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Trends in body mass index according to educational attainment for urban Australian adults between 1980 and 2007

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Conflict of Interest

The authors declare no conflict of interest

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1 **ABSTRACT**

2 **Background:** We have previously demonstrated that between the years 1980 and 2000, the mean body mass
3 index (BMI) of the urban Australian population increased, with greater increases observed with increasing BMI.
4 The current study aimed to quantify trends over time in BMI according to education between 1980 and 2007.

5
6 **Methods:** We compared data from the 1980, 1983 and 1989 National Heart Foundation Risk Factor Prevalence
7 Studies, 1995 National Nutrition Survey, 2000 Australian Diabetes, Obesity and Lifestyle Study and the 2007
8 National Health Survey. For survey comparability, analyses were restricted to urban Australian residents aged
9 25-64 years. BMI was calculated from measured height and weight. The education variable was dichotomised
10 at completion of secondary school. Four age-standardised BMI indicators were compared over time by sex and
11 education: mean BMI, mean BMI of the top five percent of the BMI distribution, prevalence of obesity
12 ($BMI \geq 30 \text{ kg/m}^2$), prevalence of class II+ obesity ($BMI \geq 35 \text{ kg/m}^2$).

13
14 **Results:**

15 Between 1980 and 2007, the mean BMI among men increased by 2.5 kg/m^2 and 1.7 kg/m^2 for those with low
16 and high education levels, respectively, corresponding to increases in obesity prevalence of 20 (from 12% to
17 32%) and 11 (10% to 21%) %-points. Among women mean BMI increased by 2.9 kg/m^2 and 2.4 kg/m^2 for those
18 with low and high education levels respectively, corresponding to increases in obesity prevalence of 16 (12% to
19 28%) and 12 (7% to 19%) %-points. The prevalence of class II+ obesity among men increased by 9 (1% to 10%)
20 and 4 (1% to 5%) %-points for those with low and high education levels, and among women increased by 8 (4%
21 to 12%) and 4 (2% to 6%) %-points. Absolute and relative differences between education groups generally
22 increased over time.

23 **Conclusions:** Educational differences in BMI have persisted among urban Australian adults since 1980 without
24 improvement. Obesity prevention policies will need to be effective in those with greatest socio-economic
25 disadvantage if we are to equitably and effectively address the population burden of obesity and its
26 corollaries.

27 **Keywords**

28 Socio-economic factors, Obesity, Health Status Disparities, Trend analysis, Skew

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35 **Trends in body mass index according to educational attainment for urban**
36 **Australian adults between 1980 and 2007**

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38 **INTRODUCTION**

39 We have previously shown that between 1980 and 2000, the age-adjusted mean body mass index (BMI) of
40 urban Australian adults increased by 1.4kg/m² for men and 2.1kg/m² for women¹. During this time, the
41 prevalence of obesity doubled to around 20%, and the increasing right skew of the population BMI distribution
42 resulted in a four-fold increase in the prevalence of class II+ obesity (BMI≥35kg/m²)¹. Recent estimates from
43 the Australian Bureau of Statistics indicate that 27.5% of Australian adult men and women were obese in
44 2011-12². Similar patterns of increasing obesity and mean BMI have been observed in other developed
45 countries³.

46 One important facet of this epidemic is the socio-economic gradient in the prevalence of overweight and
47 obesity, such that in developed countries, including Australia, those of a lower socio-economic position⁴ (SEP)
48 are more likely to be overweight or obese than their counterparts of higher SEP^{5,6,7,8}. These differences are
49 generally larger and more consistent among women than men⁹. As obesity is a major risk factor for a range of
50 chronic diseases and conditions¹⁰, including cardiovascular disease¹¹, type 2 diabetes^{12,13} and disability¹⁴, the
51 observed differences in obesity prevalence across socio-economic strata are likely to contribute to the
52 disproportionate burden of ill-health among the most disadvantaged.

53 It is important to determine whether socio-economic differences in excess weight have changed over time, as
54 this can direct our prevention and treatment efforts to ensure improvement across all socio-economic groups.
55 We found nine previous studies which examined trends in mean BMI or the prevalence of obesity among
56 adults in developed countries by an indicator of SEP^{5,15-22}. Although these trends studies vary considerably in
57 their methodology, time frames and populations of interest, all demonstrate a tendency for lower SEP men
58 and women to have a higher absolute increase in mean BMI or prevalence of obesity over time compared to
59 their higher SEP counterparts. However, many are based on self-reported height and weight data, most have
60 not tested for statistical significance, and only one study¹⁹ examines changes in severe obesity and the skew of
61 the BMI distribution. Because obesity related pathophysiology is exponentially related to BMI²³, it is important
62 that changes to the socio-economic patterning of the entire BMI distribution are monitored over time.

63 The aim of our study was to quantify trends in the BMI distribution among urban Australian adult men and
64 women according to level of education. Education is a proxy for individual-level SEP which is commonly used,
65 enabling comparisons with previous literature²⁴, and is typically more stable and accurately reported
66 compared to other SEP indicators²⁵. We used six nationally-representative cross-sectional surveys with
67 objectively measured height and weight to determine changes in two common indicators of population weight
68 (mean BMI, and prevalence of obesity) and two indicators of severe adiposity (mean BMI of the top five
69 percent of the BMI distribution, and prevalence of class II+ obesity).

70 **METHODS**

71 **Data Sources**

72 This analysis compares data from six Australian cross-sectional surveys to represent changes to the Australian
73 population between 1980 and 2007: the 1980²⁶, 1983²⁷ and 1989²⁸ National Heart Foundation Risk Factor
74 Prevalence Studies (RFPS); the 1995 National Nutrition Survey²⁹ (NNS); the 2000 Australian Diabetes, Obesity
75 and Lifestyle Study³⁰ (AusDiab) and the 2007 National Health Survey³¹ (NHS). All RFPS were conducted on a
76 random selection of men and women aged 25-64 years (extended to 20-69 years in 1989) residing in capital
77 cities (extended to the Australian Capital Territory and Northern Territory in 1989) to represent the Australian
78 population. The total number of participants (response rate) were 5,603(67%), 7,615(75%) and 9,279(65%) in
79 1980, 1983 and 1989, respectively. To utilise objectively measured height and weight, we chose the 1995 NNS,
80 a random sample of the 57,633 Australians from private dwellings who had been interviewed for the 1995 NHS
81 (91.5% response rate)³². Of those approached, 13,858 (61%) elected to participate in the 1995 NNS. AusDiab
82 was conducted in 42 randomly selected clusters around Australia in a target population aged ≥ 25 and baseline
83 data included 11,247 participants (37% response rate). The 2007 NHS was a multi-stage, household based
84 survey of 17,426 private dwellings across Australia from August 2007 to June 2008 with one randomly selected
85 adult and child (two to 18 years old) selected from each dwelling. The total number of participants (response
86 rate) was 20,788 (91%).

87 **Anthropometric measurements**

88 Participants' height and weight were measured in each survey using a stadiometer and digital scales, and were
89 used to calculate participants' BMI in kg/m^2 . Within the AusDiab survey, NNS and NHS, where multiple
90 readings were taken to improve accuracy, measurements were averaged. BMI was categorised in accordance
91 with the World Health Organization guidelines³³: normal weight, ($\text{BMI} \geq 18.5\text{kg}/\text{m}^2$ and $< 25\text{kg}/\text{m}^2$) overweight,
92 ($\text{BMI} \geq 25\text{kg}/\text{m}^2$ and $< 30\text{kg}/\text{m}^2$) obese, ($\text{BMI} \geq 30\text{kg}/\text{m}^2$). The population of class II+ obese, ($\text{BMI} \geq 35\text{kg}/\text{m}^2$) was
93 also assessed to evaluate trends in severe obesity.

94 **Socio-economic position**

95 Socio-economic position was based on participants' highest educational attainment and dichotomised into
96 those who completed secondary education (12 years of education; high education) or did not complete
97 secondary education (low education). Questions regarding highest educational attainment were similar across
98 the six surveys.

99 **Selection Criteria**

100 Of the 68,390 potential subjects across the six surveys, subjects were excluded from the current analysis if
101 they were recorded as currently pregnant ($n=417$), or were missing information on anthropometric
102 measurements ($n=10,320$) or educational attainment ($n=42$). Participants who did not live in a capital
103 city($n=8,159$) or were aged < 25 or > 64 years($n=12,786$) were excluded from the NNS, AusDiab and NHS to

104 maximise comparability with the RFPS. The final sample size(year) was 5,537(1980), 7,544(1983), 7,667(1989),
105 5,002(1995), 5,502(2000) and 5,348(2007).

106 **Statistical analyses**

107 All analyses were stratified by sex and education level. A kernel density plot³⁴ was used to describe the crude
108 distribution of BMI in 1980 and 2007. All subsequent analyses were age-standardised or stratified by age (age-
109 specific), and a sample-specific person weight was applied to each survey to reflect the Australian distribution
110 of age, sex and locale (inter and intra state) at the time of each survey. Additionally the AusDiab and NHS
111 estimates were adjusted for the cluster sample design—by specifying cluster and stratum variables in AusDiab
112 and using jackknife variance estimation for NHS estimates. For age-standardised analyses, age was
113 standardised using the direct method³⁵ with the estimated 2007 total mid-year Australian resident population
114 used as the standard population³⁶, to ensure trends were not confounded by changes to the population age
115 structure over time. Age-specific analyses were conducted according to ten-year age intervals (25-34, 35-44,
116 etc.).

117 The distribution of age, sex and educational attainment and the prevalence of obesity and class II+ obesity
118 were tabulated for each survey year. Changes to BMI over time by education were explored using four metrics
119 1) mean BMI, 2) prevalence of obesity, 3) mean BMI within the top five percent of the BMI distribution and 4)
120 prevalence of class II+ obesity. The mean BMI of the top five percent was obtained in a two step process for
121 each survey. We first obtained the 95th percentile of the survey-weighted BMI distribution in each sex and
122 educational strata and selected persons who were at or above this BMI cutoff point. Among these survey
123 participants, the age-standardised mean BMI was then calculated.

124 Age-standardised estimates, associated standard errors and 95% confidence intervals for the four BMI metrics
125 were calculated for each survey for each sex and education stratum, with additional age-specific estimates
126 calculated for mean BMI and the prevalence of obesity. The resulting estimates were then compiled to
127 examine changes within and between education levels over the period 1980 to 2007. For the prevalence
128 metrics, we also estimated absolute and relative differences across education level and compared these over
129 time.

130 To determine whether changes in the difference between education levels in each of the four age-
131 standardised BMI metrics examined were statistically significant, we performed a variance weighted least
132 squares (vwls) regression with the estimate of each BMI metric as the dependent variable, weighted with the
133 survey standard error estimate, and educational attainment and survey year (continuous) as the independent
134 variables. Testing the significance of an interaction term between year and educational attainment provided a
135 test of whether or not changes over time to the age-standardised BMI-metric varied by educational
136 attainment. In some models the most appropriate fit for year was year and year squared.

137 All analyses were conducted using Stata version 12 (Stata Corp. LP., College Station, TX, USA). Statistical
138 significance was tested at the 5% level and for interactions a p-value <0.05 was deemed significant.

139 Ethics approval for the current study was obtained from Alfred Hospital Ethics Committee; Alfred ethics
140 project number 55/12.

141 **RESULTS**

142 Summary statistics of eligible participants from all surveys are presented in Table 1. Across the six surveys, the
143 number of participants in each age, sex and education level ranged from 96 to 817. The ratio of men to women
144 was similar across the six surveys, and there was generally a greater or equal proportion of participants with
145 high educational attainment (Table 1).

146 **Trends in the overall BMI distribution by education**

147 Figure 1 shows that the BMI distribution is more spread, skewed to the right and shifted to the right among
148 men and women of both education levels in 2007 compared to 1980. In addition, compared to their high
149 education counterparts those of a low education appear to have a greater right skew in 1980 and a further
150 shift to the right and increase in right skew in 2007.

151 **Trends in mean BMI and the prevalence of obesity by education**

152 Among men, from 1980 the age-standardised mean BMI increased by 2.5kg/m² among men of low education
153 and 1.7kg/m² among men of high education to a mean of 28.2kg/m² and 27.1kg/m² in 2007 (Figure 2).
154 Concurrently, the prevalence of obesity increased by 20 and 11 percentage points among men of low and high
155 education, respectively, to a prevalence of 32% and 21% in 2007 (Figure 3). The absolute differences in obesity
156 prevalence between education levels increased from 2 percentage points in 1980 to 11 percentage points in
157 2007, which in relative terms corresponds to a 20% higher prevalence of obesity for men of low education in
158 1980 and a 52% higher prevalence for men of low education in 2007 compared to their counterparts of high
159 education.

160 Among women, from 1980 the age-standardised mean BMI increased by 2.9kg/m² among women of low
161 education and 2.4kg/m² among women of high education to a mean of 27.4kg/m² and 26.0kg/m² in 2007
162 (Figure 2). Concurrently, the prevalence of obesity increased by 16 and 12 percentage points among women of
163 low and high education respectively to a prevalence of 28% and 19% in 2007 (Figure 3). The absolute
164 differences in obesity prevalence between education levels increased from 5 percentage points in 1980 to 9
165 percentage points in 2007, which in relative terms corresponds to a 71% higher prevalence of obesity among
166 women of low education women in 1980 and a 47% higher obesity prevalence for women of low education in
167 2007.

168 Age-specific results were generally consistent with age-standardised results across all time points (appendix),
169 older men and women were more likely to be obese and have a higher BMI than their younger counterparts.

170 **Trends in the mean BMI of the top five percent and the prevalence of class II+ obesity by education**

171 Among men, from 1980 the age-standardised mean BMI among those in the top five percent of the BMI
172 distribution increased by 5.4kg/m² among men of low education and 4.3kg/m² among men of high education,
173 to a mean of 39.5kg/m² and 38.4kg/m² in 2007 (Figure 4). Concurrently, the prevalence of class II⁺ obesity
174 increased by 9 and 4 percentage points among men of low and high education respectively to a prevalence of
175 10% and 5% in 2007 (Figure 5).The absolute differences in class II⁺ obesity prevalence between education
176 levels increased from no difference in 1980 to five percentage points in 2007, which in relative terms
177 corresponds to a 100% higher prevalence of class II⁺ obesity for men of low education men in 2007 compared
178 to their counterparts of high education.

179 Among women, from 1980 the age-standardised mean BMI among those in the top five percent of the BMI
180 distribution increased by 6.7kg/m² among women of low education and 6.3kg/m² among women of high
181 education, to a mean of 43.8kg/m² and 40.8kg/m² in 2007 (Figure 4). Concurrently, the prevalence of class II⁺
182 obesity increased by 8 and 4 percentage points among women of low and high education respectively to a
183 prevalence of 12% and 6% in 2007 (Figure 5). The absolute differences in obesity prevalence between
184 education levels increased from 2 percentage points in 1980 to 6 percentage points in 2007, which in relative
185 terms corresponds to a 100% higher prevalence of obesity among women of low education at both time
186 points.

187 **Time trends in differences between education levels**

188 For the four age-standardised BMI metrics studied, a linear relationship between survey year and the
189 prevalence of obesity and class II⁺ obesity among women, and the mean BMI and mean BMI of the top five
190 percent among women was observed, so an interaction between survey year and education was tested for
191 these metrics. A quadratic relationship was observed between survey year and the prevalence of obesity and
192 class II⁺ obesity among men, and the mean BMI and mean BMI of the top five percent among women was
193 observed, so an interaction between survey year squared and education was tested for these metrics.

194 No statistically significant interactions were identified. However, we found a suggestion of an interaction
195 between education and survey year on mean BMI among men (p=0.06).

196 **DISCUSSION**

197 In this analysis of trends in BMI according to educational attainment among urban Australian adults between
198 1980 and 2007, we found that those with a lower education were more likely to have a greater right skew of
199 the BMI distribution and to experience greater absolute and relative increases in mean BMI, the mean BMI of
200 the top five percent and the prevalence of obesity and class II⁺ obesity compared to their higher education
201 counterparts over time. Hence, increases in BMI previously demonstrated for all urban Australians¹ appear to
202 have been greater among those with lower education levels. As a result, in 2007 levels of obesity and severe
203 obesity were respectively fifty percent greater and twice as great among Australian men and women of a
204 lower education level compared to their higher education counterparts.

205 Among men, differences between high and low education levels across the four BMI metrics were generally
206 small or non-existent in 1980 and appeared to become more substantial over time. A suggestion of a
207 significant widening of the difference in mean BMI between education levels across between 1980 and 2007
208 was observed. Among women, we saw that differences between education levels for all four BMI metrics were
209 substantial in the 1980's and persisted over time with no indication of narrowing. For both men and women,
210 absolute and relative differences in the prevalence of obesity and class II⁺ obesity were generally higher in
211 2007 than in 1980^{3, 37}. These gender differences observed in socioeconomic inequalities in obesity have been
212 previously well described³⁸.

213 Our results regarding the persistence of educational differences over time in two common indicators of
214 population weight, mean BMI and the prevalence of obesity, are in accordance with much of the previous
215 literature that we have identified regarding these trends in Australia and in other developed countries. We
216 extend the analysis by Bennet *et al.*,¹⁵ who found that between 1980 and 1989 there was a greater increase in
217 BMI among Australian adults with a lower education level compared to their higher educated counterparts.
218 We also provide support for the findings of Najman *et al.*⁵ and Devaux *et al.*,¹⁷ who both used self-reported
219 BMI data and found that differences in obesity prevalence between education levels appear to have persisted
220 for Australian adults between 1990 and 2001^{5, 17}, with some indication of widening between 2001 and 2005
221 due to a higher absolute increase in obesity prevalence among those of a lower SEP compared to their higher
222 SEP counterparts.

223 Differences in mean BMI according to education, occupation, or deprivation indices have persisted over time
224 without improvement in Denmark (1985-2005), Finland (1982-2002), France (1981-2003), Portugal (1995-
225 1999), Scotland (1995-2005), Spain (1985-2005) and Sweden (1981-2004)²¹. Differences in obesity prevalence
226 have persisted over time without improvement according to income in Austria (1973-2007)¹⁸ and Brazil (1989-
227 1997)²⁰, education in Belgium (1997-2004)¹⁶ and the US (1969-2008)^{17, 19, 22} and income or occupation in
228 Canada (1994-2005), Italy (1994-2005), Spain (1995-2003) and USA (1999-2008)¹⁷. Conversely, a small
229 narrowing of differences in obesity prevalence between SEP groups over time has been observed in England
230 (1995-2007), France (1995-2006) and Korea (1998-2005)¹⁷, a finding that was not shared by our study but
231 which may be attributable to their differing population composition, use of self-reported data or shorter
232 follow-up period. Alternatively, this discrepancy may be attributable to public policy implemented to address
233 obesity for these countries and time-periods, a possibility which deserves thorough investigation. Delineation
234 of if, and indeed how, public policy is responsible for the narrowing in obesity prevalence observed in these
235 countries would enable further dissemination globally. Nevertheless, the general international consistency in
236 socio-economic trends observed for mean BMI and obesity prevalence, two common indicators of population
237 weight, means that our study is likely to be robust, and allows for the possibility that socio-economic trends
238 we observed for the mean BMI of the top five percent and class II⁺ obesity, two indicators of severe adiposity
239 which have been less well-studied, may also apply beyond Australia.

240 Our results for these indicators of severe adiposity are in accordance with the one previous study¹⁹ we
241 identified which examines severe adiposity trends by SEP. Among US adults, Ljungvall¹⁹ found that differences
242 across education levels for the top 15% of the BMI distribution and prevalence of class II+ obesity had existed
243 since the 1960's and persisted over time with no indication of improvement¹⁹. While increases in these
244 indicators of severe adiposity were greater among those with a lower education, a statistically significant
245 change in this difference over time was not observed¹⁹. It is possible that, as can be observed in the figures of
246 both our study and Ljungvall's, absolute differences between education groups have in fact widened since
247 2000, with the small number of data points limiting our ability to detect such a change. It appears that within
248 the US and Australia, increases in class II+ obesity and the skew of the BMI distribution may have started to
249 slow among those of a higher education while continuing to increase among those of a lower education.
250 Hence, socio-economic differences are potentially widening for both obesity and for severe obesity, likely
251 driving further inequalities in health, wellbeing and productivity. It will be important to continue to monitor
252 these socio-economic trends into the future

253 The strength of our study lies in its comprehensive analysis by education level of changes to BMI over a long
254 series of time-points. We utilised nationally-representative surveys which measure height and weight and are
255 highly comparable regarding our primary variables of interest, education and BMI. Further, our findings are
256 age-standardised to ensure changes in population adiposity over time are not confounded by changes to the
257 population age structure. Additionally, we examined educational differences in the secular changes in BMI
258 across the entire BMI distribution, allowing a more comprehensive understanding of the educational
259 disparities in excess adiposity. Our use of education is another strength; compared to income or occupation,
260 education is a stable and reliable marker of SEP for both sexes^{25, 39, 40}, is less susceptible to reverse causality^{25,}
261 ⁴⁰, and is most likely to reflect health behaviours⁴¹, making it a useful indicator of socio-economic differences
262 in obesity. Further, the ubiquitous use of education as an indicator of SEP²⁴ facilitates comparison between our
263 results and previous literature. That being said, our trends analyses use data spanning 1980 to 2007 and adults
264 born between 1916 and 1982. We acknowledge that changes to rates of educational attainment over our
265 study period⁴² potentially complicate the comparability of the comparator groups over time⁴³. Nevertheless,
266 the findings represent the observed differences in adiposity between groups with the same level of
267 educational attainment over time.

268 Further limitations include variation in the methodology, sampling and response rates of the six surveys
269 assessed. While the three RFPS's were conducted according to the same protocol, the NNS, AusDiab and NHS
270 were each conducted independently and sampled slightly different areas. Additionally, while the response
271 rates of the RFPS and NNS are not dissimilar, the NHS and AusDiab respectively have substantially higher and
272 lower response rates, which may impact the comparability of the study populations and the extent to which
273 education levels and BMI levels are represented. The differences between surveys also meant we could not
274 apply our regression analyses at the level of individual respondents, and instead performed an interaction test
275 across a vpls regression analyses, further lowering the power of the interaction test⁴⁴. The most likely
276 implications of these limitations are that our results have underestimated the educational differences across

277 the BMI spectrum, since “absence of strong evidence that interaction is present does not imply that
278 interaction is absent”⁴⁴. Further, due to the maximum scale weight, we truncated all individual’s weight to
279 140kg when weight was recorded above 140kg in the 1995 NNS and 2007 NHS. This would likely lead to an
280 underestimation of the observed inequalities in mean BMI of the top five percent and of changes in
281 inequalities over time. Our analysis was limited to the six biomedical surveys of Australian adults which have
282 been conducted since 1980, and we did not have sufficient power to conclude on important variations
283 between these time points. Our exclusion of non-urban-dwelling participants means our results are limited in
284 their generalisability to rural and remote Australians.

285 **Implications**

286 Action to reduce socio-economic inequalities in obesity, a primary cause of morbidity and mortality
287 internationally needs to be underpinned by regular monitoring. Only through knowing the nature and size of a
288 problem can it be effectively prevented and addressed^{45, 46}. Knowing the extent to which the BMI distribution
289 differs across the socio-economic gradient is particularly important. Globally, action to prevent and treat
290 obesity is increasing, and we need to ensure more disadvantaged groups benefit from these efforts. The
291 exponential relationship between BMI and the risk and severity of obesity-related morbidity and mortality²³
292 means changes in the socio-economic patterning of the skew of the population BMI distribution can have a
293 substantial impact on the socio-economic distribution of the pathophysiological corollaries of obesity^{9, 10, 47}.
294 Hence, if we are less successful in controlling obesity among those of a lower SEP we are also missing the bulk
295 of the overall obesity burden. Our finding that increases in all four BMI metrics were greater among those with
296 a low education indicates a faster increase in weight gain since 1980 across the entire BMI spectrum for this
297 group compared to their high education counterparts. By 2007, men and women with a low education had a
298 substantially higher mean BMI, prevalence of obesity, right-skew of the BMI distribution and levels of severe
299 obesity than their high education counterparts. These trends provide an important baseline from which both
300 current and future obesity prevention initiatives can be evaluated. They provide some indication of how past
301 initiatives and the obesogenic environment may have acted differentially across different socio-economic
302 groups in Australia, and can aid present-day policy decisions on how healthcare and prevention resources
303 should be rationalised⁴⁸. As our findings are limited to the concept of high or low education as a marker of SEP,
304 evaluation of trends according to socio-economic gradient, rather than socio-economic gap as we have
305 measured here would augment our findings⁴⁹. Further, we recommend analysis of alternate SEP indicators for
306 further insights. The identification of factors amenable to policy intervention which are driving the relationship
307 between a lower SEP and higher rates of adiposity could be an important next step in identifying public policy
308 targets that could both prevent and reduce inequalities in obesity. Finally, it will be important for future
309 studies to continually monitor trends in both overall and severe obesity across different socio-economic levels
310 using the most up to date data to ensure a timely and effective response to future changes to socio-economic
311 differences across the BMI distribution.

312 Supplementary information is available at IJO's website

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319 **CONFLICT OF INTEREST**

320 None to declare

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430 **FIGURE LEGENDS**

431 Figure 1. Body mass index distribution for urban Australian men and women aged 25-64 in 1980 and 2007 by
432 education

433 Figure 2. Age-standardised mean BMI* for urban Australian men and women aged 25-64 by education

434 Figure 3. Age-standardised prevalence of obesity for urban Australian men and women aged 25-64 by
435 education

436 Figure 4. Age-standardised mean BMI* within top five percent of BMI distribution for urban Australian men
437 and women aged 25-64 by education

438 Figure 5. Age-standardised prevalence of class II+ obesity for urban Australian men and women aged 25-64 by
439 education

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