The Role of Family Structure in the Evolution of Health from Adolescence to Young Adulthood by Gender

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The incidence of the intact two-biological-parent (traditional) family has been steadily decreasing since the 1960s. Families with nontraditional structures often suffer from less income and time available, which can lower their investment in the children. The effects of single-parent family living on cognitive and educational outcomes are well established, but less is known about the effects on health. Using all four waves of the National Longitudinal Study of Adolescent Health, we estimate both static logit and discrete-time hazard models to test hypotheses whether growing up in a nontraditional family leads to poorer physical and mental health outcomes, measured by self-reported health, weight, depression and smoking. We improve upon previous studies by measuring family structure by the timing of maternal relationships, extending analyses through young adulthood, and examining associations by gender. We find an adverse association between nontraditional family structures and adolescent smoking and health outcomes that is stronger for girls than for boys, and which persists into young adulthood for some outcomes. Compared to girls, boys face a greater association between family structure and adverse health transitions after adolescence. The presence of other adult males diminishes some of the adverse consequences of paternal absence for some outcomes.

1. Introduction

Since 1960, the prevalence of the traditional, two-biological-parent, family has been declining in the United States. In 1960, about 8% of children lived in single-parent families, which by 2004, was 26% (Kreider 2008). On average, non-traditional families, especially single-parent families, suffer from lower incomes, and the time of the single parent, usually the mother, can be spread thin among work, child care and other activities.

A well-established body of literature documents negative consequences of growing up in single-parent families for children's future well-being and human capital outcomes, particularly educational attainment and cognition (Gennetian 2005; Krein and Beller 1988; McLanahan and Sandefur 1994). Moreover, gender differentials have often been found in these associations. Among the first, Krein and Beller (1988) show a negative relationship between living in a single-mother family and young adult educational attainment that is significantly worse for boys than for girls. Recently, Bertrand and Pan (2013) find that the gender gap in disruptive behavior, whereby boys behave worse, is much larger in single-mother than in traditional families.

A growing literature suggests the negative relationship extends to children's health. Children living in single-mother homes have worse physical, mental, and dental health than their counterparts in traditional families (Angel and Worobey 1988; Bramlett and Blumberg 2007; Dawson 1991; Harknett 2009; Heard et al. 2008; Langton and Berger 2011; Montgomery et al. 1996). Children's access to health services, such as physician visits, can also be compromised in single-parent families (Chen and Escarce 2006; Fairbrother et al. 2005; Leininger and Ziol-Guest 2008). Children who experience transitions away from a two-parent family are also more likely to suffer adverse physical and mental health, including depression (Brown 2006; Bzostek and Beck 2011; Harknett 2009; Langton and Berger 2011; Mauldon 1990; Spruijt and de Goede 1997). Such health problems can persist and become exacerbated in adulthood (e.g. Case et al.

2005; Fletcher et al. 2010), making it all the more important to understand the correlates for their development in adolescents.

In addition to affecting health outcomes themselves, nontraditional family structures have been associated with unhealthy and risky behaviors, such as smoking, substance use, and poor diet (Antecol and Bedard 2007; Bjarnason et al. 2003; Fletcher and Sindelar 2012; Francesconi et al. 2010; Griesbach et al. 2003). Antecol and Bedard (2007) find that paternal absence increases the risk of adolescents engaging in sexual activity, marijuana use, drinking, or smoking before age 15 (see also, Hoffmann and Johnson 1998; Lammers et al. 2000; Hill et al. 2001). With respect to diet, some children living in single-parent families were found to consume a higher percentage of their calories from fat (Johnson-Down et al. 1997), and adolescents, in nontraditional families, to have a lower frequency of vegetable and variety of simple sugar consumption and higher likelihood of skipping breakfast (Stewart and Menning 2009).

While most of these studies have focused on single-parent families, some evidence suggests that the negative relationships extend to stepfamilies (Beller and Chung 1992; Case et al. 2001; Case and Paxson 2001; Hill et al. 2001). However, the findings are somewhat mixed. Ginther and Pollak (2004) find that children in blended families, whether step- or half-siblings, attain lower levels of education than those in traditional families, but some effects disappear when controls are added (see also Gennetian 2005). Evenhouse and Reilly (2004) find negative relationships, even after the inclusion of sibling fixed-effects, between living with a stepfather and multiple measures of children's well-being, including some of health. They also find gender differences in these family structure effects.

While many studies consider "single-mother families" a monolithic category, in reality, the group is heterogeneous; children classified as living in "single-mother" households may actually have different experiences (see Conway and Li 2012). Such families arise from out-of-wedlock births or from divorce, leading to a nonresident father who may have varied involvement with the child (Graham and Beller 2002). Moreover, along with a single mother, such families may include grandparent(s), other relatives, and/or partners entering and leaving who are not reported. If the mother remains single, she may not have a partner or may cohabit, bringing in what is sometimes referred to as a social father, who may invest less in the child than a step-father. For some, this pattern may be repeated, resulting in complex family structures (e.g., Meyer and Cancian 2012).

Despite strong associations between family structure and child outcomes, the magnitude and direction are heterogeneous across studies, structures, and period of childhood. For instance, Griesbach et al. (2003) found that living in a stepfather family played a larger role in promoting smoking than in a single-mother family in a sample of 15-year olds. By contrast, Antecol and Bedard (2007) found that the presence of a stepfather made no difference in adolescents' decisions to try smoking before age 15. Most studies examining timing find that early childhood (i.e., before five years) has the most harmful effects (e.g., Krein and Beller 1988). But, Francesconi et al. (2010) found that father exit during the latter part of childhood played a larger role in smoking behavior. Still others find little association between family structure and child outcomes (e.g., Lang and Zagorsky 2001).

Many of the studies on health use a static measure of family structure only, collected at the time of the survey. The limitation of such a "snapshot" is that it does not capture variation in how much time, nor what period of childhood, children spend without their fathers. Some studies obtain richer measures by using the mother's marital history (e.g., Antecol and Bedard 2007; Francesconi et al. 2010), or by exploiting longitudinal data to examine cross-wave differences (e.g., Bzostek and Beck 2011; Langton and Berger 2011). Likewise, family structure transitions *per se* can also affect children (e.g., Hill et al. 2001).

Additionally, little is known about the role of childhood family structure in the trajectory of health outcomes and behaviors post-adolescence, as the majority of the aforementioned studies consider outcomes only at the time of the survey. Studies that do follow subsequent health outcomes use only binary measures of family structure during adolescence, finding little long-term impact on obesity (Crossman et al. 2006) or self-reported health (Heard et al. 2008). However, Francesconi et al. (2010) find that the presence of a lone mother any time up to age 16 raises the hazard for starting smoking by age 21.

This study adds to the literature in several ways. First, we consider health as a set of dynamic outcomes by analyzing waves of data spanning adolescence to young adulthood (ages 15-32). The long-term consequences of living without a biological father can have important policy implications. For instance, if living in a single-parent family increases one's likelihood of smoking during adolescence, but the adolescents are more likely to quit shortly thereafter, this would have different implications than if they remained smokers as adults. Second, we combine the mothers' reports of presence or absence of the child's biological father with her marital history to get the most accurate picture of their childhood family structure from birth through age 15. Third, we examine the relationship between family structure and child health by gender. Finally, we consider multiple measures of physical and mental health outcomes, including self-reported health, weight, and depression; and one important health behavior, smoking.

2. Conceptual Framework

Grossman (1972) introduced a formal theory for the production of health, whereby each individual was endowed with a "stock" of health capital that depreciates over their lifetime. Individuals gain utility from good health, through increased earnings as well as more productive time in both the labor market and the home. Importantly, investments in health enable a person's health stock to be maintained or increased. Similarly, disinvestments have ramifications for future health. A single parent's investment in their child's health may be compromised as a result of financial or time constraints, or a lower average level of education (Haveman and Wolfe 1994). As time and market goods may be combined to produce commodities within the household (Becker 1965), child's health may be negatively influenced by single-parent family structure. In stepfamilies, the financial constraints tend to be less severe, but children are considered to be marriage-specific capital (Stevenson 2007). As a result, the additional resources of a stepfather may not always be shared with the child. Akashi-Ronquest (2009) finds evidence for the "biological preference hypothesis", whereby parental investments at home tend to be lower for children raised in a family with a stepfather relative to those, in an intact family.

In addition to the reduced economic resources, other mechanisms by which family structure might affect health, in both the short and long run, include investment of parental time, biological effects, and gender. First, the trajectory of nonresident father involvement may not be constant over time across mothers or children. For instance, some nonresident fathers may decrease their level of contact after their initial departure (Cheadle et al. 2010). Parental involvement is directly linked to the development of both cognitive and non-cognitive skills (Bertrand and Pan 2013). Lower investment of parental time and income may mean fewer doctors' visits among children, leading to lower self-reported health, or less healthy diets, with a higher percentage of calories from fast food, and less exercise, promoting overweight or obesity.

Recent data show a negative relation between income and percentage of calories consumed from fast food and a positive relation with weight status among young adults (Fryar and Ervin 2013).

Second, the biological response to stress has been implicated in the development of many physical and mental health diseases, including heart disease, stroke, asthma, and depression. Cortisol is a hormone that is largely responsible for the human stress response, which is regulated in part by the hypothalamic-pituitary-adrenal (HPA) axis. Importantly, in the context of this study, children who experience a parental divorce are noted to have long-term changes in the activity of their HPA axes (Bloch et al. 2007).

The relationship between family structure and health may vary by gender as well, due both to biological reasons and variations in levels of father involvement. First, boys and girls may differ physiologically in their overall development and in their response to stress. Specifically, changes in endocrine profiles (including testosterone and cortisol) have been found to be more highly associated with paternal absence in boys than in girls (e.g., Elzinga et al. 2008). Second, the etiology of different physical and mental health problems is often complex and multifactorial, such that the risk for problem development is likely to differ by gender. For example, Hamil-Luker and O'Rand (2007) find that girls (but not boys) who spend their entire childhood without their biological father are more likely to suffer a heart attack later in life. By contrast, Fuller-Thomson and Dalton (2012) find that experiencing a parental divorce before age 18 raised the risk of stroke but only in men.

Studies suggest that fathers become more involved with sons than with daughters (Lundberg and Rose 2002; Lundberg and Rose 2003). As evidence, men’s wages and labor supply increase more with the birth of a son, and women who have a son premaritally are more likely to get married and marry sooner than those who have a daughter. Although Lundberg et al. (2007) find greater paternal involvement with sons than with daughters born nonmaritally only around the child's birth, if married at the birth, fathers are more likely to stay if the child is a son rather than a daughter. This suggests that nonresident fathers of sons are likely to be a more adversely selected group than of daughters. Bertrand and Pan (2013) find that single mothers spend systematically less time with their sons than with their daughters, and that non-cognitive skill development is lowered by more for boys than for girls raised in nontraditional families. As these results suggest worse outcomes for sons, we hypothesize a gender difference in health outcomes that is more negative for boys.

3. Data and Empirical Strategy

The National Longitudinal Study of Adolescent Health (Add Health) broadly surveys health, health behaviors and their contexts. Wave I in 1994-1995 consisted of approximately 90,000 adolescents in grades 7 - 12 from high schools and their "feeder schools," aged 12-21 at the time of the survey. A subsample of approximately 20,000, who participated in an in-home questionnaire, were interviewed in follow-up waves in 1996, 2001-2002, and 2007-2009 (Waves II, III and IV, respectively). We use all four waves though key household variables, such as parental relationship history and income, are only collected at Wave I. This study focuses on a subsample of adolescents whose biological mother was interviewed (about 85% of the 17668 parental respondents, or 15,077 adolescents)[1], and who completed a questionnaire about the presence of the child's biological father in the home[2] and a relationship history for their most

[1] Adolescents who lived with adoptive parents were omitted.

[2] The mother is asked if the child's biological father currently lives in the household. If not, she is asked if the child ever lived with his/her biological father, and what year he most recently did. Further, if the biological father was living with the mother at Wave I, we consider the adolescent to have always lived in a traditional two-parent household. This may misclassify some fathers who left the household and subsequently returned prior to Wave I.

recent three marriage or marriage-like relationships[3] (or indicated they were never in such a relationship), or 13,936 adolescents. We use Wave I sampling weights to correct for the complex survey design for the Wave I static model and the hazard models. Wave IV longitudinal weights are used for the Wave IV analyses.

Our sample is selected so as to maintain a balance between a sufficient number of observations and a fairly complete picture of the father's presence and mother's marital history over the child's life. We restrict our analyses to adolescents aged 15 -18 at Wave I, who by Wave IV are adults ages 27 to 32, which includes 10,037 individuals[4]. Additionally, we drop adolescents if any one of the mother's marital or marriage-like partners died, or if the adolescent ever spent 6 months or more away from the biological mother, did not report living with his/her biological mother, or did not have a Wave I sampling weight (361, 641, 98, and 561 adolescents, respectively). Our final sample includes 7,628 observations, which further excludes 748 adolescents due to missing data on the variables of interest below.

Variable Definitions

We employ similar measures of paternal absence as Antecol and Bedard (2007), but generate them somewhat differently due to the availability of the information about the biological father's presence in the household. From these questions, we generate a series of dummy variables to denote when (and if) the mother ends the relationship with the father. We place this transition into one of four mutually exclusive categories: the father was never present, or he left when the child was aged 0-5, 6-10, or 11-15. The entry of other males—men whom the

[3] A marriage-like relationship is defined as "living with someone as if you were married to him or her when you are not."
[4] Most of the excluded individuals were under age 15 (3075), but an additional 824 above age 18 were also excluded. As mothers' relationship status was not available before 1977, we cannot ascertain family structure during the child's earliest years for those over 18.

mother shared a marriage (i.e., stepfathers) or marriage-like (often considered social fathers) relationship with after the biological father left the household[5]—is also considered.

We calculate these family structure variables using two series of questions involving the history of (a) the father's absence if the father is not living with the mother at the time of the Wave I interview, and (b) the mother's most recent three marriage or marriage-like relationships (including the present such relationship). Though some surveys do not differentiate between the mother's spouse and the child's biological father, Add Health does. The use of the marital history alone often requires the assumption that the mother's spouse at the time of the child's birth was the child's biological father. Under this assumption, children of never-married mothers would by default be classified as having their father never present. This could misclassify fathers as being never present under three circumstances: (1) mothers who do not report ever being married (or in a marriage-like relationship), (2) biological fathers who choose to marry the mother subsequent to the child's birth, and (3) biological fathers in social relationships who do not officially marry the mother.

In order that observations experience uniform exposure to living in a nontraditional family, we measure family structure only through age 15, despite including 16-18 year olds in the sample for whom some studies do measure family structure (e.g., Francesconi et al. 2010; Krein and Beller 1988). Table 1 shows the pattern of paternal absence by period of childhood and other male presence, broken down by child gender and age; Panel A is by our definition and

[5] We aggregate all other men who report being in a marriage or marriage-like relationship with the mother as "other males" in our analyses. Stepfathers are traditionally defined as men who enter the household through marriage, while cohabiting fathers imply the entrance of men with more informal relationships with the mother. However, given the way marriage-like relationship is defined in Add Health, it is difficult to meaningfully disaggregate men who enter through a marriage (over 80%), from a marriage-like relationship. A limitation of this aggregation of "other males" is that to the extent that marriage is a signal of an increased commitment, some of these "other males" may actually have little interest in the child. Another limitation is that males who marry the mother may differ systematically from those who do not with regard to income or socioeconomic status, which can then influence child outcomes. Disaggregated results, similar to those presented here, are available from the authors upon request.

Panel B uses marital history alone. By period of childhood, the majority of biological fathers who leave do so towards the beginning of the child's life. Relatively few leave after the child reaches age 15: only about 3% of 18-year-old respondents report their biological fathers left when they were 16-18. If we assume that their reports reflect the complete parental residential history of 18-year-olds nationally in 1994-1995, misclassification of family structure due to stopping at age 15 is likely to be small. Despite this, truncating the sample in this manner is likely to bias our estimates towards the null, rendering them a lower bound of the true effects.

Although we can measure family structure retrospectively, we can only measure some important variables, like income, at Wave I. Thus, it may misrepresent the "true" income across the evolution of the household (e.g. Wolfe et al. 1996). We impute income if missing using mother's marital status, race, ethnicity, occupation, and educational attainment. Other than income, many household socioeconomic and demographic characteristics are collected at Wave I, some from the child directly, such as race, age, birth order and national origin, and some from the child's mother, including her education, U.S. birth status, age, religious attendance, self-reported health, and smoking. The mother also reports variables about the child in Wave I, including any functional limitations or mental retardation. Other control variables are reported by the child over all four waves, including the child's employment status (ten hours or more per week), religious attendance, and region.

Given that family structure may affect children in complex and multi-dimensional ways, we consider several measures of mental and physical health, as well as smoking. Mental health is measured as depressive symptomatology. For physical health, we consider the adolescents' self-reported general health scale and their overweight or obese status. Finally, smoking is based on self-reported cigarette smoking questionnaires throughout adolescence and young adulthood.

Evidence for depressive symptoms is derived from questions from the Center for Epidemiologic Studies Scale for Depression (CES-D) [6]. Adolescents' self-reported health status is measured by a five-point categorical scale during each survey wave, which can take values of excellent, very good, good, fair, or poor. Though this measure has some limitations, the most serious of which includes non-random measurement error (Crossley and Kennedy 2002), it is widely agreed to be a strong predictor of subsequent mortality (in adults) and health care utilization[7]. Following several studies (e.g. Contoyannis and Li 2011; Polsky et al. 2009), we condense self-reported health into two variables, in order to simplify the modeling and interpretation of results.

We define an individual as overweight or obese based on their body mass index (BMI)[8]. We classify adolescents (Wave I) based on the CDC's age- and gender-based percentiles for children ages 2-20 (Kuczmarski et al. 2002). We define an individual who is less than 18 as overweight or obese if their BMI exceeds the 85th percentile for their age and gender, respectively. After age 18, we use the CDC's definition of BMI $\geq$ 25 to define overweight or obesity.

While many lifestyle measures are important to the evolution of health, we focus on smoking for two reasons. First, it is one of the few that are consistently and comprehensively defined throughout the entire course of Add Health. Second, some lifestyle variables (e.g.,

[6] See Radloff (1977) for a description of the CES-D scale. Add Health contains modified versions of the scale. Individuals respond to each depressive symptom in one of four ways: 0 (never/rarely), 1 (sometimes), 2 (a lot of the time), or 3 (most/all of the time). While the full CES-D scale asks 20 such questions to assess depression, Wave I asks only 18, with the questions becoming sparser in subsequent waves such that by Wave IV, only five such questions are asked. To maintain internal consistency, we utilize only the five questions asked in all waves. The answers to these questions are averaged together and rescaled to a maximum score of 60. Following Roberts et al. (1991), boys with scores of 22 or above, along with girls with scores of 24 or above are classified as depressed, in Waves I and II. In Waves III and IV, a cutoff score of 24 is used for both genders (Irwin et al. 1999).

[7] See Contoyannis and Li (2011) for a more detailed discussion of the strengths and limitations of the self-assessed health measure.

[8] BMI is calculated as weight (in kilograms) divided by height (in meters), squared. Height and weight are self-reported by the adolescent in Wave I, and measured directly by Add Health in Wave II. We correct potential measurement bias in Wave I using a linear prediction model by using Wave II data to compare differences in self-reported and measured BMI.

drinking or sexual activity), are not unequivocally detrimental to health as children grow into adulthood and, their relevance as harmful behaviors wanes.

Empirical Strategy

Health outcomes and behaviors can be expressed as functions of individual, household, and unobserved factors. We segment our analyses by gender for reasons discussed above. To be comparable with existing literature, we first analyze the direct relationship of family structure to health (H_i) during Wave I (adolescence), after controlling for demographic and socioeconomic factors, as reported during Wave I:

$$(2) \qquad H_i^* = \alpha + \beta FS_i + \gamma Z_i + u_i.$$

In Equation (2), FS is a time-invariant vector of mutually exclusive categories that represent the timing of paternal absence from the household and whether other males entered or not through age 15. A variable indicating if the child was born out-of-wedlock is also included. The vector Z controls for demographic and socioeconomic variables, including income and an income imputation flag. Additionally, these variables include maternal characteristics such as education, age at the child's birth, employment, religious practices, smoking and physical health. Also included are child characteristics, such as their health insurance coverage, whether they have a learning disability, whether they are mentally retarded, or have problems using their hands, arms, legs, or feet. The number of siblings living in the household at Wave I is also controlled for. These variables are used in all specifications. An additional set of variables are collected from the child consistently over the entirety of the Add Health survey, including their age, employment status, religious attendance, and region. These controls are used only in the models in which the outcome variable is from the same survey wave.

Second, we estimate a similar model to ascertain the long-term associations between childhood family structure and health during Wave IV (young adulthood). The controls are largely the same as for Wave I, but use the child's reports at Wave IV as available (see above), and include a dichotomous variable denoting if the child's living arrangement changed from Wave I to IV.

We then consider the role of family structure in the probability of entry into, or exits from, "bad" health states after Wave I[9]. Using Waves II through IV, we estimate several discrete-time hazard models to draw out the relationship between family structure and long-term transitions in health outcomes and smoking. A discrete-time hazard approach has two major advantages in this context. First, family structure may have different effects in promoting upward transitions (i.e., to better health states) than downward transitions (i.e., to poorer health states). Second, in adolescents and young adults, some may never report having an unfavorable health outcome (i.e., good or lower health status) or start smoking during their course in Add Health, resulting in right censoring of the data[10].

To estimate a hazard model, the data is reconstructed to reflect a "person-period" data set, in which each individual has multiple records, corresponding to each discrete period (i.e., survey wave) in which the individual is observed. The time variable is started after Wave I, which represents the time when adolescents' health and health behaviors can potentially change. A logistic model is then fitted to the transformed data, in the form of Equation (3):

$$Y_{it} = \delta + \varphi FS_{i1} + \theta Z_{it} + e_{it} \quad (i = 1, \dots, N; t = 2, \dots, T). \tag{3}$$

[9] Add Health surveys the adolescent's smoking history as of Wave I, so it is possible to determine if an individual started and quit smoking prior to Wave I. Therefore, the quitting analysis includes changes occurring before Wave I.

[10] While it would be desirable to use child-level fixed effects in our analyses, estimation of these models in this context would require changes in child paternal absence over time, which is not available from the mother in subsequent periods after Wave I.

At each wave, there are four potential transitions that individuals can make relative to their Wave I health or smoking status. They can (1) remain in the "good" health state, (2) transition from the "good" to the "bad" state, (3) transition from the "bad" to the "good" state, or (4) remain in the "bad" state. The same vector of both time-varying and time-invariant covariates (Z) included in Equation (2) is included in Equation (3). As with the static models, the hazard models are considered separately for boys and girls. In all models, marginal effects, evaluated at the sample means, are reported.

4. Results and Discussion

Descriptive Analysis

Tables 2 and 3 show descriptive statistics on health, family structure, and demographic and socioeconomic measures, by father absence, for girls and boys, respectively. More than 30 percent of children spent some time without their biological fathers during the first 15 years of their lives. In those families, the mothers tend to work more, but to have lower incomes and educational attainment; they are about twice as likely to smoke and rate their physical health more poorly. Their children are more than twice as likely to be Black, and their boys, but not girls, are significantly more likely to have been diagnosed with a learning disability.

For Wave I health, in general, adolescents whose fathers ever left report worse outcomes. The magnitude of these differentials in outcomes are consistently larger for girls than for boys (e.g., in physical health, 0.1 vs. 0.05). As adolescents transitioned into adulthood (Wave IV), depression improved, but the other outcomes worsened with substantial increases in the cumulative probability of ever regularly smoking[11], and overweight/obesity. More than 60% of

[11] This outcome, by definition, includes those who ever tried regularly smoking (for instance, in their teens) and then quit. However, almost 20% of the sample tried regularly smoking after Wave I (up to Wave IV).

young women and 70% of young men were at least overweight, estimates consistent with population prevalences (Flegal et al. 2010). Importantly, all family structure differentials on health measures persisted into adulthood, except the depression differential which narrowed. Boys appear to have had a delayed response to their fathers leaving in that their likelihood of good or lower health rises much more catching up with that of girls by Wave IV, and their likelihood of smoking exceeds that of girls.

In addition to health measures, some of the time-varying factors change from Wave I to Wave IV as the adolescent ages into adulthood. Nearly 90% of individuals had a different living arrangement at Wave IV, primarily stemming from moving out of the parental home during Waves III and IV. Additionally, they attended religious services less frequently and were more likely to be employed. Despite these changes, the subset of individuals who remained in the sample was very similar in terms of baseline demographic and socioeconomic characteristics[12] to the analytic sample considered at Wave I.

Estimation Results: Static Specifications

As stated above in Equation (2), we estimate a series of static logit models on measures of physical and mental health and smoking. The independent variables included are listed under "family structure measures", "static measures", and "time-varying measures" in Tables 2 and 3. Only the latter set take on different values in predicting Wave IV outcomes.

Tables 4 and 5 present specifications with different sets of measures of family structure over the child's life for girls and boys, respectively. Panel A includes a binary measure denoting if the biological father was ever absent. Panel B disaggregates this measure, by considering

[12] The full descriptive statistics is available from the authors upon request.

whether or not the child saw the entrance of another male[13]. Panel C "unpacks" these measures still further according to the period of childhood when the biological father left and whether or not a step- or social father entered subsequently. The Wave I findings for each outcome are presented on the left and the Wave IV findings, on the right.

For girls, the Wave I findings suggest that paternal absence is associated with increased probabilities of ever smoking regularly; of reporting good, fair, or poor (good or lower) health; and of reporting symptoms suggestive of depression. For smoking and health status (but not depression), the association is somewhat stronger if another male was present (Panel B). By period of childhood (Panel C), nearly all the adverse associations are found among those girls whose fathers were either never present or left during her pre-school years (ages 0-5). With the exception of depression, differentials exist by whether or not other males were present. For instance, if the biological father was never present, but a step- or social father was, the girls are 12 percentage points more likely to smoke (column 1); if the father was never present, and no other males were, physical health suffers and is 14 percentage points more likely to be rated only good or worse (column 3). Also for physical health, an identical magnitude, albeit weaker, association shows up if the father left when girls were 6-10, and other males were present.

Still for girls, the Wave IV findings show an overall decrease from Wave I in the magnitude and significance of the association between family structure and health outcomes, particularly in the aggregated results. This diminution is somewhat expected given that respondents are now on average, age 29, most are living on their own, and other unobserved intervening events could have mediated the effects. Nevertheless, the signs and some magnitudes are the same, particularly for smoking and physical health. Disaggregated, all

[13] Computations from Tables 2 and 3 show other males present in households of approximately 19% of all girls and 57% of girls whose fathers ever left. These values are similar for boys.

relationships from Wave I, except for depression, when the father was never present (or he left ages 6-10) persist into adulthood. This suggests that early father departure establishes a trajectory that is set by adolescence and is unlikely to change subsequently.

By contrast, the pattern of associations between depression and the timing of paternal exit changes substantially from Wave I to Wave IV, suggesting more dynamic effects for mental than physical health. Whereas in adolescence fathers never being present was the most adversely associated with depression, in young adulthood, paternal exit between the child's ages 0 to 5, no other male entrance, was the largest (15 compared with 10 percentage points higher); paternal exit while his girls were 6-10 with no other male entering actually appears to have protected against depression by nearly 10 percentage points.

For boys, the Wave I findings only show a significant aggregate adverse association for depression of about half the magnitude as for girls, and somewhat surprisingly, a highly significant protective association with overweight. The latter grows increasingly strong as the boys age, particularly after age 6, suggesting that the lower weight observed in adolescence may be a more acute response. In further support of this presumption, the relationship between family structure and both depression and weight status is insignificant at Wave IV. In their place, however, a lower health status emerges for those whose father was never present, if another male entered. This suggests that sons may develop some negative long-term health effects, though long-term associations appear stronger for daughters. Antecol and Bedard (2007), who use NLSY data to estimate smoking models similar to ours for Wave I, find similar patterns of associations according to timing of father absence (especially for girls), albeit at considerably higher magnitudes.[14]

[14] Part of the disparity in results, in addition to the use of different samples, is their outcome of trying a cigarette compared with ours of ever regularly smoking.

Important gender and timing differences emerge. First, and most importantly, the association between family structure and health outcomes is lower for boys than for girls. Second, girls show enduring relationships on smoking behavior and health status from early father absence, whereas some boys may show weak health relationships that only appear in young adulthood. Finally, adolescent weight is largely unrelated to paternal absence in girls, but may be kept down in boys, especially if the father leaves mid- to late childhood.

These results contrast with the gender differences found for educational attainment and behavior, as for example by Bertrand and Pan (2013), which are generally more negative for boys. The differences between our findings and theirs are plausible for two primary reasons. First, we consider health-related outcomes, which likely have data generating processes that are different from those for education and behavior. Second, many of the outcomes they considered were for children younger than our Wave I sample; we may not be able to detect problems that emerge at younger ages (e.g., age 10), but that resolve by the time of adolescence. Antecol and Bedard, however, find no gender differences in the relationship between paternal absence and the health behaviors they consider.

In terms of the control variables (results not shown), out-of-wedlock birth played no significant role on girls' health outcomes, but had a marginally significant positive role in overweight in Wave IV males. Increasing age increases the propensity to ever regularly smoke among adolescents, but non-whites, including Hispanics and Blacks, tend to report less smoking. Higher levels of maternal education lowered the probability of overweight, depression, and reporting good or worse health, in girls, but had little appreciable association with boys' outcomes. Maternal health status was also associated with physical and mental health outcomes, but mainly in girls.

As discussed previously, because family structure changes are retrospective, some of these control variables can be viewed as mediators between them and the health outcomes. To investigate how this might affect the results, we ran several pared-down models, including only age of child, race, and maternal U.S. birth status. Results from these models (not shown) suggest a higher association between paternal absence and the outcomes considered here. For instance, for girls at Wave I, any paternal absence is associated with an approximately 10 percentage point increased probability for either smoking or reporting adverse health outcomes, in contrast to 6.3 and 7.4 percentage point increases with all the control variables. Similar attenuations are found for Wave IV associations for girls as well as many of the associations for boys. In several cases, the addition of the control variables reduced the significance to under the 10% level. However, as many family structure variables remain significant despite the inclusion of controls that can potentially attenuate the relationships, our findings should be interpreted as a lower-bound estimate of the true effect of family structure on health, and therefore provide evidence on the potentially large effects that paternal absence (and other male presence) can have on health. Additionally, other unobserved factors that are correlated with both child health and family structure may further bias these results.

Estimation Results: Discrete-Time Hazard Models

While the Wave IV models presented in Tables 4 and 5 consider the net effect of family structure over time, there could be transitions in smoking or health outcomes that are not reflected in those results, especially if the outcomes are particularly dynamic over time. As such, we estimate several discrete-time hazard models for smoking and depression (Table 6), and for self-reported health and weight status (Table 7), by gender. These models include the time-varying and time-invariant child, household, and maternal measures listed in Tables 2 and 3 as covariates. Out-of-wedlock birth status and changes in living arrangements after Wave I, while largely insignificant in the static models, are presented here since they do appear to play some role in predicting health transitions over time.

The results on quitting among smokers at (or before) Wave I (columns 1 and 2) suggest that boys (but not girls) with no father or other male present, were significantly less likely to quit (7.2 percentage points). In addition, boys who were born out-of-wedlock had a 4 percentage point lower likelihood of quitting; taken together, these attain a combined 11.2 percentage point lower hazard of quitting, which is quite substantial. Interestingly, changing living arrangements into young adulthood (i.e., leaving the parental home) is associated with a 6.8 percentage point increase in the likelihood of girls (but not of boys) quitting. Though paternal absence may lower the hazard of quitting smoking for boys, there is no relationship with their starting to smoke (column 4). By contrast, for girls whose fathers left when they were pre-school age, if no other male entered, there is a weakly significant 7.2 percentage point increase in starting to smoke (column 3).

Like the results for smoking, the likelihood that girls who were classified as depressed during Wave I (column 5) transition out appears unrelated to family structure, but is significantly lowered by having been born out of wedlock or changing living arrangements after adolescence. Among the relatively small number of boys depressed during Wave I (column 6), across many of the categories of paternal absence, there is a strong, positive hazard for transitioning out, especially if fathers leave when boys are ages 6 to 10. This suggests that boys with absent fathers who show symptoms of depression in adolescence are strongly likely to recover from it. Similarly to girls, however, boys showed strong negative hazards for transitioning out if they were born out of wedlock or changed their living arrangements. Each of these negative hazards are large enough to counterbalance the positive hazard of paternal absence, rendering the young man no more likely on net to transition out of depression after Wave I. Again, as with smoking, there is little evidence that individuals who were not depressed during Wave I (columns 7 and 8) are any more likely to become depressed if they experienced paternal absence; in fact, there is a small negative (protective) association for girls whose fathers left between ages 6 and 10 and no other males entered. Gender differences in recovery from depression if the father left during mid- to late childhood favor boys over girls; for example, if the father left at child's ages 6-10 and another male entered, the gender differential in the recovery hazard is about 0.42.

Turning to Table 7, we find the greatest transitions occur for self-reported health in girls and overweight/obesity in boys. First, we consider the role of disaggregated family structure in the transition after adolescence to "very good" or "excellent" among adolescents reporting "good" or lower health at Wave I (columns 1 and 2). Girls whose fathers were never present, and without another male, had a marginally significant 11 percentage point lower hazard of improving their health. This finding is consistent with and shows why the Wave I pattern revealed in Table 4 endures to Wave IV. By contrast, if the father didn't leave until the girls were young teenagers (11-15), they were 14 percentage points more likely to improve their health after Wave I. Thus, girls appear to be able to recover their physical health better than their mental health from a family breakdown. There could have been conflict in the family, now gone, that affected physical health before the late departure. For the downward health transition (columns 3 and 4), girls whose fathers left between their ages 6 and 10 with another male entering were more likely to experience the deterioration. This result is also consistent with the Wave I to IV findings in Table 4. These results taken together suggest that there may be an optimal time from the perspective of the female child's health for leaving among those dads who will leave. We find significant negative health hazards for leaving before the young teen years.

The most important finding for the hazard results on overweight/obesity (columns 5-8) is that for those boys whose father was never present, and another male entered, the results consistently show, downward (column 6) and upward (column 8), hazards toward a higher weight status in adulthood. This points to a long-term adverse relationship that living without a father has on boys' weight. With the addition of a step- or social father, these associations become completely insignificant, suggesting such fathers may be good substitutes for biological fathers in terms of diet and exercise in the household production framework. Even though paternal absence appears to be associated with long-term transitions to a higher weight status, as shown in Table 5, it does not appear to be associated with boys' probability of being overweight by Wave IV.

The results suggest a more dynamic association between family structure and post-adolescent health outcomes in boys as compared with girls. Boys experience significant adverse hazards for all outcomes other than self-reported health. While the static results (Tables 4 and 5) suggest girls' physical health and smoking in Wave I seem to be more influenced by their childhood family structure than boys', in girls, the associations with certain family structure transitions (especially those involving a never-present father) persist into Wave IV. For boys, however, there is a smaller overall association between family structure and Wave I or Wave IV outcomes, but there is more lability in the outcomes. This highlights the importance of considering dynamic outcomes in addition to the static associations at a single point in time. During all periods of childhood when the biological father might leave, there are adverse hazards on at least one health outcome or smoking, except if the father waits until the child is 11-15 years old when the results show no significant negative associations. By this age, the child's personality and behavior are likely to have become well-established.

5. Conclusions

We explored the role of family structure—specifically biological father departure and other-male entrance—in the evolution of smoking, and physical and mental health outcomes from adolescence into adulthood. This study addressed several gaps in the literature concerning the interaction between family structure and child outcomes generally, and health outcomes and behaviors in particular. First, we construct a more accurate set of measures reflecting the child's family structure from birth through age 15 by using maternal questionnaires that explicitly dealt with the biological father, rather than a marital history alone. Second, we incorporate other males into the analyses. Finally, we consider the impact of family structure on the long-term trajectory of several health outcomes and smoking, separately by gender.

From the descriptive analyses, the negative association between paternal absence and adolescent health is seen: children growing up without their father tend to have higher rates of depressive symptomatology and a lower subjective rating of their own health. Baseline static estimates of paternal absence on adolescent health paralleled findings in the literature, revealing that adolescents spending time without their fathers were more likely to report worse physical health status, higher rates of smoking, and higher rates of depression, but little evidence that family structure affects adolescent weight outcomes. By contrast to previous literature on cognitive outcomes, during adolescence, girls tended to be more sensitive to paternal absence than boys. By period of childhood, paternal absence starting early in the girl's life is the most strongly associated with adverse outcomes, paralleling earlier literature. Adolescent boys growing up without their fathers were less likely to be overweight or obese, though this association disappeared during young adulthood. However, some associations persist from adolescence to young adulthood, such as girls' physical health status and smoking, suggesting some of the adverse consequences of paternal absence are set by adolescence and are unlikely to change over time.

Using discrete-time hazard models, we examined the long-term associations of paternal absence with health and smoking transitions. In general, we found that adolescents spending time without their fathers were more likely to transition from better health to worse health, though the association differed by outcome. Some of the most important specific findings follow. Gender differences observed at adolescence are less clear over the long run; while girls show effects immediately, boys are not immune. Boys, but not girls, who had regularly smoked by adolescence were less likely to quit if their father left during the early portion of their lives. Boys who spent their entire childhood without their biological or other fathers were also more likely to gain weight after adolescence. Consistent with the static results, girls' self-reported health deteriorates if the father was never there. The hazard estimates show some results that are consistent with the static estimates, but some that are not revealed in the static estimates, making their addition an important contribution to our understanding.

Overall, our results suggest that while most of the adverse health consequences of paternal absence are evident by adolescence or earlier, paternal absence may serve a small role in increasing the persistence of smoking and worse self-reported health into young adulthood. Policy interventions directed at smoking cessation and the improvement of adolescent health may be especially beneficial among children growing up without a father.

Two other results have implications for policy and/or future study. One is the timing of fathers' leaving for girl's (self-reported) health. Fathers who leave when girls are young restrict their recovery of excellent health, while those who leave when they are pre- and young teens give them good chances for self-reported health to improve. To confirm these patterns, it would be desirable to pursue studies with direct measures of health, not just perceived health. If these patterns were to hold up, it would suggest fathers who intend to leave but care about their child's health wait until the girl becomes a pre-teen.

Our study has several limitations. First, due to considerations of sample size and uniformity, we chose to measure family structure only up to age 15. While we do not believe this leads to substantial misclassification, it may bias the family structure estimates toward the null. Second, most of the covariates included in the models occurred "post-disruption", capturing household heterogeneity after the father left. It is possible that the observed variables collected after the father's departure may mediate some of the associations between family structure and child health, rendering the estimates as lower bounds to the true effect. This is plausible based on our estimates with minimal covariates. Additionally, it is possible that unobserved factors associated with paternal absence and child health may have influenced the observed results. Finally, the data we use has large inter-wave gaps, which makes studying the dynamics of health status and behaviors more difficult.

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Table 1: Family structure through childhood by gender and age at Wave I interview (1995)

	Girls					Boys				
	All girls (15-18)	15	16	17	18	All boys (15-18)	15	16	17	18
Panel A: Employing maternal reports on biological father and marital history										
Father never present, no other males present	0.035	0.036	0.031	0.037	0.037	0.030	0.032	0.026	0.033	0.030
Father never present, other males present	0.076	0.083	0.069	0.085	0.065	0.063	0.054	0.079	0.060	0.061
Father left between ages 0 and 5, no other males present	0.027	0.035	0.022	0.038	0.013	0.028	0.028	0.039	0.026	0.019
Father left between ages 0 and 5, other males present	0.076	0.082	0.088	0.061	0.069	0.076	0.096	0.075	0.058	0.074
Father left between ages 6 and 10, no other males present	0.033	0.045	0.034	0.024	0.026	0.027	0.024	0.037	0.019	0.029
Father left between ages 6 and 10, other males present	0.033	0.042	0.027	0.028	0.036	0.031	0.052	0.026	0.017	0.025
Father left between ages 11 and 15, no other males present	0.052	0.039	0.066	0.057	0.046	0.046	0.033	0.048	0.064	0.041
Father left between ages 11 and 15, other males present	0.008	0.007	0.000	0.014	0.014	0.008	0.004	0.013	0.006	0.009
Father ever absent through age 15	0.340	0.369	0.337	0.344	0.306	0.309	0.323	0.343	0.283	0.288
Other male ever present through age 15	0.193	0.214	0.184	0.188	0.184	0.178	0.206	0.193	0.141	0.169
Father left between ages 16 and 18	0.013		0.006	0.022	0.027	0.018		0.010	0.029	0.036
Panel B: Employing marital history only										
Father never present, no other males present	0.092	0.118	0.097	0.086	0.061	0.094	0.112	0.119	0.093	0.048
Father never present, other males present	0.117	0.128	0.122	0.128	0.087	0.095	0.088	0.103	0.082	0.106
Father left between ages 0 and 5, no other males present	0.022	0.024	0.019	0.026	0.016	0.021	0.019	0.025	0.025	0.013
Father left between ages 0 and 5, other males present	0.069	0.082	0.070	0.068	0.052	0.071	0.098	0.066	0.068	0.047
Father left between ages 6 and 10, no other males present	0.020	0.021	0.018	0.019	0.022	0.020	0.012	0.023	0.018	0.030
Father left between ages 6 and 10, other males present	0.035	0.039	0.041	0.027	0.031	0.033	0.047	0.037	0.025	0.022
Father left between ages 11 and 15, no other males present	0.034	0.033	0.036	0.033	0.035	0.033	0.028	0.038	0.036	0.030
Father left between ages 11 and 15, other males present	0.010	0.008	0.003	0.015	0.015	0.011	0.008	0.016	0.011	0.010
Father ever absent through age 15	0.399	0.453	0.406	0.402	0.319	0.378	0.412	0.427	0.358	0.306
Other male ever present through age 15	0.231	0.257	0.236	0.238	0.185	0.210	0.241	0.222	0.186	0.185
Father left between ages 16 and 18	0.011		0.008	0.015	0.024	0.008		0.006	0.011	0.017
Observations	3910	943	1036	1051	880	3718	838	997	1013	870

Note: Other male refers to a man with whom the mother shared a marriage or marriage-like relationship after the child's biological father left.

Table 2: Health and demographic characteristics of Add Health respondents in adolescence and young adulthood: Girls

	All girls	Father ever left (34 % of girls)	Father never left (66 % of girls)
Health measures (Wave I)			
Overweight or obese status	0.230	0.242	0.224
Good or lower health ***	0.336	0.404	0.300
Meets depression criteria ***	0.182	0.238	0.153
Ever regularly smoked cigarettes by Wave I interview ***	0.238	0.289	0.212
Health measures (Wave IV) +			
Overweight or obese status	0.629	0.657	0.615
Good or lower health ***	0.427	0.497	0.393
Meets depression criteria *	0.139	0.161	0.129
Ever regularly smoked cigarettes by Wave IV interview ***	0.431	0.487	0.403
Family structure measures			
Father never present, no other males present	0.035	0.104	
Father never present, other males present	0.076	0.223	
Father left between ages 0 and 5, no other males present	0.027	0.080	
Father left between ages 0 and 5, other males present	0.076	0.222	
Father left between ages 6 and 10, no other males present	0.033	0.096	
Father left between ages 6 and 10, other males present	0.033	0.098	
Father left between ages 11 and 15, no other males present	0.052	0.152	
Father left between ages 11 and 15, other males present	0.008	0.025	
Child born out-of-wedlock ***	0.210	0.414	0.104
Static measures: maternal and child characteristics (collected at Wave I)			
Child is Asian ***	0.030	0.014	0.038
Child is Black ***	0.154	0.260	0.100
Child is Hispanic	0.104	0.087	0.113
Child is other race	0.092	0.093	0.092
Birth order ***	1.833 (1.158)	1.565 (0.909)	1.971 (1.161)
Mother U.S. born ***	0.885	0.919	0.868
Income in 1995 (thousands) ***	47.506 (41.747)	33.649 (33.884)	54.663 (43.589)
Missing income in 1995	0.105	0.092	0.112
Mother's highest grade: high school	0.437	0.437	0.438
Mother's highest grade: some college ***	0.190	0.228	0.170
Mother's highest grade: college or beyond ***	0.221	0.168	0.248
Mother worked outside the home in past year *	0.799	0.821	0.787
Mother ever employed full-time in past year ***	0.613	0.670	0.583
Mother age at birth ***	25.152 (5.123)	23.236 (4.927)	26.143 (4.938)
Number of siblings in household in 1995 ***	1.442 (1.179)	1.320 (1.225)	1.505 (1.150)
Mother religious attendance: at least weekly ***	0.381	0.266	0.440
Mother religious attendance: between weekly and monthly	0.182	0.196	0.175
Mother religious attendance: less than monthly ***	0.229	0.280	0.202
Mother smokes ***	0.279	0.414	0.209
Mother reports very good or better health ***	0.575	0.514	0.607
Child does not have health insurance **	0.104	0.129	0.091
Child has a learning disability	0.079	0.088	0.074
Child is mentally retarded ***	0.008	0.013	0.006
Child has difficulty using his hands/arms **	0.008	0.012	0.005
Child has difficulty using his legs/feet ***	0.019	0.035	0.011

Table 2 (continued): Health and demographic characteristics of Add Health respondents in adolescence and young adulthood: Girls

	All girls	Father ever left (34 % of girls)	Father never left (66 % of girls)
Time-varying measures: child characteristics (Wave I) +			
Age **	16.387 (1.159)	16.308 (1.151)	16.427 (1.161)
Child employed more than 10 hours per week	0.333	0.333	0.334
Child religious attendance: at least weekly ***	0.395	0.286	0.452
Child religious attendance: between weekly and monthly **	0.193	0.220	0.179
Child religious attendance: less than monthly *	0.198	0.217	0.188
Region: West ***	0.159	0.160	0.158
Region: Midwest	0.362	0.349	0.369
Region: South **	0.345	0.389	0.322
Time-varying measures: child characteristics (Wave IV) +			
Age	28.956 (1.032)	28.944 (1.045)	28.962 (1.025)
Child employed more than 10 hours per week ***	0.779	0.733	0.801
Child religious attendance: at least weekly ***	0.199	0.157	0.220
Child religious attendance: between weekly and monthly	0.205	0.184	0.215
Child religious attendance: less than monthly	0.324	0.339	0.316
Child's living situation in Wave IV different than in Wave I	0.882	0.903	0.871
Region: West	0.165	0.149	0.174
Region: Midwest	0.362	0.356	0.364
Region: South **	0.343	0.396	0.317
Observations (Wave I/Wave IV)	3910/2274	1343/759	2567/1515

Notes: Standard deviations in parentheses. Girls under the age of 15 at the time of the Wave I interview are excluded.
Father presence refers to the child's biological father up to the year the child turned 15.
Proportion tests for categorical variables and t-tests for continuous variables were used to calculate significant differences between the sample of girls whose biological fathers ever left and those whose fathers never left.

+ Means of Wave IV variables are taken for the sample of the respondents who responded to the Wave IV survey interview

* p<0.10, ** p<0.05, *** p<0.01.

Table 3: Health and demographic characteristics of Add Health respondents in adolescence and young adulthood: Boys

	All boys	Father ever left (32% of boys)	Father never left (68% of boys)
Health measures (Wave I)			
Overweight or obese status	0.276	0.264	0.281
Good or lower health **	0.271	0.308	0.255
Meets depression criteria ***	0.096	0.127	0.082
Ever regularly smoked cigarettes by Wave I interview **	0.238	0.274	0.222
Health measures (Wave IV) +			
Overweight or obese status	0.700	0.717	0.691
Good or lower health ***	0.408	0.493	0.367
Meets depression criteria **	0.082	0.107	0.071
Ever regularly smoked cigarettes by Wave IV interview *	0.502	0.542	0.483
Family structure measures			
Father never present, no other males present	0.030	0.098	
Father never present, other males present	0.063	0.204	
Father left between ages 0 and 5, no other males present	0.028	0.090	
Father left between ages 0 and 5, other males present	0.076	0.247	
Father left between ages 6 and 10, no other males present	0.027	0.088	
Father left between ages 6 and 10, other males present	0.031	0.099	
Father left between ages 11 and 15, no other males present	0.046	0.149	
Father left between ages 11 and 15, other males present	0.008	0.026	
Child born out-of-wedlock ***	0.188	0.373	0.106
Static measures: maternal and child characteristics (collected at Wave I)			
Child is Asian ***	0.033	0.018	0.039
Child is Black ***	0.124	0.247	0.069
Child is Hispanic	0.111	0.114	0.109
Child is other race	0.095	0.094	0.095
Birth order ***	1.792 (1.053)	1.602 (0.912)	1.878 (1.100)
Mother U.S. born ***	0.885	0.925	0.868
Income in 1995 (thousands) ***	48.026 (40.600)	34.206 (33.177)	54.221 (42.075)
Missing income in 1995 **	0.101	0.076	0.112
Mother's highest grade: high school	0.434	0.445	0.429
Mother's highest grade: some college *	0.186	0.206	0.177
Mother's highest grade: college or beyond ***	0.239	0.176	0.267
Mother worked outside the home in past year	0.809	0.828	0.800
Mother ever employed full-time in past year ***	0.603	0.685	0.567
Mother age at birth ***	25.058 (5.146)	23.432 (5.352)	25.787 (4.879)
Number of siblings in household in 1995	1.440 (1.153)	1.358 (1.289)	1.478 (1.084)
Mother religious attendance: at least weekly ***	0.393	0.300	0.435
Mother religious attendance: between weekly and monthly	0.177	0.171	0.179
Mother religious attendance: less than monthly ***	0.247	0.301	0.223
Mother smokes ***	0.278	0.449	0.202
Mother reports very good or better health ***	0.597	0.518	0.633
Child does not have health insurance **	0.091	0.113	0.081
Child has a learning disability ***	0.172	0.239	0.143
Child is mentally retarded	0.009	0.013	0.008
Child has difficulty using his hands/arms ***	0.011	0.014	0.009
Child has difficulty using his legs/feet ***	0.016	0.021	0.014

Table 3 (continued): Health and demographic characteristics of Add Health respondents in adolescence and young adulthood: Boys

	All boys	Father ever left (32% of boys)	Father never left (68% of boys)
Time-varying measures: child characteristics (Wave I) +			
Age **	16.444 (1.159)	16.371 (1.145)	16.476 (1.163)
Child employed more than 10 hours per week	0.368	0.345	0.379
Child religious attendance: at least weekly ***	0.369	0.281	0.408
Child religious attendance: between weekly and monthly	0.201	0.210	0.197
Child religious attendance: less than monthly	0.170	0.181	0.165
Region: West	0.142	0.138	0.144
Region: Midwest	0.342	0.350	0.339
Region: South	0.368	0.369	0.367
Time-varying measures: child characteristics (Wave IV) +			
Age	29.063 (1.070)	29.078 (1.071)	29.056 (1.071)
Child employed more than 10 hours per week **	0.843	0.799	0.864
Child religious attendance: at least weekly	0.148	0.128	0.158
Child religious attendance: between weekly and monthly **	0.181	0.141	0.200
Child religious attendance: less than monthly	0.319	0.329	0.315
Child's living situation in Wave IV different than in Wave I	0.878	0.871	0.881
Region: West	0.147	0.132	0.154
Region: Midwest	0.351	0.350	0.351
Region: South	0.371	0.390	0.362
Observations (Wave I/Wave IV)	3718/1856	1185/571	2533/1285

Notes: Standard deviations in parentheses. Boys under the age of 15 at the time of the Wave I interview are excluded.
Father presence refers to the child's biological father up to the year the child turned 15.
Proportion tests for categorical variables and t-tests for continuous variables were used to calculate significant differences between the sample of boys whose biological fathers ever left and those whose fathers never left.

+ Means of Wave IV variables are taken for the sample of the respondents who responded to the Wave IV survey interview
* p<0.10, ** p<0.05, *** p<0.01.

Table 4: Logit models of adolescent smoking, weight status, self-reported health status, and depression at Wave I & IV interviews (Girls)

	Wave I				Wave IV			
	Smoking	Overweight/ Obese status	Good, fair or poor health	Depression	Smoking	Overweight/ Obese status	Good, fair or poor health	Depression
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Biological father absence								
Father ever absent up to age 15	0.063***	-0.014	0.074***	0.060***	0.055	-0.022	0.050	-0.003
	(0.022)	(0.020)	(0.024)	(0.022)	(0.036)	(0.033)	(0.035)	(0.022)
Panel B: Biological father absence and Other male entrance								
Father ever absent, no other males present	0.061*	-0.012	0.067**	0.063**	0.062	-0.027	0.066	-0.008
	(0.033)	(0.027)	(0.033)	(0.031)	(0.045)	(0.044)	(0.045)	(0.026)
Father ever absent, other males present	0.069***	-0.016	0.083***	0.063**	0.050	-0.017	0.037	0.002
	(0.025)	(0.023)	(0.029)	(0.026)	(0.044)	(0.041)	(0.042)	(0.026)
Panel C: Biological father departure, disaggregated								
Father never present, no other males present	0.094	-0.008	0.145**	0.117**	0.035	-0.023	0.178**	-0.019
	(0.064)	(0.048)	(0.061)	(0.056)	(0.083)	(0.082)	(0.080)	(0.040)
Father never present, other males present	0.123***	-0.047	0.069	0.101***	0.127**	-0.057	-0.014	-0.002
	(0.043)	(0.030)	(0.043)	(0.037)	(0.060)	(0.063)	(0.059)	(0.034)
Father left between ages 0 and 5, no other males present	0.030	-0.072*	0.108*	0.077	0.103	-0.045	0.010	0.152**
	(0.045)	(0.037)	(0.061)	(0.067)	(0.092)	(0.086)	(0.083)	(0.077)
Father left between ages 0 and 5, other males present	0.047	0.027	0.093**	0.056	0.006	-0.046	0.039	-0.009
	(0.035)	(0.031)	(0.040)	(0.045)	(0.064)	(0.059)	(0.059)	(0.035)
Father left between ages 6 and 10, no other males present	0.022	-0.002	-0.012	0.056	0.058	-0.078	0.005	-0.097***
	(0.053)	(0.056)	(0.060)	(0.067)	(0.085)	(0.086)	(0.084)	(0.020)
Father left between ages 6 and 10, other males present	0.031	-0.003	0.145*	0.057	0.019	0.108	0.161*	0.024
	(0.050)	(0.049)	(0.074)	(0.063)	(0.095)	(0.071)	(0.090)	(0.058)
Father left between ages 11 and 15, all	0.097*	-0.022	0.032	0.040	0.070	-0.020	0.028	-0.026
	(0.053)	(0.038)	(0.045)	(0.037)	(0.068)	(0.066)	(0.069)	(0.032)
Number of adolescents/adults	3958	3969	3968	3968	2334	2306	2339	2339

Notes: Marginal effects from logit models reported. Estimates adjusted for covariates in Tables 2 and 3. Robust standard errors in parentheses.
Sample sizes are for specifications in Panel A. Sample sizes are slightly lower in Panels B and C.
* p<0.10, ** p<0.05, *** p<0.01.
Smoking is defined as ever smoking at least one cigarette per day for 30 days.
Adolescents who are aged 15 to 18 at the time of the Add Health Wave I interview (1995) are included in the sample. All those whose father left between ages 11 and 15 are aggregated due to infrequent other male presence in this age group.
Wave IV sampling weights used for Wave IV analyses.

Table 5: Logit models of adolescent smoking, weight status, self-reported health status, and depression at Wave I & IV interviews (Boys)

	Wave I				Wave IV			
	Smoking	Overweight/ Obese status	Good, fair or poor health	Depression	Smoking	Overweight/ Obese status	Good, fair or poor health	Depression
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Biological father absence								
Father ever absent up to age 15	0.036	-0.059***	0.030	0.032***	0.001	0.004	0.046	-0.002
	(0.024)	(0.021)	(0.025)	(0.012)	(0.039)	(0.034)	(0.039)	(0.014)
Panel B: Biological father absence and Other male entrance								
Father ever absent, no other males present	0.028	-0.069***	0.019	0.035*	0.005	0.000	0.012	-0.008
	(0.031)	(0.024)	(0.033)	(0.019)	(0.052)	(0.046)	(0.051)	(0.016)
Father ever absent, other males present	0.042	-0.049*	0.038	0.032**	-0.002	0.006	0.072	0.002
	(0.031)	(0.026)	(0.032)	(0.015)	(0.047)	(0.041)	(0.048)	(0.017)
Panel C: Biological father departure, disaggregated								
Father never present, no other males present	-0.049	-0.051	0.005	0.027	0.006	0.088	0.037	-0.004
	(0.063)	(0.048)	(0.059)	(0.033)	(0.098)	(0.072)	(0.097)	(0.026)
Father never present, other males present	0.050	-0.039	0.038	0.051*	-0.058	-0.008	0.131*	0.015
	(0.046)	(0.040)	(0.052)	(0.030)	(0.072)	(0.065)	(0.074)	(0.029)
Father left between ages 0 and 5, no other males present	-0.004	-0.043	-0.013	-0.043**	0.037	-0.035	-0.011	0.001
	(0.045)	(0.049)	(0.059)	(0.020)	(0.097)	(0.086)	(0.095)	(0.033)
Father left between ages 0 and 5, other males present	0.054	-0.042	0.002	0.033	-0.014	-0.001	0.006	0.003
	(0.044)	(0.035)	(0.044)	(0.023)	(0.066)	(0.058)	(0.062)	(0.023)
Father left between ages 6 and 10, no other males present	0.014	-0.084*	-0.031	0.077	-0.012	-0.021	0.016	0.018
	(0.054)	(0.044)	(0.050)	(0.048)	(0.088)	(0.080)	(0.091)	(0.039)
Father left between ages 6 and 10, other males present	0.013	-0.046	0.085	-0.013	0.096	0.051	0.173	0.001
	(0.064)	(0.055)	(0.065)	(0.031)	(0.097)	(0.083)	(0.106)	(0.040)
Father left between ages 11 and 15, all	0.081*	-0.078**	0.053	0.057	0.021	-0.022	-0.021	-0.041***
	(0.047)	(0.034)	(0.053)	(0.038)	(0.076)	(0.069)	(0.069)	(0.013)
Number of adolescents/adults	3775	3799	3799	3799	1914	1897	1922	1909

Notes: Marginal effects from logit models reported. Estimates adjusted for covariates in Tables 2 and 3. Robust standard errors in parentheses.
Sample sizes are for specifications in Panel A. Sample sizes are slightly lower in Panels B and C.
* p<0.10, ** p<0.05, *** p<0.01.
Smoking is defined as ever smoking at least one cigarette per day for 30 days.
Adolescents who are aged 15 to 18 at the time of the Add Health Wave I interview (1995) are included in the sample. All those whose father left between ages 11 and 15 are aggregated due to infrequent other male presence in this age group.
Wave IV sampling weights used for Wave IV analyses.

Table 6: Discrete-time hazard models for smoking and depression.

	Smoking				Depression			
	Tried smoking by Wave I Quitting by or after Wave I		Wave I: Non-smoker Starting after Wave I		Wave I: Depressed No depression after Wave I		Wave I: Not depressed Depression after Wave I	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Father never present, no other males present	-0.034	-0.072***	-0.022	-0.014	-0.004	-0.070	-0.007	-0.000
	(0.035)	(0.011)	(0.025)	(0.036)	(0.090)	(0.177)	(0.025)	(0.019)
Father never present, other males present	-0.035	-0.032	0.028	0.003	-0.054	0.182**	-0.013	0.019
	(0.033)	(0.028)	(0.023)	(0.033)	(0.077)	(0.078)	(0.025)	(0.018)
Father left between ages 0 and 5, no other males present	-0.046	-0.016	0.072*	0.013	0.017	0.110	0.027	0.012
	(0.033)	(0.043)	(0.041)	(0.058)	(0.101)	(0.172)	(0.026)	(0.022)
Father left between ages 0 and 5, other males present	-0.025	0.023	0.010	-0.006	0.002	-0.222*	0.007	0.002
	(0.023)	(0.033)	(0.025)	(0.028)	(0.069)	(0.128)	(0.021)	(0.014)
Father left between ages 6 and 10, no other males present	-0.042	0.014	0.048	0.028	0.025	0.169***	-0.042***	-0.009
	(0.027)	(0.061)	(0.034)	(0.037)	(0.125)	(0.062)	(0.016)	(0.019)
Father left between ages 6 and 10, other males present	0.014	-0.044	0.035	-0.011	-0.179	0.238***	0.059	-0.007
	(0.057)	(0.031)	(0.040)	(0.040)	(0.121)	(0.069)	(0.037)	(0.020)
Father left between ages 11 and 15, all	-0.038	0.011	0.002	-0.009	-0.145	0.122	0.002	0.017
	(0.025)	(0.035)	(0.022)	(0.029)	(0.100)	(0.115)	(0.019)	(0.018)
Out-of-wedlock birth	0.049	-0.040**	0.003	0.003	-0.114**	-0.239***	0.012	-0.008
	(0.055)	(0.018)	(0.017)	(0.019)	(0.052)	(0.080)	(0.012)	(0.009)
Living arrangement different than in Wave I	0.068***	0.005	0.004	0.016	-0.141**	-0.263***	0.009	-0.001
	(0.025)	(0.023)	(0.013)	(0.016)	(0.056)	(0.078)	(0.011)	(0.011)
Number of observations (person-time)	1445	1468	6808	5847	1015	467	6977	7300

Notes: Marginal effects from logit models reported.Estimates adjusted for covariates in Tables 2 and 3, including wave indicator variables. Robust standard errors in parentheses.
* p<0.10, ** p<0.05, *** p<0.01.
Smoking is defined as ever smoking at least one cigarette per day for 30 days. Quitting is defined as smoking no cigarettes for the past 30 days.
Girls in all waves and boys in Waves III and IV are classified as depressed if their weighted CES-D score is 24 of above.
Boys in Waves I or II are classified as depressed if their weighted CES-D score is 22 or above. See text for further details.
All those whose father left between ages 11 and 15 are aggregated due to infrequent other male presence in this age group.

Table 7: Discrete-time hazard models for physical health status and weight status.

	Self-reported health status				Overweight or Obese Status			
	Wave I: Good/fair/poor health Very good/excellent health after Wave I		Wave I: Very good/excellent health Good/fair/poor health after Wave I		Wave I: Overweight or obese Normal weight after Wave I		Wave I: Normal Weight Overweight or obese after Wave I	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Father never present, no other males present	-0.114*	-0.090	-0.013	-0.038	0.014	-0.041***	0.025	0.101**
	(0.061)	(0.120)	(0.036)	(0.043)	(0.040)	(0.014)	(0.047)	(0.050)
Father never present, other males present	-0.037	-0.029	-0.010	-0.010	0.003	0.003	-0.046*	-0.006
	(0.055)	(0.067)	(0.027)	(0.027)	(0.026)	(0.027)	(0.025)	(0.040)
Father left between ages 0 and 5, no other males present	0.081	0.005	-0.015	-0.021	0.009	0.027	-0.025	0.021
	(0.070)	(0.100)	(0.039)	(0.040)	(0.048)	(0.034)	(0.037)	(0.048)
Father left between ages 0 and 5, other males present	-0.074	-0.029	0.050	0.022	-0.020	0.018	-0.045	0.007
	(0.046)	(0.064)	(0.031)	(0.028)	(0.016)	(0.027)	(0.029)	(0.029)
Father left between ages 6 and 10, no other males present	0.090	-0.086	-0.030	0.012	0.030	0.031	-0.061*	-0.044
	(0.091)	(0.116)	(0.043)	(0.044)	(0.058)	(0.047)	(0.031)	(0.053)
Father left between ages 6 and 10, other males present	-0.053	-0.042	0.116**	0.037	0.011	-0.048***	-0.034	0.006
	(0.081)	(0.094)	(0.052)	(0.046)	(0.050)	(0.013)	(0.032)	(0.056)
Father left between ages 11 and 15, all	0.139**	-0.008	-0.016	0.022	-0.027	0.019	-0.040	0.007
	(0.065)	(0.070)	(0.037)	(0.032)	(0.019)	(0.033)	(0.029)	(0.030)
Out-of-wedlock birth	0.029	-0.024	-0.003	0.025	0.007	0.023	0.021	0.028
	(0.050)	(0.049)	(0.018)	(0.022)	(0.021)	(0.019)	(0.021)	(0.026)
Living arrangement different than in Wave I	0.086*	0.005	-0.010	0.009	0.002	0.023*	0.025	0.026
	(0.049)	(0.047)	(0.020)	(0.018)	(0.015)	(0.014)	(0.018)	(0.019)
Number of observations (person-time)	2254	1574	5379	5531	1919	2098	6171	5207

Notes: Marginal effects from logit models reported.Estimates adjusted for covariates in Tables 2 and 3, including wave indicator variables. Robust standard errors in parentheses.

* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Overweight oe obesity status is defined as having a body mass index (BMI) of 25 or above for those age 18 or older. For those under 18, those whose BMI are the 85th percentile for age and gender are classified as overweight or obese.

All those whose father left between ages 11 and 15 are aggregated due to infrequent other male presence in this age group.