Social Antecedents and Union Outcomes of Adolescent Intimate Relationship Trajectory: A focus on overweight youth's development

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The dramatic increase in the prevalence of obesity among American youth has attracted the attention of health researchers over the past few decades. Although a broad array of the consequences of adolescent overweight has been studied, we know very little about their experiences of intimate relationships (defined here as romantic relationships that involve sexual behaviors). As adolescent romantic relationship has emerged as a critical research area, scholars have started to understand the longitudinal development of intimate relationship using more sophisticated mixture modeling techniques. Even though research has indicated that overweight teens are more likely to encounter peer rejection and are less likely to have romantic or sexual relationships, no studies have attempted to describe the long-term relationship development of these disadvantaged youth. We also have limited knowledge about the antecedents and consequences of intimate relationship trajectory in adolescence. On the one hand, intimate relationship experiences are very likely constrained by the poor social integration of overweight youth into the peer network, since romantic relationships often evolve from friendships within the peer context. On the other hand, the fact that obesity is associated with lower likelihood of union formation in adulthood could be due to limited intimate relationship experiences in adolescence, given that recent studies point to the close linkage between teen romantic relationships and union behaviors in adulthood.

This study seeks to contribute to the paucity of related research by addressing three major questions: (1) How does intimate relationship develop across the entire span of adolescence and early adulthood for adolescents of different weight statuses? (2) What is the role of social relationship with peers in shaping the developmental trajectory of intimate relationships? (3) How does intimate relationship trajectory affect the likelihood of ever been married or cohabited in adulthood for overweight youth? The current study uses a nationally representative sample from four waves of the National Longitudinal Study of Adolescent Health (Add Health) to examine these issues.

Conceptual Framework: The Life Course Perspectives

Intimate relationships during adolescence and young adulthood represent a key developmental experience in the life course. The emergence of romantic involvement with and sexual interests in the opposite sex has important implications for an individual's identity and overall well-being, especially when intimate relationships become more normative during late adolescence and early adulthood. The trajectories of relationship development, in turn, can have long-term impact on the union formation prospects in later phases of the life course. The current study draws on two main theses of the Life Course Perspectives to approach this issue.

The life course perspective emphasizes the significance of studying human lives within contexts and the importance of earlier life events on later outcomes. First of all, the life course perspectives posits that human lives are lived interdependently and human behaviors are affected by shared relationships with others (Elder et al. 2003). That is, individuals are embedded in a web of social relationships with family members and friends throughout their lives (Elder 1994). Individuals' behaviors are often shaped by micro-level interpersonal contexts. In adolescence,

family and peer groups are two settings that have influential impacts on teenagers' development. The choices and behaviors of adolescents are affected by values and attitudes of parents and friends. Teens growing up in families with warm and loving parents tend to thrive developmentally in many domains in later life (Masten et al. 1999, Masten and Coatsworth 1998). Similarly, youth who have a closer relationship with parents are less likely to be involved in high-risk sexual activities (Sieving et al. 2000, Inazu and Fox 1980, Kotchick et al. 2001).

As for social influences from friends, existing research shows the significant impact peer relationships have on various problem behaviors, such as drinking, smoking, drug use, and sexual behaviors (Biddle et al. 1980, Mounts and Steinberg 1995, Wang et al. 1995, Sieving et al. 2006, Zimmer-Gembeck et al. 2004). Friends' influences are especially pronounced when adolescents are more socially integrated into peer groups (Cavanagh 2007, Connolly and Goldberg 1999, Jaccard et al. 2005). Studies of adolescent sexual behaviors show that peers affect the onset of sex and subsequent sexual contacts teens have (Sieving et al. 2006, Zimmer-Gembeck et al. 2004). Therefore, adolescent intimate relationship development needs to be understood in the context of social relationships.

Second, the life course perspective argues that the timing and sequence of critical life events matters. As maintained by Elder, Johnson, and Crosnoe (2003), "the developmental antecedents and consequences of life transitions, events, and behavioral patterns vary according to their timing in a person's life." Major transitions in life often divide individuals into different social trajectories that have long-lasting influences on later developmental processes and outcomes. With regard to adolescent intimate relationships, early onset of first sex is linked to a series of negative consequences, including higher risk for depression and having more lifetime sexual partners, etc (Terry-Humen et al. 2006). In a recent study, riskier sexual relationship trajectories during adolescence are associated with lower maternal education, not living with both biological parents, more risk-prone personality, and more negative peer pressure (Moilanen et al. 2010). Moilanen and colleagues (2010) shows that adolescents with a high risk sexual trajectory during adolescence have the lowest percentage of college completion, the highest likelihood to have cohabited, a low likelihood to be married, and the most dating partners by age 22.

Research Design
Data
The current study uses four waves of data from the National Longitudinal Study of Adolescent Health (Add Health). Add Health was designed to study health behaviors of a cohort of adolescents who were in grades 7-12 during the 1994-1995 academic year (Harris et al. 2003). The data were collected mainly through adolescent in-home interviews. The first wave of Add Health was collected between September 1994 and December 1995. A follow-up Wave 2 interview was done between April 1996 and August 1996. The Wave 3 interview was conducted with respondents in young adulthood between 2001 and 2002. Finally, Wave 4 interview was completed during years 2007-2008 when respondents were between the ages of 25 and 30.

This study also utilizes the network data that were constructed from adolescents' friendship nominations at Wave 1. The network data link friendship nominations sent and received by each individual respondent in the in-school questionnaire. This special data file provides important information regarding structural properties of friendship networks among adolescent peer groups. One key feature to be noted is that this network file only makes use of reports from respondents who attended schools that have response rates of 50 percent or higher. It is generally more difficult to offer reasonable estimates of the network structure if a school has a response rate lower than 50 percent (Moody 2005).

Study Sample

The adolescents being studied are those who participated in the first three waves of Add Health and the sample size decreased a bit when the union outcomes in Wave 4 were analyzed. There are a total of 10,828 respondents who participated in the first three waves with valid weights. We decided to start the study from Wave 2[1] because (1) objective height and weight were measured at Wave 2; and (2) at Wave 3 respondents were asked to provide a six- to seven-year retrospective report on their romantic/sexual relationship history since Wave 2. To facilitate trajectory analyses by age groups, only those who were between the ages of 13 and 18 at Wave 2 were included (about 93% of all longitudinal sample from Waves 1 to 3). There are 10,044 respondents for the trajectory analyses. The sample size is further decreased to 8,744 due to sample attrition in panel surveys when union formation behaviors at Wave 4 were included in the final set of analyses.

Statistical Analyses

Descriptive statistics are presented to offer an overview of the study sample by weight status. For the analyses of intimate relationship trajectories, a group-based modeling technique was used to extract developmental trajectories of intimate relationships from adolescence to young adulthood. Based on a repeatedly measured outcome variable, this approach is a form of finite mixture modeling that estimates a set of parameters that define the shapes of several different trajectories and calculates the probability of trajectory group memberships for each respondent (Nagin 2005).

Nagin and colleagues developed a SAS procedure called PROC TRAJ to fit this type of model for longitudinal data. This procedure performs data sequence grouping and estimates different parameter values for the data distribution of each trajectory. Age-specific observations of the number of sexual relationships between Waves 2 and 3 (about 6 years) were constructed. The optimal number of trajectories is four for all three age groups (i.e., ages 13-14, 15-16, and 17-18). These four trajectories are: multi-partner, early sexual onset, later sexual onset, and never-had-sex trajectories. One thing to be noted is that the "never-had-sex" group for those in ages 17 and 18 is composed of two groups: youths who are sexually experienced but had very limited intimate relationship experience after their sex debut and those who are sexually inexperienced. The characteristics of respondents in each trajectory are further illustrated by a set of descriptive statistics. Weight status and the entire array of variables related to sexual development and social relationships were entered into a multinomial logistic regression to see how they predict membership in the intimate relationship trajectories. Finally, the likelihood of ever been married or cohabited by Wave 4 is investigated with logistic regression models in the last set of analyses.

Preliminary Findings

Descriptive Results

A larger share of overweight adolescents is whites and blacks, as shown in Table 1. They tend to have lower educated mothers and to come from single-parent families. The next figure presents the graphical illustration of the results from mixture modeling for intimate relationship trajectories by two-year age groups. The x-axis uses age midpoints because there are two age cohorts in each of the three age groups.

The characteristics of individuals in each trajectory are presented in Table 2. Relatively more overweight youth are on the "never-had-sex" trajectory than on any other trajectory. Respondents in the multi-partner trajectory tend to have the most disadvantaged profiles. They are more likely to come from non-traditional families and to score on average the lowest on protective factors and

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[1] Wave 1 survey is also used mainly for the purpose of acquiring socioeconomic characteristics of respondents, such as maternal education, family structure, and race/ethnicity, which were only measured at Wave 1.

highest on risk factors related to sexual behaviors. They tend to be more integrated into the peer network and are more likely to have experienced romantic relationship by Wave 2. Youth who belong to the "early onset" trajectory have similar risk profile as those in the multi-partner trajectory, although a bit less disadvantaged. They tend to be older than the sexually inexperienced youth and are over-represented by blacks and youth of other race.

Multinomial regression analyses predicting trajectory membership
The next sets of analyses are conducted separately by age group. In the first panel of models (ages 13-14), overweight teens are significantly less likely than normal weight teens to be on the early onset and later onset trajectories than to be sexually inexperienced. This negative body weight effect is largely explained by poorer social relationships among the overweight youth, as statistical significance is eliminated in Model 4. For those ages 15-16, at risk of overweight youth are less likely than normal weight youth to be on the later onset trajectory than to be on the never-had-sex trajectory; whereas overweight youth have much lower risk than normal weight youth to be in the early onset trajectory than to be sexually inexperienced. Both of these effects are again largely mediated by lower level of social integration. Finally, for ages 17-18 adolescents in the last panel, negative effect of being overweight on belonging to the multi-partner trajectory is again explained by social relationship variables. Overweight status still associates with lower likelihood of having an early onset intimate relationship trajectory in Model 4, even when social relationships are taken into account.

Union formation outcomes in adulthood
In Table 4, overweight youth are about 22% less likely than normal weight youth to be married by Wave 4, when they entered adulthood between the ages of 25 and 30. This negative association remains robust even after sociodemographic characteristics and intimate relationship trajectories in adolescence were controlled, although all three trajectories increase the odds of a marriage. As for cohabitation, overweight youths' lower risk of ever cohabited only emerged after sociodemographic controls were added to Model 2 in Table 5. However, this statistical significance is reduced to non-significant once intimate relationship trajectories were considered in Model 3.

Discussion and planned additional analyses
The findings presented above reveal the critical role of social relationships in mediating the impact of body weight on intimate relationship trajectory. Overweight adolescents are more at risk of experiencing the trajectory without any intimate partner than the other trajectories because of peer rejection and low social integration. As intimate relationship experiences during adolescence are important in shaping union formation in adulthood, it is not surprising to find that the likelihood of marriage and cohabitation is much lower for overweight youth when they enter adulthood. When intimate relationship trajectories are taken into account, they only eliminate the negative association between being overweight and risk of cohabitation, but not that between overweight status and risk of marriage. This may partly due to the fact that marriage requires more resources and commitment than forming a cohabiting union and that other forces are simultaneously at work as well. Perhaps socioeconomic attainment is a key factor in decreasing the marital prospect of the overweight, since they tend to lower educational and occupational achievement and those with better attainment are more often selected into marital unions. Thus, the next steps for this study would be incorporate a few more measures for socioeconomic attainment in adulthood to tease out the reason why overweight youths have more difficulties entering into a marriage.

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

Unweighted N	All Respondents (N=10044)	Underweight (n=438)	Normal weight (n=5300)	At risk of overweight (n=3066)	Overweight (n=1240)
Age at Wave 2 (range, 13-18)	15.77	16.16 **	15.81	15.57 ***	15.72
Gender (%)					
males	49.60%	55.31% †	48.19%	50.16%	54.36% **
females	50.40%	44.69% †	51.81%	49.84%	45.64% **
Race (%)					
White	68.45%	71.94%	70.41%	63.59% ***	63.81% **
Black	15.10%	8.44% †	13.69%	18.28% ***	19.69% ***
Hispanic	11.69%	10.35%	11.01%	13.73% *	12.90%
Other	4.76%	9.26% **	4.89%	4.40%	3.60%
Maternal education (%)					
less than HS	16.12%	19.67%	14.92%	16.68%	20.38% ***
High school	42.64%	42.36%	41.45%	43.77%	47.08% **
Some college	17.67%	11.46% *	18.26%	18.63%	15.17% *
College and beyond	23.57%	26.50%	25.37%	20.92% *	17.37% ***
Family structure (%)					
Two-biological-parent family	57.72%	62.39%	58.06%	56.32%	56.65%
stepfamily	15.85%	12.60%	16.92%	14.88%	12.57% **
single-parent family	22.68%	22.85%	21.50%	24.20% †	26.48% **
other family	3.75%	2.16%	3.51%	4.61% †	4.29%

Chi-square or T-test test against normal-weight adolescents: † p<.10; * p<.05; ** p<.01; *** p<.001

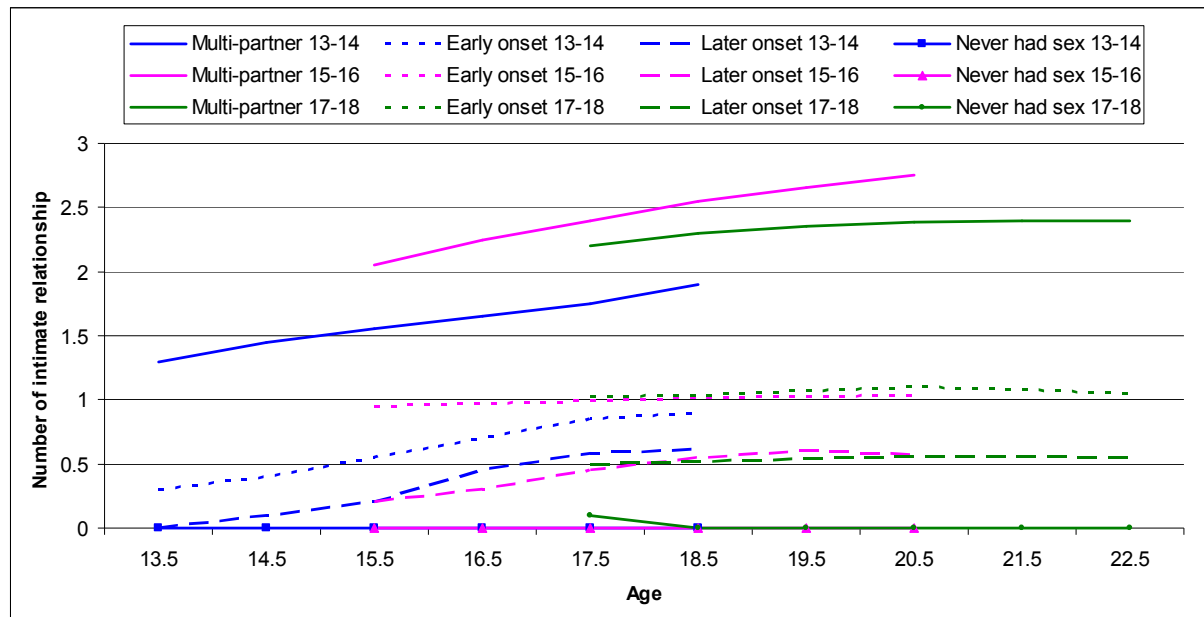**Figure 1. Patterns of intimate relationship trajectory by age group from mixture modeling**

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Table 2. Characteristics of members in each intimate relationship trajectory

	Multi-partner (n=438)	Early sexual onset (n=5300)	Later sexual onset (n=3066)	Never-had-sex (n=1240)
Unweighted N				
Underweight	1.61% *	2.85%	3.47%	4.02%
Normal weight	65.05%	68.38%	66.72%	62.00%
At risk of overweight	20.52% *	16.27%	14.73%	14.55%
Overweight	12.81% *	12.50% ***	15.08% *	19.42%
Basic socio-demographics				
Age at Wave 2 (range, 13-18)	15.84 †	16.13 ***	15.25 *	15.50
Gender (%)				
males	46.41%	48.63%	51.07%	51.04%
females	53.59%	51.37%	48.93%	48.96%
Race (%)				
White	67.62%	68.02%	69.72%	67.55%
Black	20.81% **	16.90% **	12.45%	11.89%
Hispanic	7.30% †	11.52%	12.42%	12.03%
Other	4.27% †	3.56% **	5.41% *	8.53%
Maternal education (%)				
less than HS	14.12%	16.82%	15.37%	15.63%
High school	43.33%	44.41% *	41.18%	38.43%
Some college	18.91%	17.81%	18.06%	15.71%
College and beyond	23.64%	20.96% ***	25.39% *	30.24%
Family structure (%)				
2-biological-parent family	44.90% ***	52.78% ***	63.04% **	70.23%
stepfamily	20.61% ***	17.87% ***	14.54% ***	8.90%
single-parent family	29.63% ***	25.05% ***	19.80%	17.10%
other family	4.86%	4.30%	2.62%	3.78%
Factors related to sexual development				
Protective factors (range, 3-15)	10.28 ***	11.05 ***	11.71 †	11.94
Self-reported grades (range, 1-4)	2.66 ***	2.70 ***	2.94 **	3.07
School adjustment (range, 6-30)	19.93 ***	21.08 ***	22.25	22.15
Religiosity (range, 3-12)	8.21 ***	8.29 ***	8.84 †	9.13
R's attractiveness (range, 1-5)	3.64 **	3.61 ***	3.56 **	3.43
Motivation to have sex (range, 5-25)	14.40 ***	13.85 ***	13.03 *	12.44
Perceived social consequences of sex (range, 1-15)	7.30 ***	7.62 ***	8.78 **	9.38
Social Relationship Characteristics				
Feeling of socially marginalized (range, 1-10)	2.46 †	2.27	2.18	2.22
Number of received friendship nominations (range, 0-27)	5.50 ***	5.19 ***	4.79 ***	4.09
Closeness with same-sex friends (range, 0-25)	9.45 ***	8.82 ***	7.82 ***	6.80
Closeness with opposite-sex friends (range, 0-25)	6.48 ***	5.77 ***	4.27 **	3.71
Had romantic relationship by w2 (%)	72.99% ***	61.55% ***	37.87% ***	24.93%

T-test or Chi-square test against Never-had-sex Trajectory: † p<.10; * p<.05; ** p<.01; *** p<.001

Table 3. Multinomial logistic regression models predicting the odds of intimate trajectory membership (weighted data)

Ages 13-14

	Model 1			Model 2			Model 3			Model 4		
	Multi-partner	Early onset	Later onset	Multi-partner	Early onset	Later onset	Multi-partner	Early onset	Later onset	Multi-partner	Early onset	Later onset
Underweight	0.06*	0.22*	0.50†	0.06*	0.23*	0.51	0.04*	0.24*	0.57	0.04*	0.21*	0.54
Normal weight (ref.)	--	--	--	--	--	--	--	--	--	--	--	--
At risk of overweight	1.71	1.30	1.23	1.63	1.25	1.22	1.65	1.25	1.27	1.77	1.27	1.27
Overweight	0.94	0.60**	0.63*	0.94	0.56*	0.63*	0.76	0.52*	0.62†	1.01	0.66	0.70
Male	0.71	1.06	1.01	0.75	1.09	1.02	0.42	0.62*	0.76	0.48	0.66†	0.78
Age at W2	2.83†	1.34	0.71†	2.98	1.35	0.71†	2.96†	1.27	0.69†	2.62	1.12	0.62*

Ages 15-16

	Model 1			Model 2			Model 3			Model 4		
	Multi-partner	Early onset	Later onset	Multi-partner	Early onset	Later onset	Multi-partner	Early onset	Later onset	Multi-partner	Early onset	Later onset
Underweight	0.39	0.75	1.49	0.49	0.94	1.71	0.38	0.73	1.47	0.62	1.82	1.70
Normal weight (ref.)	--	--	--	--	--	--	--	--	--	--	--	--
At risk of overweight	0.95	0.83	0.69†	0.88	0.76	0.65*	0.85	0.70	0.62*	0.95	0.79	0.68†
Overweight	0.86	0.69	0.85	0.72	0.57*	0.75	0.76	0.55*	0.74	0.98	0.71	0.88
Male	0.72	0.68**	0.88	0.73	0.69*	0.90	0.34**	0.35***	0.60**	0.53†	0.52**	0.74†
Age at W2	2.63**	1.68**	1.02	2.57**	1.63**	1.00	2.17*	1.48*	0.97	1.96*	1.34†	0.95

Ages 17-18

	Model 1			Model 2			Model 3			Model 4		
	Multi-partner	Early onset	Later onset	Multi-partner	Early onset	Later onset	Multi-partner	Early onset	Later onset	Multi-partner	Early onset	Later onset
Underweight	0.40†	0.60	0.57	0.44	0.65	0.62	0.36†	0.57	0.58	0.33†	0.53†	0.54
Normal weight (ref.)	--	--	--	--	--	--	--	--	--	--	--	--
At risk of overweight	1.31	1.29	1.17	1.26	1.22	1.11	1.17	1.18	1.13	1.31	1.29	1.20
Overweight	0.90*	0.49***	0.70	0.35*	0.48**	0.70	0.38*	0.51**	0.77	0.48	0.60*	0.84
Male	1.10	1.18	1.49*	1.15	1.24	1.54*	0.63	0.76	1.43	0.98	1.00	1.71*
Age at W2	1.43	1.01	0.85	1.36	0.97	0.81	1.25	0.91	0.78	1.05	0.80	0.73

Note: The reference category in the outcome variable is the never-had-sex trajectory. Model 2 also includes race, maternal education and family structure variables. Model 3 includes variables in Model 2 and a set of variables related to sexual behaviors. Model 4 includes all variables in Model 3 and a set of social relationship variables.

Table 4. Odds ratios of ever married by Wave 4 (weighted data)

	Model 1	Model 2	Model 3
Intercept	0.02 ***	0.02 ***	0.02 ***
Underweight	0.98	0.94	0.96
Normal weight (ref.)	---	---	---
At risk of overweight	1.03	1.07	1.07
Overweight	**0.78 ****	**0.80 ****	**0.84 ***
Age	1.27 ***	1.30 ***	1.29 ***
Male	0.61 ***	0.60 ***	0.60 ***
White (ref.)		---	---
Black		0.36 ***	0.36 ***
Hispanics		0.82 †	0.82 †
Other		0.51 ***	0.53 ***
Maternal education			
<HS (ref.)		---	---
HS		0.91	0.90
Some College		0.87	0.87
College+		0.77 *	0.79 *
Family structure			
Two-parent family (ref.)		---	---
Stepfamily		1.08	1.02
Single-parent-family		0.86 *	0.82 **
Other family		1.06	1.04
Multi-partner Trajectory			2.42 ***
Early sexual onset Traj.			2.20 ***
Later sexual onset Traj.			2.11 ***
Never-had-sex Traj. (ref.)			---

Table 5. Odds ratios of ever cohabited by Wave 4 (weighted data)

	Model 1	Model 2	Model 3
Intercept	2.11 †	2.73 **	2.59 *
Underweight	0.75 †	0.79	0.83
Normal weight (ref.)	---	---	---
At risk of overweight	1.00	0.96	0.93
Overweight	**0.86**	**0.81 ***	**0.87**
Age	0.96 *	0.94 **	0.89 ***
Male	1.09 †	1.11 †	1.14 *
White (ref.)		---	---
Black		1.29 *	1.27 *
Hispanics		0.79 †	0.80 †
Other		1.07	1.03
Maternal education			
<HS (ref.)		---	---
HS		0.87	0.86
Some College		0.82	0.83
College+		0.66 ***	0.68 ***
Family structure			
Two-parent family (ref.)		---	---
Stepfamily		1.73 ***	1.58 ***
Single-parent-family		1.82 ***	1.71 ***
Other family		1.80 ***	1.75 **
Multi-partner Trajectory			5.32 ***
Early sexual onset Traj.			3.03 ***
Later sexual onset Traj.			1.99 ***
Never-had-sex Traj. (ref.)			---