

The Long-Arm of Adolescent Weight Status on Later Life Depressive Symptoms

Melissa Martinson¹ and Sarinnapha Vasunilashorn²

¹University of Washington

²Beth Israel Deaconess Medical Center/Harvard Medical School

Introduction

Increasingly, studies of late life health have adopted a lifecourse approach to considering the downstream influences of earlier life factors on health in mid- and late-adulthood. Prior work suggests that adverse early life circumstances are strongly linked to a broad range of later life health outcomes, including subsequent risk of hypertension, cardiovascular disease, diabetes, and mortality (Barker, 1998; Blane et al., 1996; Cruick-Shank et al., 2005; Doblhammer & Vaupel, 2001; Huxley, Shiel, & Law, 2000; Lawlor & Smith, 2005).

Given the recent increase in worldwide obesity among children and adolescents, the long-term consequences of childhood and teen obesity on the risk of poor health in adulthood is a particularly salient question. Several studies have focused on the link between earlier life obesity and adult cardiovascular disease risk (e.g., Barker, Winter, Osmond, Margetts, & Simmonds, 1989; Gunnell, Frankel, Nanchahal, Peters, & Smith, 1998; Stein et al., 1996). Fewer studies have examined the association between earlier life weight status and non-cardiovascular-related outcomes, but there is evidence to believe that such relationships exist. For instance, overweight in adolescence was observed to confer some disadvantage on educational attainment and occupational standing (Glass et al., 2010), as well as later life physical function, chronic health conditions, and mortality (Reither et al., 2009; Vasunilashorn & Martinson, 2013).

From this growing body of work, there is evidence that the long-term consequences of teen weight status may also be associated with mental health in adulthood. A national Australian school survey found that childhood overweight and obesity increased the risk of mid-adulthood mood disorder, which included diagnoses of mood, anxiety and substance use (Sanderson et al., 2011). Examination of women from The Nurses' Health Study II cohort indicated that childhood and adolescent obesity was a risk factor for adult depression (Sanchez-Villegas et al., 2013). To our knowledge no study has investigated this link in US adolescent men and women. This may be especially important given that the consequences of overweight and obesity on mental health throughout the lifecourse may differ between men and women, as observed in studies of adolescent weight status and late life physical function (Vasunilashorn & Martinson, 2013). This paper addresses two additional gaps in knowledge: (1) whether the influence of earlier life overweight on mental health extends beyond midlife and into older adulthood; and (2) whether

the relationship between adolescent weight status on late life mental health in the US resembles that of previous studies in Australia.

Our study aims to investigate the longitudinal association between weight status measured in adolescence and mental health approximately 47 years later. To accomplish this, we examine the links between a novel indicator of adolescent weight status and depressive symptoms in later life using the Wisconsin Longitudinal Study (WLS), a prospective cohort study following high school graduates from Wisconsin schools in 1957. Concerns surrounding childhood and adolescent obesity emerged following the 1980s, a time during which several established longitudinal studies had not incorporated questions regarding body weight prior to adulthood. Using weight status determined from high school photographs is a strength, given that it is representative of adolescent conditions and does not rely on retrospective self-reporting of body weight. Hence the weight measure from photographs is not confounded by potential biases in respondents' recall of current and previous health. Furthermore, prior studies have used the WLS high school photograph-based body measures to predict chronic health conditions, mortality, and labor market outcomes and have been proven to be a reliable measure of body weight (Glass, Hass, & Reither, 2010; Reither, Hauser, & Swallen, 2009).

Methods

The WLS is a longitudinal study that follows approximately 10,000 class of 1957 high school graduates in Wisconsin (Sewell et al., 2004). Follow up surveys were conducted in 1964, 1975, 1993, and 2004. In 2004, respondents are about 65 years of age, and the outcome measure, depressive symptoms, is obtained from this wave. Given this, WLS is an ideal study to investigate the association between adolescent overweight and later life mental health in US men and women.

The WLS uses the modified Center for Epidemiologic Studies Depression Scale (CES-D) to measure depressive symptoms. Respondents answer 20 questions and each scale item asks about the way the respondent felt or behaved during the past week with four response options: rarely or never (less than 1 day); some or a little (1-2 days); occasionally or moderate (3-4 days); and most or all (5-7 days). The CESD score ranges from 0 to 60. Scores of 16 and higher are the standard cutpoint for mild to moderate depression (Radloff, 1977).

The independent variable of interest is standardized relative body mass (SRBMI) from high school yearbook photographs of the graduates in 1957. Photos were collected in 2000 and assessed based on an 11-point scale to estimate the SRBMI measure by 6 coders. The SRBMI scale has demonstrated high interrater reliability ($\alpha = .91$), and the values represent standard deviation differences from the mean scale value (Reither et al., 2009). We construct 4 SRBMI categories based on previous research using the WLS (Glass et al., 2010; Vasunilashorn & Martinson, 2013). The categories are: underweight ($\text{SRBMI} \leq -1$), normal weight ($-1 < \text{SRBMI} <$

0), risk of overweight ($0 < \text{SRBMI} < 1$), and overweight ($\text{SRBMI} \geq 1$). Normal weight is the reference group for all analyses.

Given their association with weight status and mental health, we consider additional variables as controls. These include: family income in 1957, head of household education in 1957, retrospective reports of child health, and body mass index in 1993. We create income quintiles for ease of interpretation for family income. Head of household education is categorized as: less than 8th grade, grade 8 to 11, high school diploma (12 years), and some college (13 or more years). Child health is dichotomized where excellent/very good health translates to good health and good/fair/poor health translates to poor health (Smith, 2009). BMI in adulthood is based on the standard CDC cutpoints for normal weight, underweight, overweight, and obese.

We calculate mean scores of the CESD scale by each SRBMI category for both women and men. We then estimate gender stratified logistic regression models using the dichotomous CESD measure for mild to moderate depression given prior evidence of gender differences in the long-term consequences of weight status. Odds ratios are presented.

Results

The mean CESD scores are presented in Table 1. The scores for women who were overweight in high school are significantly higher than those who were normal weight. This relationship also exists for men, though it is not statistically significant. Table 2 presents the results from the logistic regression analysis on depressive symptoms at age 65 on SRBMI from high school yearbook photographs using the standard cutpoint for depressive symptoms. The relationship between overweight in adolescence and depressive symptoms in later life is statistically significant for women, even when adult BMI is controlled for. However, there is no relationship between adolescent weight and depressive symptoms in later life for men.

Conclusions

This study finds that overweight adolescents had poorer mental health in later life compared to their normal body weight counterparts. Of particular interest are the gender differences in this relationship, with overweight teenage women having worse later life mental health than normal weight teen women. These findings suggest that: (1) the link between earlier life weight status and adulthood mental health extend beyond midlife and into later life adulthood; and (2) the relationship between earlier life obesity and later life mental health extend beyond childhood obesity and include adolescent overweight. Our findings align with that of prior work (e.g., Sanderson et al., 2011; Sanchez-Villegas et al., 2013) and suggest a robust relationship between childhood weight and late life mental health, including similarities in reported gender differences.

References

- Barker DJP. (1998). *Mothers, babies, and health in later life*. London, UK: Churchill Livingstone.
- Barker DJP, Winter PD, Osmond C, Margetts B, Simmonds SJ. (1989). Weight in infancy and death from ischaemic heart disease. *Lancet*, 2, 577-580.
- Blane D, Hart C,L, Davey Smith G, Gillis CT, Hole DJ, Hawthorne VM. (1996). Association of cardiovascular disease risk factors with socioeconomic position during childhood and during adulthood. *British Medical Journal*, 313, 1434-1438.
- Cruick-Shank JK, Mzayek F, Liu L, Kieltyka L, Sherwin R, Webber LS, Berenson GS. (2005).Origins of the black/white difference in blood pressure: Roles of birth weight, postnatal growth, early blood pressure, and adolescent body size. *Circulation*, 111, 1932-1937.
- Doblhammer G, Vaupel JW. (2001). Lifespan depends on month of birth. *Proc Natl Acad Sci USA*, 98, 2934-2939.
- Glass CM, Hass SA, Reither EN. (2010). The skinny on success: Body mass, gender and occupational standing across the life course. *Social Forces*, 88, 1777-1806.
- Gunnell DJ, Frankel SJ, Nanchahal K, Peters TJ, & Smith GD. (1998). Childhood obesity and adult cardiovascular mortality: A 57-y follow-up study based on the Boyd Orr cohort. *American Journal of Clinical Nutrition*, 67, 1111-1118.
- Huxley RRR, Shiel AW, Law CM. (2000). The role of size of birth and postnatal catch-up growth in determining systolic blood pressure: A systematic review of the literature. *Journal of Hypertension*, 18, 815-831.
- Lawlor DA, Smith GD. (2005). Early life determinants of adult blood pressure. *Nephrology Hypertension*, 14, 259-264.
- Radloff LS. (1977). CES-D scale: A self report depression scale for research in the general

- population. *Applied Psychological Measurement*, 1, 385-401.
- Reither EN, Hauser RM, Swallen KC. (2009). Predicting adult health and mortality from adolescent facial characteristics in yearbook photographs. *Demography*, 46, 27-41.
- Sanchez-Villegas A, Field A, O'Reilly E, Fava M, Gortmaker S, Kawachi I, Ascherio A. (2013). Perceived and actual obesity in childhood and adolescence and risk of adult depression. *Journal of Epidemiology Community Health*, 67, 81-86.
- Sanderson K, Patton GC, McKercher C, Dwyer T, Venn AJ. (2011). Overweight and obesity in childhood and risk of mental disorder: a 20-year cohort study. *Australian and New Zealand Journal of Psychiatry*, 45, 384-392.
- Sewell WH, Hauser, RM, Springer KW, Hauser TS. (2004). As we age: A review of the Wisconsin Longitudinal Study, 1957-2001. In K.T. Leicht (Eds.), *Research in Social Stratification and Mobility (Volume 20)*, pp. 3-114). Oxford: Elsevier.
- Smith, J. P. (2009). Reconstructing childhood health histories. *Demography*, 46, 387-403.
- Stein CE, Fall CHD, Kumaran K, Osmond C, Cox V, Barker DJP. (1996). Fetal growth and coronary heart disease in south India. *Lancet*, 348, 1269-1273.
- Vasunilashorn S, Martinson ML. (2013). Weight status in adolescence is associated with later life functional limitations. *Journal of Aging Health*, 25, 758-775.

Table 1: CESD scores by adolescent body weight in females and males

	Females n=2172	Males N=1895
Normal Weight	7.01	5.99
Underweight	6.83	5.8
Risk of Overweight	7.56	5.82
Overweight ¹	8.81***	6.67
Total	7.39	5.99

*** p<0.01, ** p<0.05, * p<0.1
¹ Statistically different from normal weight

Table 2: Effect of adolescent body weight depressive symptoms based on CESD scores from logistic regression models (Odds Ratios) ¹

(standard error in parenthesis)

	(1)		(2)		(3)		(4)
	Female		Female		Male		Male
	n=2172		n=2172		n=1895		n=1895
Underweight	1.029 (0.255)		1.080 (0.269)		1.049 (0.320)		1.065 (0.327)
Risk of Overweight	1.172 (0.183)		1.068 (0.169)		0.789 (0.167)		0.755 (0.162)
Overweight	2.020 (0.410)	***	1.666 (0.349)	**	1.130 (0.307)		1.031 (0.289)
Bottom Income Quintile	1.379 (0.323)		1.379 (0.324)		1.002 (0.313)		1.006 (0.315)
Second Income Quintile	1.346 (0.308)		1.350 (0.310)		1.109 (0.331)		1.107 (0.331)
Third Income Quintile	1.571 (0.351)	**	1.549 (0.348)	*	1.065 (0.318)		1.071 (0.321)
Fourth Income Quintile	1.160 (0.271)		1.185 (0.279)		1.242 (0.357)		1.218 (0.350)
Less than 8 th Grade	1.586 (0.406)	*	1.483 (0.383)		1.559 (0.514)		1.517 (0.502)
Grades 8-11	1.271 (0.300)		1.172 (0.279)		1.119 (0.342)		1.091 (0.334)
High School	1.071 (0.270)		0.999 (0.254)		0.960 (0.314)		0.958 (0.314)
Poor Child Health	1.631 (0.259)	***	1.640 (0.263)	***	2.677 (0.536)	***	2.699 (0.543)
Overweight Adult BMI			1.485 (0.244)	**			0.869 (0.202)
Obese Adult BMI			2.215 (0.397)	***			1.276 (0.332)
Underweight Adult BMI			2.163 (1.402)				- -
Constant	0.064 (0.016)	***	0.051 (0.014)	***	0.054 (0.017)	***	0.057 (0.020)

*** p<0.01, ** p<0.05, * p<0.1

¹ Income measured in 1957