Income-Based Inequality of Adolescent Obesity in Australia

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Abstract

We investigate the magnitude and drivers of income-based inequality of adolescent obesity. Using the Household, Income and Labor Dynamics in Australia, we estimate a concentration index of–0.1225. We also demonstrate that the inequality doubled between the years 2006 and 2014. In a decomposition analysis, we show that the greatest contributors to the observed inequality in adolescent obesity rates are socioeconomic status and maternal obesity status.

Keywords: health inequality; Australia; obesity; concentration index

Running title: Income-Based Inequality of Adolescent Obesity

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1. INTRODUCTION

Obesity status has a strong socioeconomic gradient (see, e.g., Stamatakis et al. (2010)). The concentration index (CI) is one construct used to quantify this inequality. Despite the practicality of concentration indices for estimating socioeconomic disparity in health, it has not yet been used in the context of obesity in Australia. This letter is the first to use CI to measure income-based inequality of adolescent obesity rates in Australia. We decompose the CI to examine its drivers. We thus add to the literature using this approach, allowing for international comparisons which can inform policymakers seeking to address disparities in health.

Australia is a notable country since obesity is considered to be a major public health issue in the country (AIHW 2017). The Parliament of Australia recently completed its inquiry on the "obesity epidemic in Australia".[1] About a quarter of children in Australia are considered to be with either overweight or with obesity, with prevalence rates higher for disadvantaged communities (AIHW 2017) and with overall prevalence increasing over time (OECD 2017b). Among OECD countries, Australia has the fifth highest obesity prevalence rate (OECD 2017a). Characterizing the distribution of obesity based on socioeconomic status contributes to targeting public health policies in the country to address these challenges.

2. DATA

Data are drawn from nine waves (2006–2014) of the Household, Income and Labor Dynamics in Australia (HILDA), a representative survey.[2] Although the World Health Organization (2016) defines adolescents as young people aged 10–19 years, HILDA respondents are 15 years old or above. Our sample of adolescents is thus restricted to ages 15–19. We exclude observations with missing information and those who do not live with their parents, resulting in an unbalanced panel consisting of 2,722 adolescents.

Our health outcome is obesity status; the ranking variable is equivalized household income. Body-mass index (BMI) is derived by HILDA using the self-reported measures of height and body weight. We create an indicator for adolescent obesity using the international cutoffs in Cole et al. (2000), which take into account that adolescents are still growing. Equivalized household income is calculated

[1] The final report is available here: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Obesity_epidemic_in_Australia/Obesity/Final_Report.

[2] For further information about HILDA, see Summerfield, Friedin, Hahn et al. (2015). Information on height and weight, which are used to calculate body-mass index (BMI) as kg/m^2, were collected from Wave 6 (2006) onwards.

by deflating household income by an "equivalence factor", which is calculated according to the "modified OECD" equivalence scale (OECD 2013).

3. METHODOLOGY

3.1 Concentration Index

The concentration index measures the prevalence of a health outcome over the distribution of a ranking variable. It ranges from –1 to +1, where a larger absolute value indicates greater inequality. If it is negative, there is more adolescent obesity among low-income households; conversely, a positive value implies that adolescent obesity is "pro-rich".

For a sample of i adolescents, with $i = 1,2, \dots, N$, the CI for adolescent obesity is calculated as

$$CI = \frac{2}{N\bar{Y}} \sum_{i=1}^{N} Y_i R_i - 1,$$

where Y_i is the obesity status of the i^{th} adolescent and $\bar{Y}$ is the sample mean of adolescent obesity. Each of the N adolescents are ranked by their equivalized household income (R_i), with $i = 1$ for the adolescents at the bottom of the distribution and $i = N$ for those at the top of the distribution.[3] Since the outcome variable is binary, we follow Wagstaff (2005) and normalize the CI by dividing it by $1 - \bar{Y}$ so that it falls within [–1, +1].

3.2 Decomposition Analysis

We decompose the normalized CI to quantify the relative contributions of a vector of variables to the observed inequality in adolescent obesity status. We begin the decomposition by estimating a probability model for adolescent obesity via probit. The independent variables are the following: sex, age, number of siblings, whether the adolescent is the eldest child, whether the adolescent had a close friend who died recently, having a mother with obesity, maternal educational attainment, mother's age, mother's civil (marital) status, mother's employment status, mother's smoking status, whether the mother had a close friend who died recently, equivalized household income, and SEIFA[4] decile of advantage.

We then calculate the change in predicted probability with respect to a change in any of the regressors (the average partial effect). The normalized CI (CI_n) is decomposed as

$$CI_n = \left(\frac{\beta_r \bar{X}_r}{\bar{Y}}\right) CI_r + \sum_k \left(\frac{\beta_k \bar{X}_k}{\bar{Y}}\right) CI_k + \frac{GC_\varepsilon}{\bar{Y}}, \tag{4}$$

[3] Sections 3.1 and 3.2 follow the exposition in Walsh and Cullinan (2015). Further citation is suppressed for readability.

[4] The Socio-Economic Indexes for Areas (SEIFA) is used by the Australian Bureau of Statistics to rank communities or neighborhoods based on socioeconomic status.

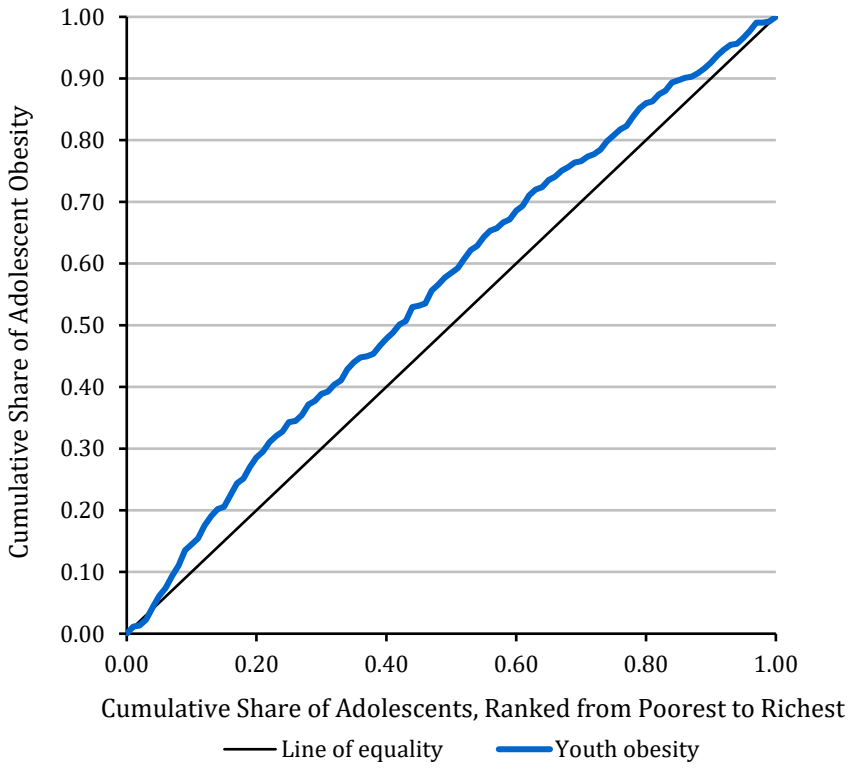
where $\bar{X}_r$ is the mean of equivalized household income, β_r is the average partial effect of equivalized household income from the earlier probit regression, and CI_r is the pre-normalized CI using equivalized household income as the ranking variable. The first term on the right-hand side represents the contribution of equivalized household income to the inequality in adolescent obesity rates. The second term is analogously defined as the first but applies to each of the k independent variables in the probit regression. The third term is the residual component. Dividing each term by CI_n recovers the percentage contributions of each regressor to the overall inequality.

4. Results and Discussion

4.1 Socioeconomic Inequality in Adolescent Obesity

The estimated CI is –0.1225. The corresponding concentration curve is presented in Figure 1. This indicates that adolescent obesity is disproportionately found in low-income households. Using a sample of children aged 9 for the period 2007–2008 in Ireland, Walsh and Cullinan (2015) estimate a slightly higher CI of –0.168. Following their interpretation, our estimate implies that a redistribution of 12.25% of adolescent obesity from poor to rich households would result in parity. Using children aged 2–15 in Spain, Costa-Font and Gil (2013) estimate a CI of –0.1599.

Figure 1—Concentration Curve of Adolescent Obesity



Source: Author's calculations based on HILDA Release 14.

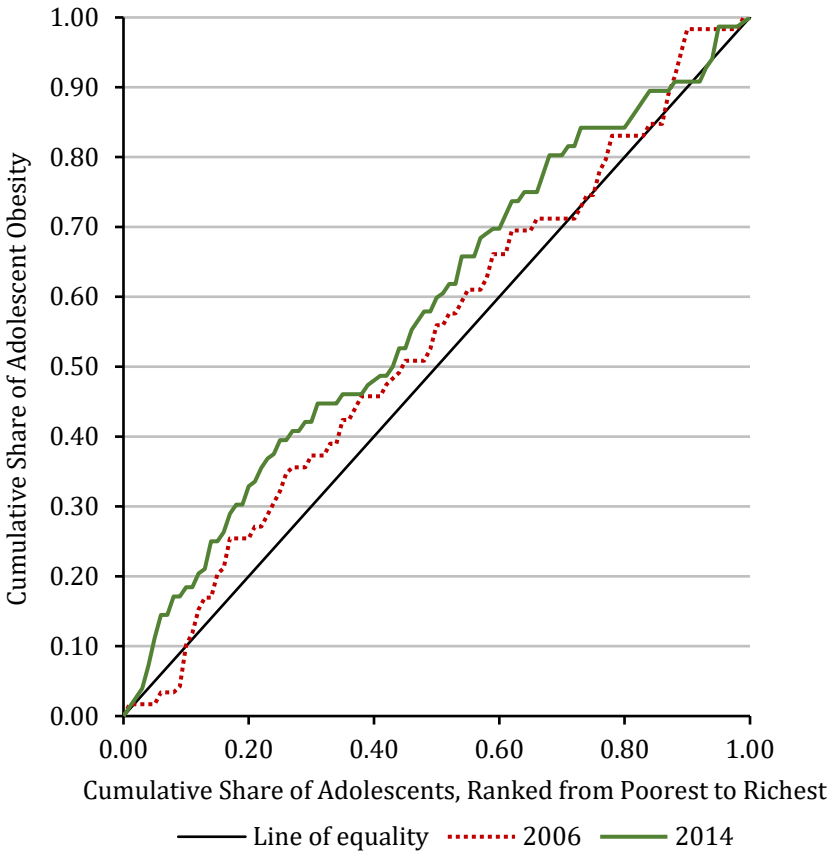
Table 1 shows that income inequality in adolescent obesity increased in Australia the period 2006–2014. The increase is consistent with estimates by Costa-Font and Gil (2013) in Spain, who found an income-based inequality increase in child/adolescent obesity of 50% over a three-year period from 2004–2007. Graphically, the increase in adolescent obesity inequality is represented in Figure 2. These results show that Australia's increasing adolescent obesity rates are accompanied by a growing socio-economic inequality in its incidence.

Table 1—Concentration Indices for Adolescent Obesity: 2006–2014, 2006, and 2014

	Pooled Sample (2006–2014)	Wave 6 (2006)	Wave 14 (2014)
Concentration index	–0.1225	–0.0721	–0.1614
Standard error	(0.02)	(0.07)	(0.06)
Observations	6877	727	836

Source: Author's calculations based on HILDA Release 14.

Figure 2—Concentration Curves of Adolescent Obesity in Australia: 2006 and 2014



Source: Author's calculations based on HILDA Release 14.

4.2 Decomposition Analysis

The decomposition results are presented in Table 2, where two models are distinguished by the choice of the reference categories for household characteristics and maternal employment status. The decomposition results show that the model explains between 84% and 86% of the inequality (the "Subtotal"

row), which is consistent with international estimates (Costa-Font and Gil 2013; Walsh and Cullinan 2015).

Table 2—Concentration Index Decomposition

	Contribution to CI (Reference 1)	Percentage Contribution (Reference 1)	Contribution to CI (Reference 2)	Percentage Contribution (Reference 2)
Mother has obesity	–0.0215	17.57%	–0.0215	17.57%
Adolescent characteristics				
Male	0.0001	–0.11%	0.0001	–0.11%
Adolescent age ≥ 17 years	0.0067	–5.47%	0.0067	–5.47%
Eldest child	–0.0006	0.48%	–0.0006	0.48%
Number of siblings ≥ 3	0.0006	–0.52%	0.0006	–0.52%
Maternal education				
Tertiary	0.0000	–0.03%	0.0000	–0.03%
Mother age				
Mother 40 years and over	–0.0100	8.20%	–0.0100	8.20%
Marital status				
Married	–0.0055	4.51%	–0.0113	9.19%
Divorced	–0.0040	3.30%	REF (2)	REF (2)
Widowed	–0.0040	3.25%	–0.0033	2.66%
Single	REF (1)	REF (1)	0.0008	–0.69%
Mother's employment				
Employed full-time	0.0045	–3.68%	REF (2)	REF (2)
Employed part-time	0.0000	–0.04%	0.0000	0.02%
Unemployed	REF (1)	REF (1)	0.0006	–0.50%
Not in labour force	0.0016	–1.33%	0.0054	–4.42%
Household characteristics				
Low SES neighborhood	–0.0395	32.28%	–0.0221	18.14%
Moderate SES neighborhood	–0.0017	1.39%	REF (2)	REF (2)
High SES neighborhood	REF (1)	REF (1)	–0.0158	12.89%
Equivalized household income	–0.0186	15.21%	–0.0186	15.21%
Proxy variables				
Mother smokes	–0.0119	9.70%	–0.0119	9.70%
Adolescent had close friend die	–0.0005	0.42%	–0.0005	0.42%
Mother had close friend die	–0.0017	1.37%	–0.0017	1.37%
Subtotal	–0.1060	86.5%	–0.0131	84.11%
Residual	–0.0165	13.50%	–0.0194	15.89%
Total	–0.1225	100%	–0.1225	100%

Source: Author's calculations based on HILDA Release 14.

The most significant contributor to the inequality in adolescent obesity is living in a low-SES neighborhood. This is followed by having a mother with obesity and then by equivalized household income. That the socioeconomic status of the neighborhood and equivalized household income explain much of the health inequality implies that there continues to be a strong socioeconomic gradient in health outcomes for Australia. That said, it is lower than the estimates using data from Spain, where equivalized household income accounted for 66 to 72% of the estimated CI (Costa-Font and Gil 2013). In addition, the share of the contribution of having a mother with obesity implies persistence in the intergenerational transmission of obesity status across generations. Our estimate of about 18% is slightly higher than the estimate for parental—not just maternal, as in our case—obesity in Costa-Font and Gil (2013), which was between 6 and 12%.

5. CONCLUSION

We estimated and decomposed the concentration index for adolescent obesity to ascertain the prevalence of income-based inequality of health in Australia and to describe the drivers of this inequality. We found that poorer households disproportionately bear the burden of adolescent obesity. This inequality has doubled over the period 2006–2014. Further research is required to investigate the underlying causes of this increase in inequality to inform policymakers.

A decomposition of the CI shows that socioeconomic status explains much of the observed inequality, but that maternal obesity status is also a significant component. This has concerning ramifications. Paired with the strong heritability of obesity and increasing female obesity rates, this suggests that—without intervention—inequality in adolescent obesity rates will continue to increase. This highlights a perturbing lack of health mobility for the poorest families in Australia. Policies intent on reducing adolescent obesity among low SES households should account for the substantial contribution that maternal obesity makes to inequality in adolescent obesity.

REFERENCES

AIHW – Australian Institute of Health and Welfare 2017, 'A picture of overweight and obesity in Australia – 2017', URL: https://www.aihw.gov.au/reports/overweight-obesity/a-picture-of-overweight-and-obesity-in-australia/data.

Cole, TJ, Bellizzi, MC, Flegal K and Dierz, WH 2000, 'Establishing a standard definition for adolescent overweight and obesity worldwide: international survey', *British Medical Journal*, vol. 320, no.7244, pp. 1240–1243.

Costa-Font, J and Gil, J 2013, 'Intergenerational and socioeconomic gradients of child obesity', *Social Science and Medicine*, vol. 93, no. 1, pp. 29–37.

OECD – Organisation for Economic Co-operation and Development 2013, *OECD Framework for Statistics on the Distribution of Household Income, Consumption and Wealth*, URL: http://www.oecd.org/statistics/OECD-ICW-Framework-Section8.pdf.

OECD (2017a) Obesity Update 2017. URL: https://www.oecd.org/els/health-systems/Obesity-Update-2017.pdf.

OECD (2017b) Health at a Glance 2017: OECD Indicators. How does Australia compare. URL: https://www.oecd.org/australia/Health-at-a-Glance-2017-Key-Findings-AUSTRALIA.pdf.

Stamatakis, E, Wardle, J and Cole, TJ 2010, 'Childhood obesity and overweight prevalence trends in England: evidence for growing socioeconomic disparities', *International Journal of Obesity*, vol. 34, pp. 41–47.

Summerfield, M, Friedin, S, Hahn, M, Li, N, Macalalad, N, Mundy, L, Watson, N, Wilkins, R and Wooden, M 2015, *HILDA User Manual—Release 14*, Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Wagstaff, A 2005, 'The bounds of the concentration index when the variable of interest is binary, with an application to immunization inequality', *Health Economics*, vol.16, pp. 93-112.

Walsh, B and Cullinan, J 2015, 'Decomposing socioeconomic inequalities in childhood obesity: Evidence from Ireland', *Economics and Human Biology*, vol. 16, no. 1, pp. 60–72.

WHO – World Health Organisation 2016, *Adolescent health*, WHO, URL: http://www.who.int/topics/adolescent_health/en/.