inequalities) study aimed to examine the characteristics of children who, despite their disadvantage were able to be physically active and not spend excessive time in screen-based behaviours, that is, they were ‘resilient’ to low physical activity and high screen-time.

Most children in the study (89% boys and 80% girls) participated in the recommended levels of physical activity. Fewer children met recommended levels of screen-time (38% of boys, 47% of girls), and approximately 40% of boys and girls were resilient to both low physical activity and high screen-time.

In terms of the factors associated with resilience to unhealthy behaviours, age was significant for both boys and girls, with younger boys and girls being more likely to meet physical activity and screen-time recommendations than older children.
Residing in rural areas was a significant factor for boys. Those living in rural areas were more likely to meet screen-time recommendations, as well as physical activity and screen-time recommendations combined, compared with boys living in urban areas. This association was not evident for girls.

For girls, having a mother with a high level of education was associated with a greater likelihood of meeting screen-time recommendations. Perhaps surprisingly, girls whose mothers were of normal weight (not overweight or obese) were less likely to meet screen-time recommendations. Additionally, girls with two or more siblings were less likely to meet screen-time recommendations compared to girls with no siblings.

The findings suggest that many children who experience socioeconomic disadvantage are resilient to physical inactivity and high screen-time. While the factors associated with resilience are largely non-modifiable, the findings point to key target groups for whom further study may be valuable, for understanding influences on behaviour and for designing interventions to reduce screen-time and increase physical activity among children.

This report will be of interest to families; community health organisations; policy makers; health professionals; and other organisations interested in children’s health.
1.1 Physical activity, screen-time and health

The health benefits of children’s participation in physical activity are well known¹. There is also emerging evidence of the detrimental health effects of excessive screen-time, including television, computer games and use of the Internet¹. Based on this evidence, recommendations have been established for children’s participation in physical activity and screen-time, which form the basis of efforts to improve health-related behaviours amongst children and young people². These recommendations identify that:

1. Children and young people should participate in at least 60 minutes (and up to several hours) of moderate-to vigorous-intensity physical activity (MVPA) every day.

2. Children and young people should not spend more than 2 hours a day using electronic media for entertainment, particularly during daylight hours.

Unfortunately, many Australian children do not meet these recommendations³. A recent national survey found that that only 40% of Australian children aged 9–13 years met the physical activity recommendations and only 7% of children met the screen-time recommendations³.
1.2 **Factors influencing physical activity and screen-time**

A range of biological, demographic, social and geographic factors impact on children's patterns of physical activity and screen-time. For example, several studies have found factors such as age, sex, weight status and family composition are likely to be important correlates\(^4\)\(^-\)\(^6\).

Although evidence is inconsistent\(^7\), some studies identify socioeconomic disadvantage as a predictor of lower rates of physical activity\(^8\) and higher rates of sedentary behaviours (including screen-time)\(^9\) among children. Geographic factors, such as living in urban versus rural areas may also be important, with one study suggesting a positive association between rural area of residence and physical activity amongst girls but not boys\(^10\), and another showing lower participation in sedentary behaviours among children living in rural compared to urban areas\(^11\).

Gaps remain, however, in our understanding of the factors that influence children's physical activity and screen-time. For example, few studies have specifically explored demographic or geographic correlates of physical activity or screen-time among children living in low socioeconomic areas or children experiencing socioeconomic disadvantage. In particular, little is known about the characteristics of ‘resilient’\(^11\) children who meet the recommendations for physical activity and screen-time, despite experiencing socioeconomic disadvantage.

1.3 **Study aims**

This study sought to add to the body of evidence regarding children's health-related behaviours in order to inform the development of interventions to promote physical activity and reduce screen-time in line with current recommendations. In particular the study aimed:

1. To describe the physical activity and screen-time behaviours of children living in disadvantaged urban and rural areas of Victoria;
2. To identify the proportion of children meeting physical activity and screen-time recommendations; and
3. To identify the demographic and geographic characteristics of ‘resilient’ children who meet physical activity and screen-time recommendations, despite experiencing socioeconomic disadvantage.
Study design and methods

2.1 Study design

This study was part of the baseline phase of the ‘Resilience for Eating and Activity Despite Inequality’ study (READI), which focused on women and children living in disadvantaged areas of urban and rural Victoria, Australia.

The study involved:

- a mailed survey of women with children aged 5–12 years;
- objective measurement of children’s moderate-to vigorous-intensity physical activity (MVPA);
- objective measurement of children’s height and weight; and
- reporting of children’s screen-time by mothers.

The data collection was conducted between July 2007 and June 2008.

Approval to conduct all aspects of the study was received from the Deakin University Human Research Ethics Committee, the Catholic Education Office and the Victorian Department of Education.

2.2 Study participants

The Australian Bureau of Statistics 2003 Census of Population and Housing Socioeconomic Index for Areas (SEIFA)\textsuperscript{12} was used to rank all suburbs in urban and rural areas of Victoria according to their SEIFA-derived suburb disadvantage. The suburbs in the most disadvantaged areas within a 200km radius of metropolitan Melbourne with a population of 1,200 people or more formed the selection pool. Participants in the READI study were recruited from 80 suburbs (40 urban and 40 rural) selected randomly from this pool.
A sample of 150 women living in each of the 80 suburbs and aged between 18–45 years were selected from the electoral roll provided by the Australian Electoral Commission (total n=11,940). These women were contacted by mail and invited to participate in the study. Of those who agreed to participate (4,935), those with a child aged between 5–12 years were asked to participate in the children’s aspect of the study, with 727 mothers consenting for their child’s participation. These mothers were mailed a survey and a reply paid envelope. A time was also arranged to visit the child’s school or home to measure their height and weight and to administer an accelerometer to objectively measure their physical activity.

### 2.3 Mothers’ survey

Of the 727 women participating in the READI study, 619 (85%) returned a completed survey. In that survey, mothers reported their child’s date of birth and the number of siblings the child had. They also reported their level of education. Response options for this question were collapsed into three categories (low=no formal qualifications, year 10 or equivalent; medium=year 12 or equivalent, trade/apprenticeship, certificate/diploma; high=university degree or higher). Mothers also self-reported their height and weight, from which maternal BMI (kg/m²) was calculated. Using standard definitions, mothers were then classified as not overweight (BMI<24.9 kg/m²); overweight (BMI 25.0-29.9 kg/m²); or obese (BMI >30.0 kg/m²). For the purposes of analyses, the overweight and obese categories were combined.

### 2.4 Children’s physical activity

In order to measure physical activity, children wore a Manufacturing Technologies Inc. accelerometer (Actigraph Model AM7164-2.2C) during waking hours for one week. During the home/school visit, children were fitted with the accelerometer on their right hip and provided with instructions on the care of the accelerometer. They were also provided with a padded reply paid envelope to return the accelerometer to the research team. The accelerometers were pre-programmed to collect data in one-minute periods.

Data downloaded from the accelerometers were analysed. Using an established regression equation and applying cut-points that identified time spent in MVPA (≥3 metabolic equivalents of rest, METs), the average minutes per day spent in MVPA was calculated. This was adjusted for the proportion of time that the accelerometer was worn to indicate the proportion of time spent in MVPA/day.
2.5 **Children’s screen-time**

Mothers reported the amount of time their child spent watching television, using the computer and playing electronic games in a typical week Monday to Friday and Saturday to Sunday\(^15\). These were summed and divided by seven to indicate minutes/day in screen-time.

2.6 **Meeting physical activity and screen-time recommendations**

The number and proportion of children who met current Australian recommendations for physical activity and screen-time were calculated. Using the accelerometer data, children who met the current Australian physical activity recommendations (>60 minutes/day MVPA) were categorised as ‘resilient to low physical activity’.

Using data reported by mothers, children who met current Australian recommendations for screen-time (<120 minutes/day) were categorised as ‘resilient to high screen-time’.

Children who met both physical activity and screen-time recommendations were categorised as resilient to both behaviours.

2.7 **Children’s height and weight**

Children’s height (m) and weight (kg) were objectively measured using a portable stadiometer and digital scales. Body mass index (BMI; kg/m\(^2\)) was calculated. From this, using a standardised equation\(^16\), children’s weight status (not overweight, overweight, obese) was calculated.
3.1 **Characteristics of study participants**

A total of 684 children participated in the READI study. Complete data for all measures were available for 373 of these children (167 boys and 206 girls).

Table 1 shows the characteristics of participants. Boys and girls were aged approximately 9 years, and the majority had at least one sibling. About half of the mothers had a medium level of education. About a quarter had a low education and the same proportion had a high level of education. About half of the mothers were classified as not overweight. A similar proportion were either overweight or obese.

Table 1. Characteristics of children in the READI study

<table>
<thead>
<tr>
<th></th>
<th>Boys (n=167)</th>
<th>Girls (n=206)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years; mean, SD)</strong></td>
<td>9.2 (±2.1)</td>
<td>9.6 (±2.0)</td>
</tr>
<tr>
<td><strong>Number of siblings (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>One</td>
<td>39</td>
<td>47</td>
</tr>
<tr>
<td>Two or more</td>
<td>51</td>
<td>44</td>
</tr>
<tr>
<td><strong>Maternal education (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Medium</td>
<td>50</td>
<td>46</td>
</tr>
<tr>
<td>High</td>
<td>25</td>
<td>29</td>
</tr>
<tr>
<td><strong>Maternal weight status (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>22</td>
<td>24</td>
</tr>
<tr>
<td>Overweight</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>Not overweight</td>
<td>52</td>
<td>50</td>
</tr>
</tbody>
</table>
Figure 1 shows the urban/rural location of the study participants. Approximately 70% of boys and girls lived in rural areas and 30% lived in urban areas.

Figure 1. Location of residence by sex

Figure 2 shows the children’s weight categories. Approximately 70% of boys and girls were categorised as not overweight. The remaining 30% were categorised as overweight or obese.

Figure 2. Weight category by sex
3.2 Physical activity and screen-time

Table 2 and Figure 3 show the average minutes/day children spent in objectively-measured MVPA and in parent-reported screen-time. Overall, boys spent over three hours/day in MVPA (mean 195 mins/day), which was over three times the recommended minimum time. Girls spent significantly less time than boys (mean 156 mins/day), but this was still more than twice the recommended minimum time.

Both boys and girls participated in more screen-time than the recommended maximum of 2 hours. Boys participated in more screen-time than girls (mean 160 mins/day and 142 mins/day respectively); this difference was also statistically significant.

Table 2. Physical activity and screen-time of children in the READI study

<table>
<thead>
<tr>
<th></th>
<th>Recommended</th>
<th>Boys (n = 167)</th>
<th>Girls (n = 206)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity (MVPA)</td>
<td>&gt; 60</td>
<td>195.0 (68.7)</td>
<td>156.4 (62.9)</td>
</tr>
<tr>
<td>(mins/day; mean, SD)a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screen-time</td>
<td>&lt; 120</td>
<td>160.0 (97.1)</td>
<td>141.9 (83.7)</td>
</tr>
<tr>
<td>(mins/day; mean, SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Calculated only for participants with four or more valid accelerometer days (including at least one weekend day). A day is valid when the accelerometer was worn for between 10 and 18 hours. Number of MVPA minutes was calculated for each day by multiplying total wear-time by percentage of time spent in MVPA.

Figure 3. Physical activity and screen-time of children in the READI study

Key findings:
- Despite living in socioeconomically disadvantaged areas, 89% of boys and 80% of girls participated in levels of physical activity at or above the recommended levels, and were therefore considered ‘resilient’ to low physical activity.
- Thirty eight percent of boys and 47% of girls were resilient to high screen-time.
- Thirty six percent of boys and 40% of girls were resilient to both low physical activity and high screen-time.
Figure 4 shows graphically the proportion of children who met physical activity and screen-time recommendations. It shows that a high proportion of girls and boys met the physical activity recommendations. A significantly higher proportion of boys met physical activity recommendations, that is, they were considered more resilient to low physical activity than girls (89% vs 80% respectively).

In contrast, children were less likely to be resilient to high screen-time, with 47% of boys and 38% of girls meeting the screen-time recommendations. The difference between boys and girls was not statistically significant.

Approximately 40% of boys and girls met both recommendations, that is, they were considered resilient to both low physical activity and high screen-time (36% vs 40%) despite living in socioeconomically disadvantaged areas.

While the data suggest many children meet the physical activity recommendations, when screen-time is also included, compliance with the national recommendations drops considerably. It is important to consider these recommendations in combination. Based on reported compliance with physical activity recommendations alone, parents and public health experts may erroneously conclude that most children are meeting public health guidelines.

Figure 4. Proportions of girls and boys meeting physical activity and screen-time recommendations
3.3  What are the characteristics of boys who are resilient to low physical activity and high screen-time?

Key findings:

- Younger boys were significantly more likely to meet physical activity and screen-time recommendations compared to older boys.
- Boys in rural areas were more likely to meet screen-time recommendations compared to boys living in urban areas. They were also more likely to meet recommendations for both physical activity and screen-time combined.

The study sought to examine the characteristics of boys who met the recommendations for physical activity and screen-time, and who could therefore be considered resilient to unhealthy behaviours despite their socioeconomic disadvantage.

Table 3 shows the likelihood of boys meeting physical activity, screen-time and both sets of recommendations according to their age group, location of residence, BMI (age- and sex-adjusted), weight status and number of siblings, as well as their mothers’ education and weight status.

In this sample, age was found to be a significant factor associated with physical activity and screen-time. Younger boys were significantly more likely to meet physical activity recommendations compared to older boys. They were also more likely to meet screen-time recommendations and to meet both physical activity and screen-time recommendations.

Living in rural areas was found to be positively associated with boys meeting the recommendations for screen-time, and for boys meeting both screen-time and physical activity recommendations. Boys living in rural areas were almost 3 times more likely to meet screen-time recommendations compared to boys living in urban areas. Boys in rural areas were also 4 times more likely to meet both physical activity and screen-time recommendations combined.
Table 3. Boys’ likelihood of meeting recommendations despite living in disadvantaged areas of Victoria

<table>
<thead>
<tr>
<th></th>
<th>Physical activity (n = 167)</th>
<th>Screen-time (n = 167)</th>
<th>Physical activity &amp; screen-time (n = 167)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.55 (0.38, 0.78)**</td>
<td>0.77 (0.64, 0.93)**</td>
<td>0.76 (0.63, 0.91)**</td>
<td></td>
</tr>
<tr>
<td><strong>Location of residence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Rural</td>
<td>2.05 (0.76, 5.52)</td>
<td>2.98 (1.31, 6.76)**</td>
<td>4.01 (1.61, 9.97)**</td>
</tr>
<tr>
<td><strong>Child’s BMI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.39 (0.10, 1.57)</td>
<td>0.65 (0.38, 1.12)</td>
<td>0.67 (0.39, 1.17)</td>
<td></td>
</tr>
<tr>
<td><strong>Child’s weight status</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight/obese</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Not overweight</td>
<td>1.46 (0.12, 17.02)</td>
<td>0.64 (0.22, 1.86)</td>
<td>0.45 (0.15, 1.29)</td>
</tr>
<tr>
<td><strong>Number of siblings</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>One</td>
<td>1.43 (0.39, 5.21)</td>
<td>0.36 (0.09, 1.40)</td>
<td>0.42 (0.10, 1.78)</td>
</tr>
<tr>
<td>Two or more</td>
<td>1.30 (0.29, 5.90)</td>
<td>0.45 (0.14, 1.45)</td>
<td>0.48 (0.13, 1.68)</td>
</tr>
<tr>
<td><strong>Maternal education</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Medium</td>
<td>0.84 (0.28, 2.54)</td>
<td>1.38 (0.48, 3.95)</td>
<td>1.71 (0.56, 5.21)</td>
</tr>
<tr>
<td>High</td>
<td>4.85 (0.38, 62.27)</td>
<td>1.35 (0.47, 3.84)</td>
<td>1.73 (0.57, 5.24)</td>
</tr>
<tr>
<td><strong>Maternal weight status</strong></td>
<td></td>
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</tr>
<tr>
<td>Overweight/obese</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Not overweight</td>
<td>1.67 (0.46, 6.08)</td>
<td>1.12 (0.44, 2.85)</td>
<td>1.14 (0.42, 3.12)</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001

NOTE: all 5–7 year olds met the physical activity recommendations
3.4 What are the characteristics of girls who are resilient to low physical activity and high screen-time?

Key findings

- Younger girls were significantly more likely to meet physical activity and screen-time recommendations than older girls.
- Girls whose mothers had a high level of education were more likely to meet screen-time recommendations.
- Girls whose mothers were of normal weight (not overweight or obese) were less likely to meet screen-time recommendations, and less likely to meet physical activity and screen-time recommendations combined.
- Girls with two or more siblings were less likely to meet screen-time recommendations compared to girls with no siblings.

The study sought to examine the characteristics of girls who met the recommendations for physical activity and screen-time, and who could therefore be considered resilient to unhealthy behaviours despite their socioeconomic disadvantage. Table 4 shows the likelihood of girls meeting physical activity, screen-time and both sets of recommendations according to their age group, location of residence, BMI (age- and sex-adjusted), weight status and number of siblings, as well as their mothers’ education and weight status.

As for boys, age was found to be a significant factor, with younger girls being more likely to meet physical activity recommendations than older girls. They were also more likely to meet screen-time recommendations and to meet both physical activity and screen-time recommendations.

Unlike boys, the location of residence (urban versus rural) did not seem to be a significant factor associated with girls meeting either physical activity or screen-time recommendations. Maternal education was however important, with girls whose mothers had a high level of education being 2.5 times more likely to meet screen-time recommendations than girls whose mothers had low levels of education.

Associations were also found in relation to number of siblings and mother’s weight category. Girls with two or more siblings were 73% less likely to meet screen-time recommendations than girls with no siblings. Girls whose mothers were of normal weight (not overweight or obese) were 50% less likely to meet screen-time recommendations and 50% less likely to meet both screen-time and physical activity recommendations, compared to those whose mothers were overweight or obese.
Table 4. Girls’ likelihood of meeting recommendations despite living in disadvantaged areas of Victoria

<table>
<thead>
<tr>
<th></th>
<th>Physical activity (n = 206)</th>
<th>Screen-time (n = 206)</th>
<th>Physical activity &amp; screen-time (n = 206)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.39 (0.29, 0.51)***</td>
<td>0.69 (0.59, 0.81)***</td>
<td>0.56 (0.45, 0.69)***</td>
</tr>
<tr>
<td>Location of residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Rural</td>
<td>1.67 (0.68, 4.13)</td>
<td>1.30 (0.62, 2.72)</td>
<td>1.54 (0.59, 4.04)</td>
</tr>
<tr>
<td>Child’s BMI</td>
<td>1.40 (0.78, 2.54)</td>
<td>0.86 (0.47, 1.57)</td>
<td>1.06 (0.54, 2.08)</td>
</tr>
<tr>
<td>Child’s weight status</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Overweight/obese</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Not overweight</td>
<td>0.64 (0.14, 2.86)</td>
<td>0.74 (0.27, 2.05)</td>
<td>0.64 (0.19, 2.16)</td>
</tr>
<tr>
<td>Number of siblings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>One</td>
<td>1.04 (0.26, 4.15)</td>
<td>0.83 (0.29, 2.35)</td>
<td>1.48 (0.37, 5.85)</td>
</tr>
<tr>
<td>Two or more</td>
<td>0.70 (0.15, 3.33)</td>
<td>0.27 (0.08, 0.88)*</td>
<td>0.34 (0.08, 1.44)</td>
</tr>
<tr>
<td>Maternal education</td>
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</tr>
<tr>
<td>Low</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Medium</td>
<td>0.57 (0.19, 1.72)</td>
<td>0.92 (0.43, 1.97)</td>
<td>0.57 (0.25, 1.29)</td>
</tr>
<tr>
<td>High</td>
<td>0.87 (0.24, 3.17)</td>
<td>2.68 (1.29, 5.55)**</td>
<td>2.22 (0.92, 5.33)</td>
</tr>
<tr>
<td>Maternal weight status</td>
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<tr>
<td>Overweight/obese</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Not overweight</td>
<td>0.94 (0.32, 2.80)</td>
<td>0.50 (0.26, 0.97)*</td>
<td>0.49 (0.25, 0.94)*</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01, ***p<0.001

NOTE: all 5–7 year olds met the physical activity recommendations
Few studies have specifically explored demographic or geographic correlates of physical activity or screen-time among children living in low socioeconomic areas or children experiencing socioeconomic disadvantage. In particular, little is known about the characteristics of ‘resilient’ children who meet the recommendations for physical activity and screen-time, despite experiencing socioeconomic disadvantage. This study sought to contribute to knowledge in this regard and thus inform efforts to improve health-related behaviours amongst children and youth.

While neighbourhood socioeconomic disadvantage is associated with increased risk of physical inactivity and sedentary lifestyles, not all people living in disadvantaged neighbourhoods are affected. In the current study, approximately 40% of children met both physical activity and screen-time recommendations, that is, they were resilient to both low physical activity and high screen-time. While the data suggest many children meet the physical activity recommendations (89% boys and 80% girls), when screen-time is also included, compliance with the national recommendations drops considerably. Thus, it is important to consider these recommendations in combination.

**Characteristics of children who are resilient to low physical activity and high screen-time**

**Children’s age**

In exploring what characteristics might be associated with resilience, the study found age was an important factor, with younger boys and girls being more likely to meet recommendations for physical activity and screen-time than older children. The findings with respect to physical activity are consistent with other studies, which have found strong declines from childhood to adolescence. The literature regarding screen-time is less consistent.

In the current study, the measure of screen-time included using computer and Internet, and it is plausible that as children get older, the amount of time spent using the computer for homework increases, thus accounting for the higher amounts of total screen-time among older compared to younger children.
Further investigation may be required to establish whether correlates of high television viewing (for example) are different from correlates of high total screen-time.

**Rural or urban location**

Rural residence was an important factor for boys but not for girls. Boys living in rural areas were significantly more likely to meet both physical activity and screen-time recommendations than those living in urban areas.

Data examining behaviours among children living in rural areas are scarce; although one previous study examining urban and rural adolescents in New South Wales also found lower sedentary time among rural compared to urban youth. One hypothesis for this finding relates to opportunities for activities in the local environment. It is possible that children living in rural areas may have more opportunities for active play, or that they have greater active travel times than children in urban areas. Children in rural areas may also have less access to screen-based technologies such as the Internet. Further research is required to investigate the correlates and determinants of physical activity and sedentary behaviours in this population.

**Family and maternal characteristics**

Family and maternal characteristics appeared to be important for meeting screen-time recommendations, particularly among girls. For example, girls with mothers who had a high education level were more likely to meet recommendations for screen-time, compared to those whose mothers had low levels of education. Previous research has also shown a positive association between sedentary behaviour and maternal education among girls and no association between maternal education and objectively-measured physical activity.

It is possible that more highly educated mothers place greater importance on participating in physical activity and limiting screen-time for their children. It may also be that mothers with higher levels of education enforce rules regarding limits to children's screen-time. This association is particularly significant in the context of this study, in which participants were recruited only from socioeconomically disadvantaged areas. It points to the importance of high levels of maternal education in encouraging healthy behaviours among children, despite these families living in disadvantaged areas.

Maternal weight was a further factor identified for girls, with girls whose mothers were of normal weight (not overweight or obese) being less likely to meet screen-time (and combined screen-time and physical activity) recommendations, than girls whose mothers were overweight or obese. While this finding is counter-intuitive and warrants further investigation, it may be that mothers who are a healthy weight are less concerned about weight management and therefore the amount of time their child spends in sedentary behaviours is less of an issue for them.
Family structure also showed associations with resilience to high screen-time among girls. Compared to those with no siblings, girls with two or more siblings were significantly less likely to meet screen-time recommendations. This is in contrast to previous research\textsuperscript{4,20,21}, although most studies to date have focused on television viewing rather than meeting total screen-time recommendations as in the current study. The reasons for this finding are not clear; however, it may be that girls with siblings have more family screen-time resulting in more time spent in these behaviours. Why this association existed for girls but not for boys also requires further investigation.

Findings from this study demonstrate that, despite living in socioeconomically disadvantaged areas, some children are resilient to low physical activity and high screen-time. Factors that are associated with resilience include younger age, higher maternal education and living in rural areas. While these factors are not easily modifiable, the findings point to key target groups for whom further study of modifiable characteristics may be valuable, for understanding influences on behaviour and for designing interventions to reduce screen-time and increase physical activity among children.
References


Children who meet recommendations for physical activity and screen-time despite socioeconomic disadvantage

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