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2 **Early clinical markers of overweight/obesity onset and resolution by adolescence**
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19 **Short title:** Early indicators of adolescent overweight/obesity

20 **Funding Source:** Prof Juonala was supported by Juho Vainio Foundation and federal research grants
21 to Turku University Hospital. Prof Wake was supported by NHMRC Senior Research Fellowship
22 1046518 and Cure Kids New Zealand. Dr Magnussen is supported by a National Heart Foundation of
23 Australia Future Leader Fellowship (100849). Prof Burgner is supported by NHMRC Senior Research
24 Fellowship 1064629 and an Honorary Future Leader Fellowship of the National Heart Foundation of
25 Australia (100369). Dr Lycett was supported by NHMRC Early Career Fellowship (1091124) and
26 Honorary National Heart Foundation of Australia Postdoctoral Fellowship (101239). Research at the
27 Murdoch Childrens Research Institute research is supported by the Victorian Government's Operational
28 Infrastructure Program. The funding bodies did not play any role in the study.

29 **Financial Disclosure:** There are no financial relationships relevant to this article to disclose.

30 **Conflicts of interest:** The authors declare no potential conflicts of interest, including no specific
31 financial interests relevant to the subject of this manuscript.

32 **Abbreviations:** BMI: Body mass index; CI: Confidence intervals; LSAC: Longitudinal Study of
33 Australian Children; SD: Standard deviation.
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35 **Key words:** Overweight, obesity, body mass index, education
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41 **Abstract**

42
43 **Objectives:** We examined how combinations of clinical indicators at various ages predict
44 overweight/obesity development, as well as resolution, by 10-11 and 14-15 years of age.

45 **Methods:** Data were derived from Birth (N=3469) and Kinder (N=3276) cohorts of the Longitudinal
46 Study of Australian Children, followed from ages 2-3 and 4-5 years, respectively. Every two years,
47 25 potential obesity-relevant clinical indicators were quantified. Overweight/obesity was defined
48 using International Obesity Taskforce cutpoints at 10-11 years and 14-15 years.

49 **Results:** In both cohorts, three factors predicted both development and resolution of
50 overweight/obesity in multivariable models. Among normal weight children, increased odds of
51 developing overweight/obesity were associated with higher child (odd ratio (OR) 1.67-3.35 across
52 different study waves) and maternal (OR 1.05-1.09) BMI, and inversely with higher maternal
53 education (OR 0.60-0.62, when assessed at age 2-7 years). Lower odds of resolving existing
54 overweight/obesity were related with higher child (OR 0.51-0.79) and maternal (OR 0.89-0.95) BMI,
55 and inversely with higher maternal education (OR 1.62-1.92, when assessed at age 2-5 years). The
56 prevalence of overweight/obesity at the age of 14-15 years was 13% among children with none of
57 these risk factors at age 6-7 years, compared with 71% among those with all 3 risk factors (P<0.001).

58 **Conclusions:** From early childhood onwards, child and maternal BMI and maternal education
59 predict overweight/obesity onset and resolution by adolescence. A simple risk score, easily available
60 to child health clinicians, could help target treatment or prevention.

61

62 INTRODUCTION

63 Clinicians are unable to easily evaluate which children will grow up to become adolescents/adults
64 with excess weight. Thus, targeted interventions for those most at risk remain elusive. The
65 consequences of this are dire, with childhood obesity predicting premature death¹⁻³ and implicated in
66 most non-communicable diseases, particularly cardiovascular disease, diabetes and cancer.⁴

67 Perhaps even more challenging clinically is predicting which children with early life weight issues
68 will become normal weight over time. This is essential to avoid unnecessary care, because many
69 children with overweight or obesity resolve naturally.⁵ The clinical importance of resolution is
70 illustrated by the observation that the risk of type 2 diabetes and adverse intermediate
71 cardiometabolic phenotypes among children with overweight or obesity who resolved to normal
72 weight by adulthood were similar to those who had never been overweight/obese.⁶ Therefore,
73 accurate early prediction of those children likely to develop overweight/obesity and those whose
74 obesity may resolve spontaneously would enable selective prevention strategies.⁷ To date, most
75 studies have ignored the important questions of who experiences incident overweight/obesity and of
76 natural resolution. In preliminary work of a small child cohort enriched for overweight and obesity,
77 we have previously reported that the strongest predictors of subsequent adiposity status were child
78 body mass index (BMI), maternal BMI and education.⁸

79 We utilized the extensive follow-up data from The Longitudinal Study of Australian Children
80 (LSAC). At five time points in two parallel cohorts followed for a decade up to ages 10-11 years
81 (N=3,569) and 14-15 years (N=3,276), we examined the independent indicators of 1)
82 overweight/obesity development in those of normal weight at each previous wave, and 2) resolution
83 to normal weight in those with overweight/obesity at each previous wave. We included only data that
84 would be readily accessible to clinicians in usual practice

85 **METHODS**

86 **Study design**

87 LSAC is conducted jointly by the Australian Department of Social Services, the Australian Institute
88 of Family Studies and the Australian Bureau of Statistics. The Australian Institute of Family Studies
89 Ethics Committee approved each wave and parents provided written informed consent.

90

91 **Participants**

92 LSAC employed a two-stage clustered sampling design to achieve a nationally representative and
93 sufficiently powered sample, stratifying postcodes by state, as well as ‘city’ versus ‘rest of state’.⁹
94 Postcodes were randomly selected after stratification, and children age 0-1 years (Birth (B) cohort)
95 and 4-5 years (Kinder (K) cohort) were randomly selected within these postcodes. Response rates to
96 the initial mail-out invitation in 2004 were 57% for the B-cohort and 50% for the K-cohort.⁹ Data
97 have been collected biennially for seven waves between 2004-2016; this paper draws on data up to
98 wave 6, when the children were aged 10-11 and 14-15 years. At wave 1, 5,107 infants were recruited
99 to the B-cohort and 4,983 4-5-year-olds to the K-cohort. At wave 6, 3,569 children from B and 3,276
100 children from K-cohort took part.

101 **Measures**

102 In face-to-face interviews with the child’s primary caregiver and with the child themselves (when
103 older), trained interviewers repeatedly elicited reports at each wave on largely the same range of
104 health measures, life-style and socioeconomic factors.

105 Child height (except for 0-1-year-olds) and weight were measured at every wave by professional
106 interviewers from the Australian Bureau of Statistics who received extensive training in
107 anthropometric measurement for up 2 weeks. At training each of the measurements was discussed in
108 detail (e.g. where on the scales the participant should stand, ponytails and hair ornaments should be
109 removed for height measurements) and a demonstration was provided for each piece of equipment

110 used. In addition, interviewers were provided with instructions cards that summarized the key steps
111 for measurements. Weight was measured in light clothing without shoes using HoMedics digital
112 BMI bathroom scales in wave 2 and 3, and the Tanita body fat scales in waves 4, 5 and 6. Height was
113 measured to the nearest 0.1cm using an Invicta stadiometer, from Modern Teaching Aids in wave 1,
114 2 and 3, and a laser stadiometer in waves 4, 5 and 6. Two height measurements were taken, and if
115 these measurements differed by 0.5 cm or more, a third measurement was taken, the average of the
116 two closest measures was used. Children were classified as having overweight or obesity based on
117 the International Obesity Task Force (IOTF) age- and sex-specific criteria for body mass index
118 (kg/m^2) at each half-year age interval.¹⁰

119 We examined a wide range of potential obesity-related indicators, selected on the basis of (1)
120 published associations with overweight/obesity and (2) feasibility and brevity for use in routine
121 clinical care (Supplementary Table 1). Historical factors were defined as those that would not change
122 between waves. All the historical factors were obtained in Wave 1, except that breastfeeding duration
123 and the age at which solids were introduced were collected across Waves 1 and 2. Historical factors
124 included birthweight z-score, duration of breastfeeding (in months), alcohol during pregnancy,
125 smoking during pregnancy, mode of delivery (vaginal vs. caesarean) and age of introduction of
126 solids (months).

127 Concurrent factors were those collected at each wave including child BMI, change in BMI from the
128 previous wave, maternal age, maternal BMI (based on self-reported height and weight), a report of
129 high-fat food consumption and sugary drink consumption, child's general health, weekday TV
130 watching, physical activity, neighborhood disadvantage, maternal psychological distress, maternal
131 education, paternal education, parental concern about child overweight, likely difficulty in raising
132 money (AUD 2,000) in an emergency, health-related quality of life (both physical and psychosocial),
133 sleep problems, outdoor activities with an adult family member, and puberty. Where concurrent
134 maternal BMI was missing at any wave, it was replaced with the value recorded two years earlier.

135 Lifestyle questions on sleep, diet, TV viewing and physical activity have been widely used and
136 shown to compare favorably to well-validated measures¹¹⁻¹⁴. Further information on each measure
137 can be found in the LSAC Rationale Documentation¹⁵. All historic and concurrent factors are
138 detailed in Supplementary Table 1.

139 **Statistical analyses**

140 Analyses were conducted in Stata 14.2 (StataCorp, Texas, USA, 2016). Data met the assumptions of
141 the statistical tests (e.g., normal distribution). To examine the predictive associations of the
142 indicators at different time points, data from waves 2-5 of B-cohort (2-3, 4-5, 6-7, 8-9 years of age)
143 and waves 1-5 of K-cohort (4-5, 6-7, 8-9, 10-11, 12-13 years of age) were used as the starting
144 points. Wave 6 of both cohorts was used as the endpoint (10-11 and 14-15 years of age). B-cohort
145 Wave 1 data were excluded because many questions did not apply at this age and the absence of a
146 length measurement precluded calculating BMI. The analytic sample was defined as children who
147 had predictor data at any wave and outcome data at the endpoint (i.e. wave 6).

148 To assess predictors of overweight/obesity *development*, only children in the normal weight category
149 at each predictor wave were included in the analyses for that wave. For overweight/obesity
150 *resolution*, only children with overweight/obesity at that predictor wave were included in the
151 analyses. Given that the outcome was binary (“not overweight /obese (reference group (ref))” vs.
152 “developed”, and “overweight/obese (ref)” vs. “resolved to normal weight”), logistic regression
153 models were used to calculate the odds of each outcome (i.e. developed or resolved). Three separate
154 models were employed, all of which were adjusted for age and sex. Model 1 examined each indicator
155 individually. Model 2 was multivariable, examining the combined effects of individual indicators
156 that at most time points were statistically associated (i.e. $p < 0.05$) across most waves with
157 overweight/obesity development or resolution in Model 1. The final Model 3 only included variables
158 that were statistically associated ($p < 0.05$) with overweight/obesity development or resolution in
159 Model 2 across most waves. For each model, we report the amount of variance in overweight/obesity

160 development or resolution explained by the indicators, age and sex (i.e. R^2). In addition, the
161 discriminative ability of predictors associated with subsequent overweight/obesity or resolution was
162 tested using C-statistics providing area under curve (AUC) values.¹⁶

163 Finally, the results from both cohorts were combined to construct a simple risk factor score for all
164 children to predict children's risk of subsequent overweight/obesity. This risk score (0-3 points)
165 included data on those risk factors with statistical significance in Model 3. Regression analyses were
166 performed to test a trend between this risk score and the prevalence of subsequent
167 overweight/obesity.

168 **RESULTS**

169 **Sample characteristics**

170 The baseline characteristics of the two cohorts are shown in Supplementary Table 2. They were also
171 close to Australian population norms in terms of neighborhood disadvantage (B-cohort mean:1014
172 (SD:59) and K-cohort mean: 1015 (SD: 57) vs. the population norm of 1000 (SD 100)). The
173 proportions of children categorised at each subsequent wave as “Developing overweight/obesity”
174 (14.7 to 6.1%) and “Resolving to normal weight” (11.8 to 3.3%) decreased with age in both cohorts
175 (Supplementary Table 3).

176 **Univariable models**

177 *Development of overweight/obesity*

178 Seven factors were associated across most waves with a higher odds of subsequent
179 overweight/obesity at both 10-11 and 14-15 years of age: higher BMI, higher change in BMI from
180 the previous wave, higher maternal BMI, smoking during pregnancy, the inability to be able to raise
181 \$2,000 in an emergency, more neighbourhood disadvantage, and pubertal maturity (Supplementary
182 Tables 4 and 5). Five factors were associated with a reduced odds across most waves: higher
183 maternal or paternal education (\geq Bachelor degree); breastfeeding for at least 6 months (for outcome
184 at 14-15 years of age); and outdoor activities more than 3 days a week and 1-2 standard alcoholic
185 drinks per day during pregnancy (for outcome at 10-11 years of age).

186 *Resolution of overweight/obesity*

187 Higher maternal and paternal education were associated across most waves with a higher odds of
188 overweight/obesity resolution (Supplementary Tables 6 and 7). Being unable to raise AUD 2,000 in
189 an emergency was associated with lower odds of resolution at 10-11 years age. In addition, greater
190 change in BMI since the previous wave was associated with lower odds of resolution at 14-15 years
191 age.

192 **Multivariable models**

193 Of these 12 factors associated with subsequent obesity development or resolution, nine were
194 combined in a multivariable model (Model 2). Smoking and alcohol consumption during pregnancy
195 and paternal education were excluded due to large amounts of missing data.

196 *Development of overweight/obesity*

197 Of the nine factors examined in the multivariable model, concurrent child BMI and maternal BMI
198 showed strong and consistent associations across ages with subsequent obesity development at 10-11
199 and 14-15 years of age (Table 1). Maternal education of at least a bachelor's degree was associated
200 with lower odds of developing overweight/obesity, but only in the early childhood waves (B-cohort
201 at age 2-3, 4-5, 6-7 years, and K-cohort at age 4-5 years). Distinct cohort effects were observed for
202 breastfeeding and neighborhood disadvantage. Breastfeeding for 6 months compared to never
203 breastfeeding was associated with lower odds of overweight/obesity development at 14-15 years of
204 age. Similarly, less neighborhood disadvantage was associated with lower odds of
205 overweight/obesity development at 10-11 years of age. Outdoors activities tended to be protective
206 against development of overweight/obesity in prepubertal children in both cohorts.

207 *Resolution of overweight/obesity*

208 Concurrent BMI showed strong, consistent associations across ages with overweight/obesity
209 resolution 10-11 and 14-15 years of age (Table 2). Cohort-specific associations were observed for
210 maternal BMI and education at age 10-11 years.

211

212 **Combined effects of BMI, maternal BMI and maternal education**

213 The three most consistent wave-on-wave predictors associated with overweight/obesity development
214 or resolution were concurrent BMI, maternal BMI, and maternal education. Thus, we combined these
215 three indicators into a final model (Table 3). These factors jointly accounted for 6.0% to 25.5% of
216 the overweight/obesity development variance and 5.9% to 17.1% of resolution to normal weight,

217 with contributions increasing the closer the indicators were in time to the outcome of weight status.
218 The predictive ability (AUC values) of these three variables on overweight/obesity development was
219 between 0.70-0.85 in B-cohort and 0.68-0.86 in K-cohort. At or after 6-7 years AUCs were 0.78-
220 0.86, and before that age 0.68-0.73. For resolution, AUCs varied between 0.72-0.81 in B-cohort and
221 0.68-0.77 in K-cohort.

222

223 Finally, a risk score (0-3 points) was calculated based on the findings of multivariable models for
224 development or resolution of overweight/obesity as the sum of three elements: own BMI (1 risk
225 point, if overweight/obese on IOTF cut-points), maternal BMI (1 risk point, if $> 25 \text{ kg/m}^2$), maternal
226 education (1 risk point if below Bachelor degree). Figure 1 illustrates the prevalence of
227 overweight/obesity at age 10-11 years and 14-15 years based on this multifactorial approach applied
228 among all children (normal weight and overweight/obese) 4-8 years earlier. For example, in the K-
229 cohort a child aged 6-7 years without any risk factors had a 13% risk of developing
230 overweight/obesity by age 14-15 years, whereas a peer with all three risk factors had a 71% risk
231 (Figure 1c).

232

233

234 **Discussion**

235 From the age of 2 to 13 years, a child's BMI and their mother's BMI predicted both the risk of
236 developing and the likelihood of resolving overweight/obesity by adolescence. In addition, at ages 2-
237 5 years maternal education status provided additional independent information. Together, data on
238 these three risk factors predict overweight/obesity especially from age 6 years onwards. These
239 findings were replicated across two national cohorts.

240 Most previous studies have examined possible risk factors in isolation and have typically examined
241 predictive factors at a single (varying) time point. Strongest predictors of overweight/obesity
242 development have been higher parental BMI,¹⁷⁻¹⁹ higher birth weight/BMI,^{18,20-22} lower
243 socioeconomic status^{8,22-25} and caesarean delivery.^{17,26-28} Our findings concord, except that mode of
244 delivery was not consistently associated with overweight/obesity in these cohorts. Analyses from the
245 Cardiovascular Risk in Young Finns Study have also shown that BMI, maternal BMI and low
246 socioeconomic status assessed in childhood are the main predictors for adulthood obesity.²⁹ We
247 illustrate that the effects of these factors are already evident in early childhood and pervasive –
248 operating at every age- until adolescence.

249 Most studies addressing prediction of future BMI have focused on predictors of obesity
250 development, whereas few have evaluated resolution. Given high rates of natural resolution⁵ with
251 age-dependent differences,³⁰ this was an important knowledge gap. In a previous cohort study, we
252 showed that those resolving high childhood BMI by adulthood, compared with those with
253 persistently high BMI, had lower average BMI at enrolment (age 6 years) and slower rates of BMI
254 increase through childhood and adolescence.³¹ In the current cohort, we have shown that
255 approximately 40% of children with were overweight/obesity at 4-5 years were in the normal weight
256 category by 10-11 years.²⁴ Previous research suggests moderate/weak evidence for associations of
257 childhood overweight/obesity resolution with lower parental BMI,^{8,23,32} higher maternal age,⁸ better
258 physical health-related quality of life and higher self-esteem,²³ with strong evidence only for higher

259 parental socioeconomic status.^{8,33} The present results suggest that from the age of 2 years onwards
260 the same factors (own BMI, parental BMI and parental education level) that are associated with
261 overweight /obesity development also provide the best prediction for resolution.

262 It was notable that diet, physical activity and other common lifestyle factors thought to be largely
263 responsible for the obesity crisis^{34,35} were not predictive of overweight/obesity development nor of
264 resolution. This lack of association may reflect the imprecision of LSAC's measures, which were
265 brief and by parental recall –similar to the questions available to clinicians in usual care. More
266 objective measures of diet and physical activity, such as accelerometer and more detailed dietary
267 assessment could more accurately assess the contribution of these factors to our outcomes. However,
268 even these measures are imperfect, and they would not be readily available to clinicians in routine
269 practice. In addition, every study must make choices, we aimed for a balanced range of potential
270 indicators that might reasonably considered in the busy primary care setting, spanning family,
271 lifestyle and social vulnerability factors. Further markers of social disadvantage, such as migrant
272 background, non-traditional family structure and parental unemployment³⁶ could also be considered
273 in future studies.

274 Practical predictive tools (like cardiovascular risk predictors) are ideally useful across multiple ages,
275 as opportunities for prevention and/or treatment can arise at any age. Furthermore, predictors should
276 be easily and quickly assessed either by self-report or clinically. Utilizing combined data on three
277 risk factors (high child BMI, high maternal BMI, and maternal education), the discriminative ability
278 of our model was numerically lower at the age of 2-5 years (AUCs 0.68-0.73) compared to age
279 groups from 6 years onwards (AUCs 0.78-0.86), possibly reflecting the adiposity rebound.^{37,38} Using
280 the combined data on these factors as a simple risk score, we observed that among children aged 6-7
281 years, the prevalence of subsequent overweight/obesity eight years later was approximately 71% in
282 individuals who had a cluster of three easily measurable risk factors in early childhood, whereas the
283 respective prevalence was only 13% in those without any of these childhood risk factors. Even

284 though this means there is a 29% false positive rate, combining these easily assessed factors provides
285 some form of clinical prediction, which is better than what is currently available. In keeping with
286 this, a similarly simple risk score using data on child and parental BMI and family income in
287 childhood (age 3-18 years) has been shown to increase the odds of adult obesity by 1.5 to 3.0 times
288 (depending on age) for each additional risk factor.²⁹

289 These data provide important information for preventive work in family-based settings. In contrast to
290 genetic or laboratory-based testing, BMI and maternal education level can be easily and immediately
291 assessed at patient encounters. Importantly, they provide data on both genetic and environmental or
292 life-style derived factors associated with obesity.^{19,39} In the case of obesity, the clinical benefit of
293 early recognition of high-risk individuals has been highlighted. For example, even though childhood
294 overweight or obesity is predictive of adult cardiometabolic outcomes, the risks are normalized
295 among those individuals who become adults without obesity.⁶ Conversely, the benefits of removing a
296 focus on those unlikely to need clinical interventions for obesity has largely been ignored, despite an
297 increasing policy emphasis on avoiding wasteful or unnecessary health care.

298 Our study has several limitations. First, some factors had much missing data (smoking and alcohol
299 consumption during pregnancy and paternal BMI) so could not be explored in combined models. The
300 predictors examined were parent/child-reported, which is subject to recall biases despite the benefit
301 of mimicking a clinical consultation. Like most cohort studies, those who were retained at wave 6
302 came from slightly less socially disadvantaged neighbourhood; however, this is only likely
303 underestimate associations. Since our research questions related to outcomes at ages 10-11 and 14-15
304 years, children and adolescents were at different pubertal stages. Even though stage of puberty did
305 not appear to greatly influence our conclusions, it is possible that conclusions might change in later
306 adolescence when puberty is complete or largely complete for the whole cohort. No inter-rater
307 reliability are available for interviewers who conducted the height and weight assessments. However,
308 these data have been widely used and rigorous cohort design and methodology provide confidence in

309 these data. Finally, data on maternal BMI were gathered using self-report rather than actual
310 measurements; however, self-reported BMI correlates very highly with measured values (correlation:
311 0.93-0.96).^{40,41} Strengths of our study include replication across two large nationally-representative
312 cohorts of children, with follow-up conducted every two years across six waves. In addition, a
313 comprehensive list of factors were included in the analyses, addressing many issues of unmeasured
314 confounding.

315

316 **Conclusions**

317 Our findings suggest that throughout childhood, in addition to a child's own BMI, maternal BMI and
318 education level are associated with overweight/obesity development in adolescence. These same
319 factors appear to be associated with overweight/obesity resolution in adolescence. Combining data
320 on these easily obtainable risk factors may help clinicians make appropriate decisions targeting care
321 to those most at risk of adolescent obesity.

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433

434 FIGURE LEGENDS

435 Figure 1

436 a) Prevalence of overweight/obesity at the age of 10-11 years according to number of risk factors
437 (overweight/obese BMI, maternal BMI >25 kg/m², maternal education less than Bachelor level) at
438 the age of 2-3 years. (B-cohort).

439 b) Prevalence of overweight/obesity at the age of 10-11 years according to number of risk factors
440 (overweight obese BMI, maternal BMI >25 kg/m², maternal education less than Bachelor level) at
441 the age of 8-9 years. (B-cohort)

442 c) Prevalence of overweight/obesity at the age of 14-15 years according to number of risk factors
443 (overweight obese BMI, maternal BMI >25 kg/m², maternal education less than Bachelor level) at
444 the age of 6-7 years. (K-cohort)

445 d) Prevalence of overweight/obesity at the age of 14-15 years according to number of risk factors
446 (overweight obese BMI, maternal BMI >25 kg/m², maternal education less than Bachelor level) at
447 the age of 12-13 years. (K-cohort)

448 P-values for trend are from regression analyses.

449 TABLE LEGENDS

450 Table 1. Multivariable models of the odds of normal weight children developing overweight/obesity
451 by age 10-11 years (B-cohort) and 14-15 years (K-cohort)

452 Table 2. Multivariable models of the odds of children with overweight/obese resolving to normal
453 weight at age 10-11 years (B-cohort) and 14-15 years (K-cohort)

454 Table 3. Final multivariable models of overweight/obesity development at age 10-11 years (B-
455 cohort) and 14-15 years (K-cohort), additionally adjusted for sex

Table 1. Multivariable models of the odds of normal weight children developing overweight/obesity by age 10-11 years (B-cohort) and 14-15 years (K-cohort)

Indicators of overweight/obesity development	2-3 years		4-5 years		6-7 years		8-9 years		10-11 years		12-13	
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	P	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
B-cohort	n=2454 (R ² =8.5%)		n=2357 (R ² =10.4%)		n=2659 (R ² =20.3%)		n=2555 (R ² =25.6%)		-		-	
Historical												
Female	1.06 (0.85, 1.32)	0.61	1.00 (0.78, 1.28)	1.00	0.91 (0.70, 1.18)	0.48	0.90 (0.64, 1.26)	0.53	-	-	-	-
Time breastfeeding (ref = never)	-	-	-	-	-	-	-	-	-	-	-	-
> 0-3 mths	0.86 (0.53, 1.41)	0.57	1.24 (0.69, 2.21)	0.47	0.72 (0.41, 1.27)	0.26	1.07 (0.50, 2.32)	0.86	-	-	-	-
3-6 mths	1.16 (0.67, 2.03)	0.59	1.56 (0.82, 2.97)	0.18	1.06 (0.56, 2.02)	0.85	0.83 (0.32, 2.14)	0.70	-	-	-	-
>6mths	1.11 (0.69, 1.77)	0.67	1.23 (0.70, 2.15)	0.48	0.88 (0.51, 1.50)	0.63	0.90 (0.43, 1.89)	0.78	-	-	-	-
Concurrent												
Age (mths)	1.02 (0.98, 1.06)	0.27	0.98 (0.94, 1.03)	0.40	0.97 (0.93, 1.00)	0.07	0.94 (0.90, 0.99)	0.01	-	-	-	-
BMI	1.69 (1.49, 1.92)	<0.001	2.01 (1.73, 2.34)	<0.001	3.38 (2.87, 3.98)	<0.001	3.81 (3.12, 4.65)	<0.001	-	-	-	-
Change in BMI z-score	-	-	0.92 (0.82, 1.04)	0.18	1.02 (0.89, 1.16)	0.81	0.78 (0.66, 0.93)	0.005	-	-	-	-
Neighbourhood disadvantage (per 100 SD units)	0.76 (0.63, 0.93)	0.007	0.85 (0.68, 1.05)	0.14	0.68 (0.55, 0.86)	0.001	0.71 (0.55, 0.92)	0.009	-	-	-	-
Maternal education (ref <Year 12)	-	-	-	-	-	-	-	-	-	-	-	-
Year 12	0.93 (0.70, 1.22)	0.58	0.99 (0.73, 1.35)	0.96	0.92 (0.66, 1.27)	0.60	1.12 (0.73, 1.73)	0.60	-	-	-	-
>=Bachelor degree	0.68 (0.50, 0.92)	0.01	0.63 (0.45, 0.88)	0.007	0.67 (0.47, 0.95)	0.02	0.90 (0.58, 1.41)	0.65	-	-	-	-
Maternal BMI	1.03 (1.01, 1.04)	<0.001	1.08 (1.06, 1.10)	<0.001	1.05 (1.03, 1.07)	<0.001	1.04 (1.01, 1.06)	0.006	-	-	-	-
Able to raise \$2000 in emergency (ref=easily)	-	-	-	-	-	-	-	-	-	-	-	-
With some sacrifice	1.07 (0.82, 1.40)	0.61	0.86 (0.63, 1.17)	0.33	0.95 (0.69, 1.31)	0.77	1.10 (0.74, 1.64)	0.63	-	-	-	-
Drastic sacrifice/cannot	1.01 (0.74, 1.38)	0.95	0.99 (0.70, 1.39)	0.93	1.12 (0.77, 1.62)	0.55	1.34 (0.83, 2.15)	0.23	-	-	-	-
Days does outdoor activities with adult (ref = 0)	-	-	-	-	-	-	-	-	-	-	-	-
1-2days	1.00 (0.61, 1.64)	0.99	1.14 (0.75, 1.74)	0.53	0.76 (0.53, 1.10)	0.15	0.72 (0.47, 1.10)	0.13	-	-	-	-
≥3 days	0.87 (0.55, 1.39)	0.56	0.89 (0.59, 1.32)	0.56	0.68 (0.47, 0.99)	0.05	0.60 (0.39, 0.92)	0.02	-	-	-	-
Puberty (per unit, range 1-5)	-	-	-	-	-	-	1.19 (0.68, 2.11)	0.54	-	-	-	-
K-cohort	-		n=2608 (R ² =6.2%)		n=2345 (R ² =16.5%)		n=2189 (R ² =21.5%)		n=2203 (R ² =24.2%)		n=2170 (R ² =30.6%)	
Historical												
Female	-	-	1.00 (0.81, 1.24)	0.98	1.14 (0.89, 1.44)	0.30	1.06 (0.80, 1.39)	0.69	1.15 (0.81, 1.63)	0.44	0.87 (0.56, 1.36)	0.55
Time Breastfeeding (ref = never)	-	-	-	-	-	-	-	-	-	-	-	-
0-3 mths	-	-	0.73 (0.48, 1.11)	0.14	0.52 (0.32, 0.85)	0.009	0.51 (0.29, 0.91)	0.02	0.54 (0.29, 1.01)	0.054	0.53 (0.26, 1.10)	0.09
3-6 mths	-	-	0.65 (0.39, 1.10)	0.11	0.46 (0.25, 0.83)	0.01	0.48 (0.24, 0.97)	0.04	0.53 (0.24, 1.15)	0.11	0.51 (0.20, 1.28)	0.15
>6mths	-	-	0.66 (0.45, 0.98)	0.04	0.58 (0.37, 0.92)	0.02	0.61 (0.36, 1.02)	0.06	0.56 (0.31, 1.00)	0.05	0.52 (0.27, 1.01)	0.05
Concurrent												
Age (mths)	-	-	1.04 (1.00, 1.08)	0.07	0.98 (0.94, 1.02)	0.27	0.94 (0.89, 0.99)	0.02	0.95 (0.90, 0.99)	0.02	0.98 (0.93, 1.03)	0.37
BMI	-	-	1.97 (1.74, 2.24)	<0.001	2.77 (2.40, 3.21)	<0.001	2.94 (2.53, 3.41)	<0.001	2.73 (2.38, 3.14)	<0.001	2.98 (2.56, 3.48)	<0.001
Change in BMI z-score	-	-	-	-	0.99 (0.85, 1.15)	0.90	0.88 (0.75, 1.03)	0.10	0.76 (0.66, 0.88)	<0.001	0.78 (0.69, 0.88)	<0.001
Neighbourhood disadvantage (per 100 units)	-	-	0.88 (0.73, 1.06)	0.19	1.04 (0.84, 1.29)	0.72	0.84 (0.66, 1.08)	0.17	1.02 (0.79, 1.32)	0.89	1.11 (0.83, 1.48)	0.48
Maternal education (ref <Year 12)	-	-	-	-	-	-	-	-	-	-	-	-
Year 12	-	-	0.79 (0.61, 1.01)	0.06	0.89 (0.67, 1.18)	0.41	0.95 (0.68, 1.33)	0.77	0.91 (0.62, 1.34)	0.65	0.85 (0.54, 1.35)	0.50
>=Bachelor	-	-	0.68 (0.52, 0.89)	0.005	0.88 (0.64, 1.19)	0.40	0.95 (0.66, 1.35)	0.76	0.88 (0.59, 1.31)	0.53	0.82 (0.52, 1.30)	0.40
Maternal BMI	-	-	(Not included)	-	1.07 (1.05, 1.10)	<0.001	1.05 (1.02, 1.08)	<0.001	1.05 (1.02, 1.08)	<0.001	1.05 (1.02, 1.08)	0.002
Able to raise \$2000 in emergency (ref = easily)	-	-	-	-	-	-	-	-	-	-	-	-
With some sacrifice	-	-	-	-	1.18 (0.89, 1.57)	0.25	1.12 (0.80, 1.55)	0.52	1.49 (0.94, 1.99)	0.36	1.56 (1.04, 2.33)	0.03
Drastic sacrifice/cannot	-	-	-	-	1.38 (1.00, 1.91)	0.05	1.41 (0.97, 1.05)	0.07	0.89 (0.59, 2.26)	0.11	1.04 (0.59, 1.83)	0.89
Days does outdoor activities with adult (ref = 0)	-	-	-	-	-	-	-	-	-	-	-	-
1-2days	-	-	1.03 (0.70, 1.52)	0.88	0.71 (0.50, 1.02)	0.07	0.80 (0.55, 1.17)	0.25	1.36 (0.94, 1.99)	0.11	0.95 (0.64, 1.42)	0.80
≥3 days	-	-	1.05 (0.73, 1.51)	0.81	0.65 (0.46, 0.93)	0.02	0.76 (0.52, 1.12)	0.16	0.90 (0.59, 1.35)	0.60	1.15 (0.73, 1.82)	0.54
Puberty (per unit, range 1-5)	-	-	-	-	-	-	-	-	1.20 (0.84, 1.70)	0.31	0.88 (0.65, 1.19)	0.41

B-cohort – Birth cohort; K-cohort – Kinder cohort; n – number; OR – odds ratio; p – p-value; ref – reference group; mths – months; std – standard; yrs: years; SD: standard deviation; BMI – Body Mass Index

Table 2. Multivariable models of the odds of children with overweight/obese resolving to normal weight at age 10-11 years (B-cohort) and 14-15 years (K-cohort)

Indicators of overweight/obesity resolution	2-3 years		4-5 years		6-7 years		8-9 years		10-11 years		12-13	
	OR (95% CI)	p	OR	p	OR	P	OR	p	OR	p	OR	p
B-cohort	n=667 (R²=13.1%)		n=640 (R²=17.6%)		n=575 (R²=24.8%)		n=636 (R²=23.4%)		-		-	
Historical												
Female	1.05 (0.75, 1.48)	0.78	1.11 (0.77, 1.59)	0.58	1.64 (1.04, 2.56)	0.03	2.50 (1.49, 4.19)	0.001	-	-	-	-
Time Breastfeeding (ref = never)	-	-	-	-	-	-	-	-	-	-	-	-
0-3 mths	1.27 (0.62, 2.60)	0.52	1.40 (0.65, 2.98)	0.39	0.69 (0.27, 1.79)	0.45	0.63 (0.26, 1.57)	0.33	-	-	-	-
3-6 mths	1.59 (0.70, 3.65)	0.27	1.51 (0.63, 3.65)	0.36	0.82 (0.26, 2.62)	0.73	0.43 (0.14, 1.27)	0.13	-	-	-	-
>6mths	1.85 (0.93, 3.70)	0.08	1.45 (0.70, 2.99)	0.32	0.83 (0.34, 2.03)	0.69	0.39 (0.16, 0.93)	0.03	-	-	-	-
Concurrent												
Age (mths)	0.94 (0.89, 1.00)	0.06	1.02 (0.95, 1.09)	0.57	1.03 (0.96, 1.10)	0.44	1.06 (0.98, 1.14)	0.13	-	-	-	-
BMI	0.72 (0.61, 0.85)	<0.001	0.46 (0.36, 0.58)	<0.001	0.37 (0.28, 0.50)	<0.001	0.35 (0.26, 0.48)	<0.001	-	-	-	-
Change in BMI	-	-	0.97 (0.84, 1.11)	0.65	0.99 (0.83, 1.19)	0.94	1.10 (0.87, 1.36)	0.46	-	-	-	-
Neighbourhood disadvantage (per 100 units)	1.08 (0.80, 1.46)	0.63	1.12 (0.83, 1.52)	0.46	1.08 (0.77, 1.53)	0.65	0.97 (0.65, 1.44)	0.87	-	-	-	-
Maternal education (ref <Year 12)	-	-	-	-	-	-	-	-	-	-	-	-
Year 12	1.09 (0.71, 1.66)	0.69	1.21 (0.76, 1.92)	0.43	0.59 (0.32, 1.07)	0.09	1.33 (0.69, 2.54)	0.40	-	-	-	-
>=Bachelor	1.86 (1.18, 2.92)	0.007	1.63 (1.00, 2.66)	0.05	1.23 (0.69, 2.21)	0.48	2.03 (1.04, 3.97)	0.04	-	-	-	-
Maternal BMI	0.89 (0.86, 0.92)	<0.001	0.93 (0.90, 0.97)	<0.001	0.96 (0.92, 1.00)	0.03	0.98 (0.94, 1.02)	0.26	-	-	-	-
Able to raise \$2000 in emergency (ref = easily)	-	-	-	-	-	-	-	-	-	-	-	-
With some sacrifice	0.88 (0.59, 1.31)	0.54	0.66 (0.43, 1.00)	0.06	0.35 (0.20, 0.63)	<0.001	0.73 (0.39, 1.36)	0.12	-	-	-	-
Drastic sacrifice/cannot	1.11 (0.69, 1.80)	0.66	0.62 (0.38, 1.00)	0.05	0.61 (0.31, 1.21)	0.16	0.89 (0.44, 1.78)	0.74	-	-	-	-
Days does outdoor activities with adult (ref = 0)	-	-	-	-	-	-	-	-	-	-	-	-
1-2days	0.70 (0.31, 1.58)	0.39	1.60 (0.85, 2.99)	0.14	2.60 (1.29, 5.24)	0.007	0.73 (0.39, 1.36)	0.32	-	-	-	-
≥3 days	0.55 (0.26, 1.19)	0.13	1.41 (0.79, 2.54)	0.24	1.37 (0.71, 2.64)	0.35	0.89 (0.47, 1.68)	0.73	-	-	-	-
Puberty (per unit, range 1-4)	-	-	-	-	-	-	0.45 (0.20, 1.01)	0.05	-	-	-	-
K-cohort	-		n=620 (R²=7.1%)		n=446 (R²=14.9%)		n=535 (R²=19.3%)		n= 620 (R²=16.2%)		n=610 (R²=16.6%)	
Historical												
Female	-	-	0.87 (0.62, 1.23)	0.44	1.31 (0.83, 2.08)	0.24	1.36 (0.88, 2.10)	0.17	1.12 (0.70, 1.78)	0.64	0.83 (0.46, 1.50)	0.54
Time Breastfeeding (ref = never)	-	-	-	-	-	-	-	-	-	-	-	-
0-3 mths	-	-	0.79 (0.37, 1.70)	0.55	0.49 (0.19, 1.27)	0.14	1.01 (0.34, 3.00)	0.98	1.27 (0.53, 3.04)	0.59	1.56(0.62, 3.88)	0.34
3-6 mths	-	-	1.00 (0.41, 2.44)	0.99	0.62 (0.19, 1.96)	0.41	2.01 (0.60, 6.76)	0.26	2.32 (0.82, 6.52)	0.11	2.08(0.70, 6.14)	0.19
>6mths	-	-	0.88 (0.43, 1.83)	0.74	0.59 (0.24, 1.50)	0.27	1.34 (0.48, 3.77)	0.58	1.15 (0.51, 2.58)	0.74	1.38(0.57, 3.30)	0.48
Concurrent												
Age (mths)	-	-	0.97 (0.91, 1.04)	0.38	1.00 (0.92, 1.07)	0.91	1.01 (0.94, 1.09)	0.81	1.06 (0.99, 1.12)	0.07	1.03 (0.97, 1.10)	0.29
BMI	-	-	0.63 (0.52, 0.76)	<0.001	0.53 (0.41, 0.68)	<0.001	0.48 (0.39, 0.58)	<0.001	0.54 (0.46, 0.63)	<0.001	0.55(0.47, 0.65)	<0.001
Change in BMI	-	-	-	-	0.97 (0.79, 0.68)	0.78	1.08 (0.90, 1.30)	0.41	1.03 (0.88, 1.19)	0.73	1.09(0.93, 1.27)	0.29
Neighbourhood disadvantage (per 100 units)	-	-	1.41 (1.00, 1.98)	0.05	1.16 (0.76, 1.77)	0.50	1.11 (0.79, 1.55)	0.55	0.84 (0.59, 1.19)	0.33	0.90(0.63, 1.28)	0.55
Maternal education (ref <Year 12)	-	-	-	-	-	-	-	-	-	-	-	-
Year 12	-	-	0.94 (0.59, 1.48)	0.78	0.88 (0.49, 1.58)	0.66	1.13 (0.66, 1.92)	0.66	0.82 (0.50, 1.34)	0.42	0.66(0.38, 1.15)	0.14
>=Bachelor	-	-	1.19 (0.74, 1.91)	0.46	0.99 (0.55, 1.79)	0.98	1.14 (0.66, 1.97)	0.64	1.09 (0.66, 1.80)	0.73	0.65(0.37, 1.15)	0.14
Maternal BMI	-	-	(Not included)	-	0.93 (0.89, 0.98)	0.004	0.93 (0.88, 0.97)	0.001	0.97 (0.93, 1.01)	0.11	0.99 (0.95, 1.03)	0.68
Able to raise \$2000 in emergency (ref = easily)	-	-	-	-	-	-	-	-	-	-	-	-
With some sacrifice	-	-	-	-	0.88 (0.52, 1.48)	0.63	1.02 (0.62, 1.68)	0.93	0.65 (0.40, 1.08)	0.10	0.87(0.52, 1.46)	0.60
Drastic sacrifice/cannot	-	-	-	-	0.46 (0.23, 0.93)	0.03	0.95 (0.50, 1.79)	0.86	0.56 (0.30, 1.05)	0.07	0.82(0.43, 1.56)	0.54
Days does outdoor activities (ref = 0)	-	-	-	-	-	-	-	-	-	-	-	-
1-2days	-	-	1.47 (0.69, 3.14)	0.32	1.21 (0.59, 2.49)	0.61	1.34 (0.73, 2.43)	0.34	0.82 (0.50, 1.33)	0.41	1.19(0.72, 1.98)	0.50
≥3 days	-	-	1.41 (0.69, 2.89)	0.35	1.00 (0.48, 2.07)	1.00	1.02 (0.55, 1.85)	0.96	0.77 (0.46, 1.28)	0.31	1.02(0.56, 1.86)	0.95
Puberty (per unit, range 1-5)	-	-	-	-	-	-	-	-	0.99 (0.61, 1.60)	0.96	0.82(0.56, 1.18)	0.28

B-cohort – Birth cohort; K-cohort – Kinder cohort; n – number; OR – odds ratio; p – p-value; ref – reference group; mths – months; std – standard; yrs: years; SD: standard deviation; BMI – Body Mass Index.;

Table 3. Final multivariable models of overweight/obesity development at age 10-11 years (B-cohort) and 14-15 years (K-cohort), additionally adjusted for sex

Predictors of overweight development	2-3 years		4-5 years		6-7 years		8-9 years		10-11 years		12-13 years	
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	P	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
B-cohort	n= 2455 (R ² =8.0%)		n= 2451 (R ² =9.6%)		n= 2753 (R ² =20.0%)		n= 2670 (R ² =21.3%)		-		-	
Study child's BMI	1.67 (1.48, 1.90)	<0.001	1.92 (1.67, 2.22)	<0.001	3.35 (2.87, 3.91)	<0.001	3.06 (2.60, 3.61)	<0.001	-	-	-	-
Maternal BMI	1.09 (1.07, 1.11)	<0.001	1.08 (1.06, 1.10)	<0.001	1.06 (1.04, 1.08)	<0.001	1.05 (1.02, 1.07)	<0.001	-	-	-	-
Maternal education (ref <Year 12)	-	-	-	-	-	-	-	-	-	-	-	-
Year 12	0.91 (0.70, 1.20)	0.52	0.97 (0.73, 1.31)	0.86	0.83 (0.61, 1.14)	0.25	1.07 (0.72, 1.60)	0.73	-	-	-	-
>=Bachelor	0.65 (0.49, 0.86)	0.003	0.62 (0.46, 0.85)	0.002	0.60 (0.43, 0.82)	0.001	0.71 (0.47, 1.06)	0.10	-	-	-	-
AUC	0.70		0.73		0.82		0.85					
K-cohort	-		n=2620 (R ² =6.0%)		n=2364 (R ² =15.8%)		n=2249 (R ² =20.6%)		n=2276 (R ² =21.8%)		n=2314 (R ² =25.5%)	
Study child's BMI	-	-	1.99 (1.75, 2.26)	<0.001	2.71 (2.37, 3.11)	<0.001	2.78 (2.43, 3.17)	<0.001	2.41 (2.14, 2.72)	<0.001	2.52 (2.21, 2.86)	<0.001
Maternal BMI	-	-	-	-	1.07 (1.05, 1.10)	<0.001	1.05 (1.03, 1.08)	<0.001	1.06 (1.03, 1.09)	<0.001	1.04 (1.02, 1.33)	0.002
Maternal education (ref <Year 12)	-	-	-	-	-	-	-	-	-	-	-	-
Year 12	-	-	0.76 (0.60, 0.97)	0.03	0.87 (0.66, 1.16)	0.35	0.92 (0.66, 1.27)	0.60	0.91 (0.63, 1.31)	0.61	0.88 (0.58, 1.33)	0.54
>=Bachelor	-	-	0.62 (0.48, 0.80)	<0.001	0.80 (0.60, 1.07)	0.14	0.82 (0.59, 1.14)	0.23	0.83 (0.58, 1.18)	0.30	0.89 (0.60, 1.31)	0.54
AUC			0.68		0.78		0.82		0.83		0.86	
Predictors of overweight resolution												
B-cohort	n=667 (R ² =12.0%)		n=676 (R ² =15.2%)		n= 607 (R ² =17.1%)		n=715 (R ² =12.7%)		-		-	
Study child's BMI	0.72 (0.61, 0.85)	<0.001	0.51 (0.43, 0.62)	<0.001	0.51 (0.41, 0.63)	<0.001	0.60 (0.51, 0.71)	<0.001	-	-	-	-
Maternal BMI	0.89 (0.86, 0.92)	<0.001	0.92 (0.89, 0.95)	<0.001	0.95 (0.92, 0.99)	0.01	0.99 (0.95, 1.02)	0.40	-	-	-	-
Maternal education (ref <Year 12)	-	-	-	-	-	-	-	-	-	-	-	-
Year 12	1.12 (0.74, 1.70)	0.58	1.34 (0.86, 2.07)	0.20	0.65 (0.38, 1.12)	0.12	1.00 (0.57, 1.76)	1.00	-	-	-	-
>=Bachelor	1.96 (1.27, 3.00)	0.002	1.90(1.23, 2.96)	0.004	1.54 (0.93, 2.55)	0.09	1.59 (0.92, 2.74)	0.10	-	-	-	-
AUC	0.72		0.75		0.81		0.77					
K-cohort	-		n=621 (R ² =5.9%)		n=458 (R ² =11.4%)		n=588 (R ² =16.2%)		n=707 (R ² =6.3%)		n=744 (R ² =12.2%)	
Study child's BMI	-	-	0.62 (0.52, 0.74)	<0.001	0.61 (0.50, 0.73)	<0.001	0.58 (0.49, 0.68)	<0.001	0.79 (0.72, 0.87)	<0.001	0.65 (0.58, 0.74)	<0.001
Maternal BMI	-	-	-	-	0.93 (0.89, 0.97)	0.001	0.93 (0.88, 0.96)	<0.001	0.95 (0.92, 0.99)	0.005	0.97 (0.94, 1.00)	0.09
Maternal education (ref <Year 12)	-	-	-	-	-	-	-	-	-	-	-	-
Year 12	-	-	1.00 (0.66, 1.52)	0.99	0.92 (0.53, 1.59)	0.77	1.17 (0.71, 1.94)	0.54	0.91 (0.59, 1.41)	0.68	0.77 (0.48, 1.22)	0.26
>=Bachelor	-	-	1.62 (1.07, 2.42)	0.02	1.19 (0.70, 2.00)	0.52	1.24 (0.76, 2.02)	0.40	1.12 (0.92, 0.99)	0.60	0.69 (0.94, 1.00)	0.13
AUC			0.68		0.74		0.77		0.72		0.75	

B-cohort – Birth cohort; K-cohort – Kinder cohort; n – number; OR – odds ratio; p – p-value; ref – reference group; yrs: years; BMI – Body Mass Index; AUC – area under curve

Supplementary Table 1: Measures table detailing specific questions/categorisation for each indicator

Indicator variables	B-cohort				K-cohort					Description	
	W2	W3	W4	W5	W1	W2	W3	W4	W5		
Historical factors¹											
Birthweight z-score	•	•	•	•	•	•	•	•	•	•	Birth weight z-score based on CDC growth charts
Time Breastfeeding (mths)	•	•	•	•	•	•	•	•	•	•	Age of completely stopped being breastfed: 1) Never; 2) <3 month; 2) 3-6 month; 3) >6 month.
Alcohol during pregnancy	•	•	•	•							1)No alcohol consumption; 2)1-2 std drinks on drinking days; 3)>2 std drinks on drinking days.
Smoking during pregnancy	•	•	•	•	•	•	•	•	•	•	Smoking during pregnancy vs. no smoking during pregnancy.
Caesarean section	•	•	•	•							Child born by caesarean section vs. vaginal delivery.
Introduction of solid (mths)	•	•	•	•							Age of child when he/she first had solid food >twice a week for several continuous weeks.
Concurrent factors											
Child BMI score	•	•	•	•	•	•	•	•	•	•	BMI was calculated by weight(kg)/height ² (m ²) .
Change in BMI score ²		•	•	•		•	•	•	•	•	BMI score of the concurrent wave minus the BMI score of the preceding wave.
Maternal age (yrs)	•	•	•	•	•	•	•	•	•	•	Calculated from date of birth.
Maternal BMI	•	•	•	•	•	•	•	•	•	•	Self-reported height and weight, BMI calculated by weight(kg)/height ² (m ²).
High-fat food consumption		•	•	•	•	•	•	• ³	• ³	• ³	Five questions summed to asses consumption of food/drink and their frequency (none, 1, 2, 3 or more) in the last 24 hours. Items included 1) meat pie, hamburger, hot dog, sausage or sausage roll; 2) hot chips or French fries; 3) potato chips or savoury snacks; 4) biscuits, doughnuts, cake, pie or chocolate; 5) full cream milk or full cream milk products.
General health	•	•	•	•	•	•	•	•	•	•	Parent reported children’s current health in general. Excellent/Very good vs. Good/Fair/Poor.
Sugary drink consumption	•	•	•	•	•	•	•	• ³	• ³	• ³	A summed score calculated based on consumption of drinks in the last 24 hours and their frequency. Items included soft drink/cordial (not diet) vs. fruit juice.
Excess weekday TV watching	•	•	•	•	•	•	•	•	•	•	Categorised according to the Australia Government Department of health recommendation, which differs across waves (2-5 year-olds: ≥1 hour; 5-18 year-olds: > 2 hours).
Enjoyment of physical activity		•	•	•	•			• ³	• ³	• ³	The parent/child was asked how much does child enjoy physical activity or exercise enjoys physical activity vs. neutral or dislikes.
Neighbourhood disadvantage	•	•	•	•	•	•	•	•	•	•	Child’s postcode was converted into Socio-Economic Indexes for Areas (SEIFA) index on Relative Socioeconomic Disadvantage scores (national mean 1000, SD 100).
Maternal psychological distress	•	•	•	•	•	•	•	•	•	•	Kessler Psychological Distress Scale (K6) consist of six questions and a five-level response scale; scale of 0-24 where higher scores indicate more psychological distress. Score 0-12: low/moderate psychological distress; Score 13-24:High psychological distress.
Maternal education	•	•	•	•	•	•	•	•	•	•	1) Did not complete Year12; 2) Completed Finish Year 12; 3) Bachelor degree or more.
Paternal education	•	•	•	•	•	•	•	•	•	•	1) Did not complete Year12; 2) Completed Finish Year 12; 3) Bachelor degree or more.

Indicator variables	B-cohort				K-cohort					Description
	W2	W3	W4	W5	W1	W2	W3	W4	W5	
Difficulty to raise money in emergency	•	•	•	•		•	•	•	•	“Suppose you only had one week to raise \$2000 for an emergency. Which of the following best describes how hard it would be for you to get that money?” 1)Easily 2)With some sacrifice 3)With drastic sacrifice or cannot raise the money.
Health-related Quality of life ³ (Physical & Psychosocial)	•	•	•	•	•	•	•	•	•	PedsQL physical (8-items) and psychosocial (15-items) health summary scores, each with a possible range of 0–100 (100=best possible health).
Sleep problem	•	•	•	•	•	•	•	•	•	“How much is your child's sleeping pattern or habits a problem for you?” Not a problem at all/A small problem vs. A moderate problem/A large problem.
Outdoor activities with adult family member	•	•	•	•	•	•	•	•	•	“In the past week, on how many days have you or an adult in your family, played a game outdoors or exercised together like walking, swimming, cycling? (Exclude older siblings or adults not living with the study child)”. Responses were categorised into three group: 1) None; 2) 1-2 days; 3) ≥3 days.
Puberty				• ⁴				• ³	• ³	Pubertal Development Scale (PDS) score, 2 of the 5 items are sex specific. Possible range of 1-4 points (4= most sexually mature).

¹ Other than ‘time breastfeeding’ and ‘Introduction of solid’ were collected from Wave 1+2 of B-cohort, all historical factors were collected from Wave 1 of both cohort.

² children with change in BMI more than 5 units were excluded from the analyses.

³The questionnaire item(s) was completed by the child.

⁴No question on voice deepening was asked. It is assumed that all of them had not started voice deepening yet at the age of 8-9 for calculating PDS scores.

Supplementary Table 2: Sample characteristics

Study variable	Mean (SD) or %	
	B-cohort at age 2-3y (n=3569)	K-cohort at age 4-5y (n=3276)
Age (mths)	33.8 (2.9)	56.8 (2.6)
Female, %	48.8	48.3
Time Breastfeeding, %		
Never	6.2	7.1
0-3 mths	24.7	22.5
3-6 mths	9.5	8.5
>6mths	59.6	61.9
BMI (kg/m ²)	16.8 (1.5)	16.3 (1.6)
Neighbourhood disadvantage	1014 (59)	1015 (57)
Maternal education, %		
Did not complete school	27.5	33.3
Completed school, not degree	35.8	33.4
Degree	36.8	33.3
Maternal BMI (kg/m ²)	25.3 (5.3)	25.1 (5.0)
6-7 years old		
Family able to raise AUD 2,000 in emergency, %		
Easily	61.9	57.7
With some sacrifice	23.8	24.6
Drastic sacrifice/cannot	14.3	17.7
Days does outdoor activities with adult, %		
0 days	15.7	14.0
1-2days	39.2	38.0
≥3 days	45.1	47.9
8-9 years old		
Puberty (per unit, range 1-5)	1.4 (0.3)	1.6 (0.5)

B-cohort – Birth cohort; K-cohort – Kinder cohort; n – number ref – reference group; mths – months; std – standard; yrs: years; SD: standard deviation; BMI – Body Mass Index; AUD – Australian dollars

B-cohort N's range from 3,412 to 3,569 with the exception of maternal BMI where N=3247

K-cohort N's range from 3,185 to 3,276 with the exception of maternal BMI where N=2702

Supplementary Table 3. Number of children included in the analysis and the percentage of weight change categories by cohort

Age(yrs)	n	Normal weight at baseline (%)		Overweight/obese at follow-up	Overweight/obese at baseline (%)
		Normal weight at follow-up	Overweight/obese at follow-up		
B-cohort					
0-1	-	-	-	-	-
2-3	3412	64.5	13.1	9.7	12.1
4-5	3440	66.7	11.7	13.6	17.8
6-7	3451	71.6	10.3	12.0	12.2
8-9	3450	72.8	6.1	15.8	18.0
K-cohort					
4-5	3261	66.3	14.7	18.0	19.7
6-7	3154	68.6	14.5	12.0	12.2
8-9	3185	67.7	10.8	15.8	18.0
10-11	3111	67.6	8.3	12.0	12.2
12-13	3155	68.8	6.7	15.8	18.0

Supplementary table 4. Normal weight children's odds of developing overweight/obese at 10-11 years in the B-cohort for each indicator variable (minimally adjusted for sex and age).

Indicators of obesity development (B-cohort)	2-3 years (n = 2678)				4-5 years (n=2698)				6-7 years (n=2811)		
	n	% ¹	OR	p	n	% ¹	OR	p	n	% ¹	OR
Historical											
Birthweight z-score, mean	2662	-0.08	1.14	0.007	2688	-0.71	1.10	0.08	2816	-0.34	1.17
Time Breastfeeding (ref = never)	161	23.6	-	-	155	17.4	-	-	151	16.5	-
0-3 mths	634	18.3	0.73	0.13	654	17.0	0.97	0.90	669	13.4	0.78
3-6 mths	261	20.3	0.83	0.43	262	18.3	1.05	0.84	272	14.7	0.87
>6mths	1621	16.7	0.65	0.03	1627	13.3	0.71	0.13	1735	11.6	0.66
Alcoholic drinks in pregnancy (ref = 0)	1405	19.1	-	-	1414	15.7	-	-	1454	13.6	-
1-2 std drinks on drinking days	959	14.3	0.71	<0.001	962	12.5	0.76	0.02	1032	10.0	0.70
>2 std drink on drinking days	71	25.4	1.44	0.20	69	21.7	1.49	0.19	67	14.9	1.11
Smoking during pregnancy (ref = no)	2084	16.2	-	-	2089	13.8	-	-	2181	11.1	-
Yes	319	25.4	1.76	0.003	326	19.6	1.53	0.006	340	19.1	1.88
Type of delivery (ref = vaginal)	1884	17.1	-	-	1912	14.4	-	-	1999	12.7	-
Caesarean	794	19.5	1.18	0.14	786	16.2	1.15	0.24	829	12.4	0.97
Introduction of solid (mths)	2514	5.01	0.98	0.56	2520	5.00	0.96	0.33	2646	4.90	0.94
Concurrent											
BMI score, mean	2678	16.2	1.70	<0.001	2698	15.6	1.98	<0.001	2822	15.7	3.47
Change in BMI score, mean	-	-	-	-	2585	-0.73	1.06	0.26	2726	-0.13	1.39
Maternal age (yrs), mean	2669	33.8	0.99	0.34	2689	35.8	0.99	0.20	2813	37.8	0.99
High fat food consumption (range 0-15), mean	-	-	-	-	2698	3.01	1.03	0.52	2825	3.64	1.01
Sugary drink consumption (range 0-4), mean	2678	1.31	1.08	0.11	2698	1.14	1.16	0.004	2825	1.16	1.11
General health (ref = fair/poor/good)	370	19.5	-	-	320	15.9	-	-	321	11.5	-
Very good/excellent	2308	17.5	0.88	0.37	2378	14.8	0.92	0.61	2507	12.8	1.12
Excess weekday TV (ref ≤ recommended time) ²	416	13.5	-	-	404	11.9	-	-	2444	11.9	-
>Recommended time	2262	18.6	1.47	0.01	2424	14.6	1.26	0.16	384	17.2	1.54
Neighbourhood disadvantage (per 100 units), mean	2678	10.2	0.66	<0.001	2698	10.0	0.65	<0.001	2827	10.2	0.62
Maternal distress (ref = low/moderate)	2545	17.8	-	-	2359	14.5	-	-	2717	12.3	-
High	133	18.0	1.02	0.93	339	17.7	1.30	0.09	111	20.7	1.87
Maternal education (ref <Year 12)	659	22.0	-	-	663	17.9	-	-	661	15.7	-
Year 12	978	20.2	0.9	0.39	948	17.6	0.97	0.83	980	14.0	0.87
≥Bachelor	1030	12.7	0.5	<0.001	1078	10.7	0.54	<0.001	1170	9.8	0.58
Paternal education (ref <Year 12)	870	19.0	-	-	870	15.9	-	-	860	13.1	-
Year 12	769	19.5	1.04	0.78	745	14.8	0.92	0.55	748	13.6	1.04
≥Bachelor	833	14.2	0.71	0.008	827	12.2	0.74	0.03	898	9.4	0.68
Maternal BMI ³ , mean	2463	24.7	1.10	<0.001	2455	25.1	1.10	<0.001	2767	25.5	1.09
Able to raise \$2000 in emergency (ref = easily)	1588	16.0	-	-	1562	14.2	-	-	1792	11.4	-
With some sacrifice	633	19.0	1.23	0.09	659	14.3	1.00	1.00	641	13.4	1.21
Drastic sacrifice/cannot	457	22.5	1.53	0.001	477	18.0	1.33	0.04	390	16.9	1.59
Physical QoL (per 10 units, range 0-100), mean	2247	8.30	1.07	0.18	2441	8.49	1.01	0.88	2813	8.06	0.93
Psychosocial QoL (per 10 units, range 0-100), mean	2246	8.07	0.99	0.77	2440	7.97	1.03	0.56	2812	7.81	0.91
Sleep problem (ref = no/small)	2349	17.5	-	-	2492	14.8	-	-	2630	12.24	-
Moderate/big	328	20.4	1.21	0.19	206	16.0	1.10	0.64	193	18.1	1.59
Days does outdoor activities (ref = 0)	147	20.4	-	-	290	18.3	-	-	426	16.2	-
1-2days	678	20.6	1.02	0.94	839	16.1	0.86	0.39	1128	12.3	0.72
≥3 days	1853	16.6	0.77	0.23	1569	13.6	0.69	0.03	1271	11.7	0.68
Puberty (ranging from 1-5), mean	-	-	-	-	-	-	-	-	-	-	-

¹Unless otherwise specified

²Categorised according to the Australia Government Department of health recommendation (2-5 year-olds: ≥1 hour; 5-18 year-olds: > 2 hours), B-cohort – Birth cohort; n – number; OR – odds ratio; p – p-value; ref – reference group; mths – months; std – standard; yrs: years; SD: standard deviation; BMI – Body Mass Index; QoL- quality of life.

Indicators of obesity development (K-cohort)	4-5 years (n=2639)				6-7 years (n=2622)				8-9 years (n=2501)			
	n	% ¹	OR	p	n	% ¹	OR	P	n	% ¹	OR	p
Historical												
Birthweight z-score, mean	2615	-0.95	1.05	0.32	2598	-0.79	1.06	0.22	2476	-0.71	1.05	0.38
Time Breastfeeding (ref = never)	174	24.7	-	-	168	24.4	-	-	167	23.4	-	-
0-3 mths	565	19.8	0.76	0.18	564	19.0	0.73	0.13	528	13.8	0.52	0.00
3-6 mths	217	17.1	0.63	0.07	221	15.8	0.58	0.04	207	10.6	0.39	0.00
>6mths	1671	16.8	0.62	0.01	1662	16.4	0.61	0.009	1591	13.1	0.49	<0.00
Smoking during pregnancy (ref = no)	1989	16.5	-	-	2008	16.3	-	-	1925	13.1	-	-
Yes	342	25.7	1.74	<0.001	327	22.6	1.50	0.006	298	18.1	1.47	0.02
Concurrent												
BMI score, mean	2639	14.7	1.98	<0.001	2622	15.7	2.74	<0.001	2501	16.3	2.81	<0.00
Change in BMI score, mean	-	-	-	-	2605	1.18	1.55	<0.001	2430	0.62	1.60	<0.00
Maternal age (yrs), mean	2621	35.2	0.98	0.10	2601	37.3	0.99	0.24	2476	39.3	0.99	0.38
High fat food consumption (range 0-15), mean	2608	3.41	1.05	0.17	2618	1.57	0.93	0.18	2498	1.17	1.03	0.50
Sugary drink consumption (range 0-4), mean	2630	1.59	1.11	0.02	2622	1.33	1.00	0.97	2498	3.30	1.15	0.00
General health (ref = fair/poor/good)	310	18.7	-	-	299	14.4	-	-	225	15.6	-	-
Very good/excellent	2329	18.0	0.96	0.79	2323	17.8	1.29	0.14	2276	13.6	0.86	0.42
Excess weekday TV (ref ≤ recommended time) ²	483	14.9	-	-	2195	17.4	-	-	2092	13.3	-	-
>Recommended time	2156	18.8	1.34	0.04	427	17.6	1.01	0.94	409	16.1	1.26	0.13
Neighbourhood disadvantage (per 100 units), mean	2639	10.2	0.78	0.004	2622	10.2	0.83	0.03	2501	10.2	0.80	0.02
Maternal distress (ref = low/moderate)	2280	17.7	-	-	2452	17.3	-	-	2182	13.7	-	-
High	359	20.6	1.20	0.20	170	18.8	1.11	0.62	319	14.4	1.06	0.73
Maternal education (ref <Year 12)	847	21.7	-	-	824	19.9	-	-	776	15.7	-	-
Year 12	885	17.6	0.76	0.03	887	18.2	0.89	0.36	819	13.7	0.85	0.26
≥Bachelor	888	15.0	0.63	<0.001	889	14.3	0.67	0.002	880	12.3	0.75	0.04
Paternal education (ref <Year 12)	955	20.6	-	-	932	21.1	-	-	887	15.8	-	-
Year 12	621	17.1	0.79	0.08	617	16.2	0.72	0.02	556	12.2	0.84	0.28
≥Bachelor	795	14.5	0.65	<0.001	779	13.9	0.60	<0.001	778	12.0	0.35	0.02
Maternal BMI ³ , mean	2190	24.8	1.11	<0.001	2369	25.0	1.09	<0.001	2256	25.2	1.08	<0.00
Able to raise \$2000 in emergency (ref = easily)	-	-	-	-	1557	15.5	-	-	1488	12.3	-	-
With some sacrifice	-	-	-	-	628	18.2	1.21	0.13	605	14.0	1.17	0.28
Drastic sacrifice/cannot	-	-	-	-	437	23.3	1.66	<0.001	408	18.9	1.66	<0.00
Physical QoL (per 10 units, range 0-100), mean	2374	8.26	0.99	0.88	2213	8.29	0.99	0.80	2295	8.49	1.01	0.90
Psychosocial QoL (per 10 units, range 0-100), mean	2374	7.77	1.00	0.93	2214	7.79	0.99	0.87	2295	7.65	0.94	0.13
Sleep problem (ref = no/small)	2316	17.9	-	-	2485	17.2	-	-	2381	13.9	-	-
Moderate/big	322	19.6	1.11	0.49	136	21.3	1.30	0.22	119	11.8	0.83	0.51
Days does outdoor activities (ref = 0)	243	18.5	-	-	365	20.3	-	-	406	16.3	-	-
1-2days	804	17.5	0.93	0.71	1000	17.0	0.80	0.15	1020	14.1	0.89	0.49

≥3 days	1590	18.4	0.98	0.93	1257	16.9	0.80	0.13	1075	12.8	0.80	0.18
Puberty (ranging from 1-5), mean	-	-	-	-	-	-	-	-	-	-	-	-

Supplementary table 5. Normal weight children's odds of developing overweight/obese at 14-15 years in K-cohort for each indicator variable (minimally adjusted for sex and age).

¹Unless otherwise specified

²Categorised according to the Australia Government Department of health recommendation (2-5 year-olds: ≥1 hour; 5-18 year-olds: > 2 hours)

³If the value of maternal BMI is missing in the concurrent wave, it was replaced by the value of maternal BMI available the previous wave (2 years ago)

K-cohort – Kinder cohort; n – number; OR – odds ratio; p – p-value; ref – reference group; mths – months; std – standard; yrs: years; SD: standard deviation; BMI – Body Mass Index; QoL- quality of life

Indicators of obesity resolution (B-cohort)	2-3 years (n = 734)				4-5 years(n=742)				6-7 years(n=623)		
	n	% res ¹	OR	p	n	% res ¹	OR	p	n	% res ¹	OR
Historical											
Birthweight z-score, mean	733	0.28	1.05	0.46	737	0.23	1.04	0.56	618	0.16	1.07
Time Breastfeeding (ref = never)	53	39.6	-	-	60	25.9	-	-	57	21.1	-
0-3 mths	231	47.6	1.33	0.36	194	37.1	1.78	0.08	179	19.0	0.88
3-6 mths	75	52.0	1.62	0.19	65	43.1	2.34	0.03	55	20.0	0.93
>6mths	375	61.9	2.39	<0.001	422	50.0	2.99	<0.001	332	29.2	1.57
Alcoholic drinks in pregnancy (ref = 0)	375	49.1	-	-	384	36.5	-	-	332	20.8	-
1-2 std drinks on drinking days	258	64.3	1.82	<0.001	255	56.5	2.07	<0.001	198	33.8	1.95
>2 std drink on drinking days	17	58.8	1.46	0.45	17	41.2	1.10	0.86	19	21.1	1.10
Smoking during pregnancy (ref = no)	532	57.9	-	-	536	47.9	-	-	451	27.2	-
Yes	109	46.8	0.66	0.05	111	32.4	0.53	0.004	92	17.4	0.57
Type of delivery (ref = vaginal)	505	57.2	-	-	485	45.6	-	-	405	27.9	-
Caesarean	228	49.6	0.74	0.06	256	41.4	0.85	0.31	217	18.9	0.63
Introduction of solid (mths)	673	4.90	1.09	0.13	692	4.94	1.04	0.46	576	4.96	1.08
Concurrent											
BMI score, mean	734	18.9	0.68	<0.001	742	18.6	0.50	<0.001	623	19.8	0.50
Change in BMI score, mean	-	-	-	-	699	0.40	0.81	<0.001	587	1.39	0.79
Maternal age (yrs), mean	734	33.6	1.03	0.03	741	35.6	1.02	0.11	619	37.5	1.03
High fat food consumption (range 0-15), mean	-	-	-	-	742	2.93	0.92	0.14	623	3.58	1.00
Sugary drink consumption (range 0-4), mean	734	1.24	0.76	<0.001	742	1.19	0.77	<0.001	623	1.26	0.89
General health (ref = fair/poor/good)	96	54.2	-	-	70	34.3	-	-	83	15.7	-
Very good/excellent	638	54.9	1.01	0.95	672	45.1	1.57	0.09	540	26.1	1.77
Excess weekday TV (ref ≤ recommended time) ²	96	64.6	-	-	91	56.0	-	-	499	26.1	-
>Recommended time	638	53.3	0.66	0.07	651	42.4	0.57	0.02	124	19.4	0.69
Neighbourhood disadvantage (per 100 units), mean	734	10.1	1.35	0.02	742	10.1	1.41	0.006	623	10.1	1.52
Maternal distress (ref = low/moderate)	702	55.8	-	-	631	45.3	-	-	598	24.4	-
High	32	31.3	0.34	0.006	111	36.9	0.70	0.10	25	32.0	1.37
Maternal education (ref <Year 12)	204	47.1	-	-	198	33.8	-	-	186	21.0	-
Year 12	279	49.5	1.11	0.57	279	39.4	1.25	0.25	231	16.5	0.72
>=Bachelor	250	67.2	2.31	<0.001	261	57.1	2.58	<0.001	201	37.3	2.26
Paternal education (ref <Year 12)	273	48.4	-	-	245	35.9	-	-	232	20.3	-
Year 12	196	54.6	1.27	0.20	213	40.8	1.22	0.30	159	20.8	1.04
>=Bachelor	184	67.9	2.24	<0.001	200	63.0	2.99	<0.001	151	38.4	2.49
Maternal BMI ³ , mean	668	26.7	0.88	<0.001	679	27.4	0.90	<0.001	610	28.8	0.93
Able to raise \$2000 in emergency (ref = easily)	382	58.1	-	-	376	51.1	-	-	342	32.2	-
With some sacrifice	208	51.4	0.74	0.08	210	40.5	0.65	0.01	178	14.6	0.33
Drastic sacrifice/cannot	144	50.7	0.73	0.10	156	32.1	0.45	<0.001	103	17.5	0.43
Physical QoL (per 10 units, range 0-100), mean	589	8.36	0.81	0.009	660	8.46	1.02	0.82	621	7.81	1.17
Psychosocial QoL (per 10 units, range 0-100), mean	588	8.10	0.87	0.05	660	7.93	1.03	0.63	622	7.67	1.06
Sleep problem (ref = no/small)	523	68.5	-	-	685	45.4	-	-	570	25.3	-
Moderate/big	80	55.0	0.78	0.28	56	28.6	0.50	0.02	53	28.9	0.73
Days does outdoor activities (ref = 0)	50	62.0	-	-	88	35.2	-	-	115	20.0	-
1-2days	183	57.4	0.85	0.62	234	45.3	1.52	0.11	223	28.3	1.72
≥3 days	501	53.1	0.72	0.29	420	45.2	1.56	0.07	285	24.2	1.40
Puberty (ranging from 1-5), mean	-	-	-	-	-	-	-	-	-	-	-

Supplementary table 6. Overweight/obese children's odds of resolving to normal weight at 10-11 years in the B-cohort for each indicator variable (minimally adjusted for sex and age).

¹Unless otherwise specified; ²Categorised according to the Australia Government Department of health recommendation (2-5 year-olds: ≥1 hour; 5-18 year-olds: > 2 hours)

B-cohort – Birth cohort; n – number; OR – odds ratio; p – p-value; ref – reference group; mths – months; std – standard; yrs: years; SD: standard deviation; BMI – Body Mass Index; QoL- quality of life.

Supplementary table 7. Overweight/obese children’s odds of resolving to normal weight at 14-15 years in the K-cohort for each indicator variable (minimally adjusted for sex and age).

Indicator (K-cohort)	4-5 years (n=622)				6-7 years (n=532)				8-9 years (n=684)				10-11 years (n=751)				n
	n	% res ¹	OR	p	n	% res ¹	OR	p	n	% res ¹	OR	p	n	% res ¹	OR	p	
ver)	614	0.24	0.91	0.19	527	0.23	0.91	0.26	679	0.14	0.83	0.02	743	0.10	0.89	0.16	76
	55	29.1	-	-	51	23.5	-	-	52	17.3	-	-	67	20.9	-	-	70
	167	32.3	1.18	0.63	148	23.6	0.99	0.13	189	21.7	1.34	0.48	189	22.2	1.07	0.84	20
	56	41.1	1.66	0.32	42	26.2	1.13	0.44	60	30.0	2.09	0.11	66	24.2	1.21	0.65	68
ref = no)	343	39.9	1.63	0.12	286	30.8	1.42	0.32	380	29.7	2.00	0.07	423	27.7	1.44	0.26	42
	445	40.7	-	-	365	31.2	-	-	466	29.4	-	-	511	27.0	-	-	52
	91	29.7	0.61	0.05	88	18.2	0.49	0.02	120	22.5	0.71	0.15	135	23.0	0.81	0.34	14
	622	18.6	0.62	<0.001	532	19.7	0.58	<0.001	684	21.4	0.55	<0.001	751	23.5	0.77	<0.001	77
	-	-	-	-	518	1.18	0.71	<0.001	664	2.37	0.91	0.21	665	2.46	0.89	0.08	63
	620	34.9	1.01	0.55	528	37.0	1.02	0.26	680	39.3	1.03	0.04	739	41.2	1.03	0.09	75
range 0-15), mean	617	3.44	0.97	0.57	532	1.51	0.90	0.27	682	2.92	1.06	0.34	750	2.36	0.93	0.13	76
range 0-4), mean	619	1.66	0.95	0.43	532	1.50	0.98	0.85	683	1.33	0.93	0.35	750	1.74	0.94	0.26	77
or/good)	68	33.8	-	-	71	15.5	-	-	87	25.3	-	-	167	22.8	-	-	16
	554	37.4	1.18	0.54	461	29.5	2.26	0.02	597	26.8	1.08	0.77	584	26.2	1.20	0.37	60
commended time) ²	75	45.3	-	-	426	27.9	-	-	519	26.0	-	-	536	26.1	-	-	52
	547	35.8	0.66	0.10	106	26.4	0.93	0.77	165	28.5	1.15	0.47	215	23.7	0.88	0.50	20
e (per 100 units), mean	622	10.1	1.65	0.001	532	10.1	1.35	0.07	684	10.1	1.42	0.01	751	10.1	1.12	0.42	77
(moderate)	525	39.4	-	-	486	29.0	-	-	585	27.4	-	-	708	26.1	-	-	70
	97	23.7	0.48	0.004	46	13.0	0.37	0.03	99	22.2	0.77	0.31	43	14.0	0.46	0.08	64
ar 12)	229	33.2	-	-	234	21.8	-	-	252	21.8	-	-	284	24.3	-	-	29
	200	33.5	1.02	0.94	201	20.9	0.97	0.91	218	24.8	1.19	0.42	233	23.2	0.94	0.77	24
	192	45.3	1.67	0.01	185	28.6	1.51	0.08	209	34.0	1.86	0.003	222	29.3	1.29	0.21	22
ar 12)	261	32.6	-	-	230	25.7	-	-	285	23.2	-	-	317	22.1	-	-	32
	135	39.3	1.35	0.18	109	25.7	1.01	0.97	148	20.9	0.88	0.62	156	19.2	0.85	0.50	16
	150	46.7	1.81	0.005	112	38.4	1.78	0.02	152	40.8	2.29	<0.001	155	34.8	1.90	<0.001	15
	503	26.8	0.93	<0.001	460	27.8	0.92	<0.001	590	27.9	0.90	<0.001	710	28.6	0.94	<0.001	74
gency (ref = easily)	-	-	-	-	261	32.2	-	-	350	28.9	-	-	440	29.5	-	-	41
	-	-	-	-	150	29.3	0.86	0.51	193	26.4	0.88	0.53	181	20.4	0.61	0.02	21
	-	-	-	-	121	15.7	0.40	0.001	141	21.3	0.68	0.10	128	18.8	0.55	0.02	14
range 0-100), mean	550	82.8	0.95	0.46	438	82.2	1.02	0.82	613	80.4	1.04	0.45	747	76.2	1.00	1.00	75
ts, range 0-100), mean	550	76.8	0.99	0.91	438	76.4	1.12	0.17	613	74.4	1.08	0.23	747	75.3	1.07	0.21	75
ll)	542	38.4	-	-	501	28.5	-	-	635	27.1	-	-	696	25.1	-	-	70
	80	27.5	0.60	0.06	30	13.3	0.40	0.10	49	20.4	0.69	0.31	51	29.4	1.24	0.50	64
(ref = 0)	49	30.6	-	-	79	25.3	-	-	131	23.7	-	-	233	26.6	-	-	32
	195	36.4	1.35	0.38	202	30.2	1.31	0.37	298	28.9	1.32	0.25	276	24.6	0.88	0.54	27

mean	378	38.1	1.42	0.28	251	26.3	1.06	0.83	255	25.5	1.12	0.66	241	24.9	0.90	0.61	16
	-	-	-	-	-	-	-	-	-	-	-	-	744	1.74	0.72	0.10	75

¹Unless otherwise specified

²Categorised according to the Australia Government Department of health recommendation (2-5 year-olds: ≥ 1 hour; 5-18 year-olds: > 2 hours)

³If the value of maternal BMI is missing in the concurrent wave, it was replaced by the value of maternal BMI available the previous wave (2 years ago)

K-cohort – Kinder cohort; n – number; OR – odds ratio; p – p-value; ref – reference group; mths – months; std – standard; yrs: years; SD: standard deviation; BMI – Body Mass Index; QoL- quality of life.