Adolescent Obesity and First Union Outcomes in Young Adulthood:
Does dating experience tell the story?

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The dramatic increase in the prevalence of teen obesity from 4.6% to 18.1% between the early 1960s and 2008 (NCHS 2010) has prompted a series of health research to study its consequences. Adolescent obesity has been linked to many unfavorable health outcomes, such as type 2 diabetes, hypertension, and cardiovascular diseases (Dietz 1998). However, the negative impact of obesity is not limited to health—they also have undesirable socioeconomic implications. Obese youths tend to have lower academic achievement, lower occupational status and higher poverty rates than their non-obese counterparts (Gortmaker, Must et al. 1993; Anderson and Butcher 2006). In particular, obese youths have lower likelihood of marrying in adulthood, particularly for women (Gortmaker, Must et al. 1993; Conley and Glauber 2006; Averett, Sikora et al. 2008; Mukhopadhyay 2008). Hence, this study aims to examine the impact of adolescent weight status on the timing of transition into first cohabitation and first marriage and the role of dating activities in mediating the effect of body weight on the likelihood of first union.

Research has indicated that obese teens are more likely to encounter peer rejection and are less likely to have romantic or sexual relationships (Pearce, Boergers et al. 2002; Halpern, King et al. 2005). The intimate relationship experiences of obese youths are very likely constrained by the poor social integration of obese youth into the peer network, since romantic relationships often evolve from friendships within the peer context (Brown 1999). Thus, the fact that obesity is associated with lower likelihood of union formation in adulthood could be due to limited relationship experiences in adolescence, given that recent studies point to the close linkage between teen romantic relationships and union behaviors in adulthood (Crissey 2005; Raley, Crissey et al. 2007).

On the other hand, research that examines the outcomes of adolescent obesity often use weight status measured at one time point as a predictor of later adjustments. This measurement fails to capture the troubling fact that adolescent obesity often persists into adulthood (Freedman, Khan et al. 2001; Reilly, Methven et al. 2003) and that longer exposure to obesity leads to worse outcomes

in adulthood (Østbye, Malhotra et al. 2011). In a recent study, about 85% of the overweight adolescents remained obese as young adults (Gordon-Larsen, Adair et al. 2004)—one would think that a time-varying weight status measure is a better predictor for adult outcomes than the conventional cross-sectional weight measure.

The data used come from the National Longitudinal Survey of Youth 1997 (NLSY97). The NLSY97 dataset offers annual reports on height and weight as well as dating activities among recent cohorts of teenagers ages 12 to 18 who were interviewed in 1997. The last wave of NLSY97 used is collected in 2009, when respondents were in the ages of 24 to 30. This paper plans to answer three questions. First, how does weight status in adolescence affect the likelihood of first cohabitation and first marriage in young adulthood? Second, is the association between weight status and timing of first union largely mediated by dating experiences in adolescence? Finally, how are these observed associations vary by men and women?

Research Design

Data

The current study uses data from the National Longitudinal Study of Youths 1997 (NLSY97). This nationwide survey is an ongoing project that has tracked a group of 8,984 youths born in the years 1980 through 1984. They were selected from 6,819 unique households that were screened from 75,291 household in 147 primary sampling units. These adolescent respondents were in the ages of 12 to 17 during the first survey year of 1997 and were interviewed annually from 1997 to 2010.

Analytic Sample

Individuals who do not have a longitudinal sampling weight or who have experienced marriage (n=2) or cohabitation (n=25) before wave 1 were left-censored from the event history models. Final sample size for both sets of analysis is 5383 for marriage and 5360 for cohabitation.

Variables and Measures

1. Outcome Variable

Union formation experiences in adulthood:

Age at first union was constructed by using reports on the date at first union (cohabitation and marriage) in the NLSY97 data. A dichotomous variable for first cohabitation and first marriage was then created separately to indicate whether a respondent has ever cohabited or married in a specific age in the person-year file.

2. Predictors and Control Variables

<u>Weight status in 1997:</u> This measure is constructed using Body Mass Index[1] (BMI) values calculated from the reported height and weight in 1997. BMI values are then categorized into underweight, normal weight, overweight, and obese, based on the age- and sex-adjusted standards published in the Centers for Disease Control growth chart. Adolescent underweight is defined as BMI values that fall at or below the 5th percentile of the age- and sex- specific BMI distribution. BMI values that fall between the 5th and 85th percentiles are defined as normal weight. Overweight is defined as a BMI value that is between the 85th and 95th percentiles. A BMI value above the 95th percentile is categorized as obese. For ages at or above 20, the cutoff BMI values for these four weight statuses are 18.5, 25, and 30.

<u>Sociodemographic characteristics:</u> Sociodemographic variables were constructed from the Wave 1 survey. These variables are: respondent's gender, race/ethnicity, family structure, and maternal education. *Race* is a five-category variable that consists of white, black, Hispanic, Asian, and other races. *Family structure* is a dummy variable for two-biological-parent family, with other family types (step families, single-parent families, and other families) as the reference category. *Maternal education* is a four-category variable recoded from mother's highest grade completed: less than high school, high school graduate, some college and college or beyond.

<u>Other covariates:</u> Height reported in 2004 (when respondents turned 19 to 25) is included as a covariate, as stature has been found to be linked to likelihood of marriage in prior studies. Two lagged time-varying measures are also included: dating frequencies and weight status in the past year. Two dummies were created for those who had dated 1-12 times in the past year and those who dated more than 12 times. Those who never dated are the reference group. For the time-varying weight measure, annual height and weight reported by each respondent is converted to BMI values. For ages at or above 20, the cutoff BMI values for the four weight statuses are 18.5, 25, and 30. In each person-year, weight status in the past year is included as a time-varying measure for predicting any transition to a first union in a given age.

Statistical Analyses

Descriptive analyses were first conducted to offer an overview of the sociodemographic characteristics of the study sample. For the analyses of transition to first unions, discrete time event history models were used to study the impact of weight status on forming a first marital or a first cohabiting union.

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[1] BMI is measured by converting height from inches to meters and weight from pounds to kilograms. BMI = [weight in kilograms (kg.) / height in meters squared (m^2)].

Preliminary Findings

As shown in the first column of Table 1, about 16% of the youths were overweight and 13% obese in 1997. The average age is 14.31 and the sample in split roughly equally in to male and female youths. Over half of the sample lives in two-parent families and the rest in single-parent, step-, or other types of families. About 68% of the sample is white and the rest are from minority groups. The average age at first date is about 14. As the sample got older across waves, the time-varying indicators show that by age 20, about 27% have cohabited and 10% got married. As for dating activities, about 43% dated less than 12 times (roughly less than once a month) and 40% dated more than 13 times in the past year. About 24% and 15% are overweight and obese. Similar measures at age 28 (last panel in first column) show that more than half (65%) had cohabited and about 50% have married. Dating activities decreased dramatically at this age and that the proportions of individuals overweight and obese have increased a lot, when compared to the figures at age 20.

The next two columns in Table 1 show that more men are categorized as overweight and obese in 1997. There are no significant difference in sociodemographic characteristics between men and women. Women in general have more union behaviors at a given age and they are generally lighter than men in terms of body weight. Dating activities between the two sexes are about the same at any given age.

Table 2 presents the findings from the discrete time event history models for all respondents. In the baseline Model 1, overweight youths are about 11% less likely than normal weight teens to get married by young adulthood, whereas obese youths are 23% less likely than normal weight teens to get married. The addition of sociodemographic covariates only explain very little of the marriage gap between obese and normal weight youths, but not that between overweight and normal weight teens. When time-varying dating frequencies over the past year are introduced into Model 3, the marriage gaps were further closed a little bit, showing the limited explanatory power of dating activities in the association between body weight and odds of marriage. Model 4 shows that once annual weight status (lagged one year) are taken into account, overweight and obese youths are no less likely to get married. The negative association in Model 1 emerged because most of them remain overweight/obese as they enter young adulthood and heavier weight status at any given age is associated with decreased likelihood (about 24% lower) of entering a first marital union, particularly for underweight and obese individuals.

The next four models on the right side of Table 2 show the findings for weight status and risk of first cohabitation. In the baseline model, overweight youths are no less likely to form a first cohabiting relationship than their normal weight peers, but obese youths are about 15% less likely to enter such a union by young adulthood. Again, sociodemographic controls and dating frequencies provide very limited explanation for why obese youths are less likely to enter a first cohabitation. However, as time-varying weight measures are added in Model 8, both overweight and obese youths are much more likely than normal weight teens to form a cohabiting union—a very intriguing suppression effect that needs to be explored in future analyses.

The next two tables present sex-stratified event history models for transition to first marriage and first cohabitation. In Table 3, the event of entry into a first marriage is analyzed for men and women separately and the findings show a clear gendered weight effect. In the baseline models (Models 1 and 5), while underweight men are 34% less likely to enter a marriage, underweight women are 38% more likely to tie the knot than their normal weight peers. Being overweight only lowers the chances of first marriage for women, not for men. The strongest negative impact of weight is observed for being obese, though women again suffer more (OR=.62 in Model 5) in the marriage market from having excessive weight than their male counterparts (OR=.90 in Model 1) in the same weight status. The addition of lagged time-varying dating activities into Models 3 and 7 offer partial explanation for the negative associations between being overweight/obese and transition to first marriage for women, but very little for men.

Table 4 presents the findings of entry into first cohabitation separately for men and women. Being underweight put women in a slightly advantageous position for forming a cohabiting union than their normal weight peers, but this pattern is not found among underweight men. Overweight men (OR=1.18 in Model 1), in contrast to overweight women (OR=.90 in Model 5), have higher likelihood of entering a cohabiting union than their normal weight peers. As for being obese, both men and women in this weight category are less likely than normal weight individuals to enter a first cohabitation. Although obese women have lower likelihood of cohabitation than their obese male counterparts, the difference is not as large as those observed in the first marriage models. The inclusion of dating activities explains part of the negative association between obesity and odds of cohabitation for women, but very limited for men. Finally, the inclusion of time-varying variables again shows a suppression effect, which is particularly strong for obese women.

Preliminary Conclusion and Future Analyses

The findings reported in this study indicate that the effect of adolescent overweight and obesity is largely mediated through persistently excessive weight in the process of transition to adulthood. Although previous studies have shown the critical role of teen romantic relationships in understanding the timing and pattern of union formation in young adulthood, this study found very slim evidence that the negative association between a heavier body weight and first union is mediated through dating activities in adolescence. One plausible interpretation for these findings is that the stigma attached to obesity is so pervasive that dating experiences have only limited mitigating effect in unpacking why obese individuals form fewer unions. Finally, the sex-stratified models show that body weight have very different influences on men and women and the associations between weight status and the chances of first union also depend on whether one is looking at marriage or cohabitation.

In future analyses, this study also plans to incorporate time-varying indicators of school enrollment measure and lagged earned income measure into the models. These two factors are also central to the timing of first marriage, and they can potentially influence the decision of entering into a cohabiting relationship as well. Since overweight and obese individuals often have lower educational attainment and earned income, these two measures can potentially mediate the impact of excessive weight on first union.

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Table 1. Sociodemographic characteristics of the study sample (weighted data)

Time-invariant Variables	**Pooled**	Men	Women
Underweight in 1997	2.36	2.33	2.39
Normal weight in 1997	68.40	63.79	73.24
Overweight in 1997	16.36	18.70	13.91
Obese in 1997	12.88	15.19	10.45
Age at 1997	14.31	14.32	14.31
Male	51.24		
Height in 2004	67.78	70.64	64.78
Two-parent Family	55.40	57.52	53.17
White	68.02	67.03	69.05
Black	15.42	15.29	15.55
Hispanics	12.82	13.35	12.27
Asian	2.36	2.76	1.94
Other race	1.38	1.56	1.20
Maternal education: less than high	18.58	18.64	18.51
High school	33.68	34.19	33.15
Some college	25.44	24.44	26.49
College and more	22.30	22.73	21.84
Age @ first date	14.05	13.74	14.38
Time-varying variables @ age20			
% cohabited	26.72	19.21	34.62
% married	9.53	5.93	13.31
In the past year, dated 1-12 times	43.11	40.16	44.99
dated 13+ times	40.29	43.04	38.55
(In the past year) underweight	3.95	3.18	4.85
normal weight	57.15	54.52	59.73
overweight	23.75	27.27	20.03
obese	15.15	15.03	15.39
Time-varying variables @ age25			
% cohabited	53.21	47.11	59.62
% married	34.41	29.32	39.76
In the past year, dated 1-12 times	40.44	39.56	41.35
dated 13+ times	30.93	31.82	30.00
(In the past year) underweight	2.19	1.27	3.15
normal weight	43.28	38.98	47.79
overweight	30.34	35.76	24.65
obese	24.19	23.99	24.41
Time-varying variables @ age28			
% cohabited	65.66	60.45	71.37
% married	50.42	45.40	55.92
In the past year, dated 1-12 times	12.61	12.01	13.26
dated 13+ times	9.70	9.90	9.48
(In the past year) underweight	1.83	0.86	2.89
normal weight	35.12	30.58	40.09
overweight	32.56	36.12	28.65
obese	30.49	32.43	28.37

Table 2. Odds ratios of discrete time event history analyses for transition to first marriage (weighted data)

	Transition to 1st Marriage				Transition to 1st Cohabitation			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Underweight in 1997	1.03	1.02	1.08	1.16	1.07	1.05	1.10	1.12
Normal weight in 1997 (ref.)	--	--	--	--	--	--	--	--
Overweight in 1997	0.89***	0.89**	0.92*	0.99	1.06	1.02	1.04	1.27***
Obese in 1997	0.77***	0.83***	0.86***	1.03	0.85***	0.78***	0.81***	1.21**
Age (center at 15)	1.26***	1.27***	1.26***	1.26***	1.14***	1.13***	1.11***	1.12***
Male	0.57***	0.58***	0.59***	0.58***	0.66***	0.69***	0.71***	0.71***
Height in 2004	1.03***	1.02***	1.02***	1.02***	1.01***	1.01*	1.00	1.00
Family Structure (ref. other families)		--	--	--		--	--	--
Two-parent Family		1.21***	1.20***	1.19***		0.53***	0.53***	0.52***
Race (ref. White)		--	--	--		--	--	--
Black		0.36***	0.38***	0.38***		0.61***	0.66***	0.67***
Hispanics		0.87***	0.89***	0.89***		0.70***	0.72***	0.73***
Asian		0.29***	0.31***	0.31***		0.38***	0.40***	0.39***
Other race		0.61***	0.62***	0.63***		0.83*	0.88+	0.93
Maternal education (ref. <HS)		--	--	--		--	--	--
High School		1.20***	1.17**	1.17**		1.06	1.04	1.04
Some College		0.95	0.92	0.91		0.89*	0.87*	0.87*
College+		0.80***	0.77***	0.76***		0.70***	0.69***	0.68***
Time-varying variables (lagged)								
dating freq. in past year (ref. 0 times)			--	--			--	--
dated 1-12 times			1.56***	1.55***			1.53***	1.50***
dated >12 times			2.41***	2.37***			2.39***	2.32***
weight in past year (ref. normal)				--				--
Underweight				0.76***				0.84**
Overweight				0.96				0.81***
Obese				0.76***				0.56***

Table 3. Odds ratios of discrete time event history analyses for transition to first marriage by sex (weighted data)

Transition to 1st marriage	Men				Women			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Underweight @ 1997	0.68***	0.69***	0.72**	0.78*	1.38***	1.33**	1.42**	1.59***
Normal weight @ 1997 (ref.)								
Overweight @ 1997	1.03	1.02	1.03	1.07	0.74**	0.79*	0.83+	0.94
Obese @ 1997	0.90**	0.91*	0.93+	1.06	0.62***	0.72***	0.77***	0.97
Age (center @ 15)	1.22***	1.21***	1.19***	1.19***	1.28***	1.32***	1.30***	1.31***
Height in 2004	1.03***	1.03***	1.03***	1.03***	1.03***	1.02**	1.01*	1.02**
Family Structure (ref. other		--	--	--		--	--	--
Two-parent Family		1.34***	1.32***	1.32***		1.12***	1.11***	1.10***
Race (ref. White)		--	--	--		--	--	--
Black		0.46***	0.48***	0.48***		0.28***	0.30***	0.30***
Hispanics		0.86***	0.87**	0.87**		0.86***	0.89**	0.89**
Asian		0.24***	0.25***	0.25***		0.35***	0.37***	0.37***
Other race		0.41***	0.41***	0.42***		0.88	0.88	0.90
Maternal education (ref. <HS)		--	--	--		--	--	--
High School		0.98	0.95	0.95		1.40***	1.38***	1.38***
Some College		0.85*	0.83**	0.83**		1.02	0.99	0.98
College+		0.54***	0.53***	0.52***		1.07	1.03	1.02
Time-varying variables (lagged)								
dating freq. in past year (ref. 0			--	--			--	--
dated 1-12 times			1.54***	1.53***			1.61***	1.58***
dated >12 times			2.43***	2.41***			2.51***	2.44***
weight in past year (ref. normal)				--				--
Underweight				0.71**				0.73***
Overweight				1.02				0.89***
Obese				0.81***				0.71**

Table 4. Odds ratios of discrete time event history analyses for transition to first cohabitation by sex (weighted data)

Transition to 1st cohabitation	Men				Women			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Underweight @ 1997	0.98	0.94	0.98	0.99	1.21+	1.21+	1.29*	1.35*
Normal weight @ 1997 (ref.)								
Overweight @ 1997	1.18**	1.11*	1.13*	1.37***	0.90*	0.92	0.97	1.21**
Obese @ 1997	0.86***	0.79***	0.80***	1.16*	0.81***	0.78***	0.84**	1.34**
Age (center @ 15)	1.10***	1.09***	1.07***	1.08***	1.17***	1.17***	1.14***	1.15***
Height in 2004	1.02***	1.02***	1.01**	1.01**	1.00	0.99+	0.99*	0.99*
Family Structure (ref. other								
Two-parent Family		0.60***	0.60***	0.60***		0.45***	0.45***	0.45***
Race (ref. White)								
Black		0.80***	0.84***	0.83***		0.44***	0.48***	0.49***
Hispanics		0.70***	0.71***	0.72***		0.69***	0.71***	0.71***
Asian		0.31***	0.33***	0.32***		0.51***	0.54***	0.53***
Other race		0.78*	0.82+	0.88		0.81+	0.83	0.88
Maternal education (ref. <HS)								
High School		0.93	0.91	0.91		1.23*	1.21*	1.22*
Some College		0.71*	0.70*	0.70*		1.15+	1.13+	1.13
College+		0.51***	0.50***	0.49***		1.05	1.04	1.03
Time-varying variables (lagged)								
dating freq. in past year (ref. 0								
dated 1-12 times			1.54***	1.51***			1.59***	1.56***
dated >12 times			2.38***	2.31***			2.58***	2.48***
weight in past year (ref. normal)								
Underweight				0.79*				0.82*
Overweight				0.80***				0.80***
Obese				0.57***				0.53***