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## Abstract

Family structure can influence adolescent health with cascading implications into adulthood. Life course theory emphasizes how this phenomenon is dynamic across time, contextualized in policy systems, and grounded in processes of selection and socialization. This study used data from the U.S. (National Longitudinal Survey of Youth 1979 Child and Young Adults,  $n = 6,236$ ) and U.K. (Millennium Cohort Study,  $n = 11,095$ ) to examine associations between a single mother family structure between ages 0-14 and early adolescent substance use at age 14 across time and place, using inverse probability of treatment weighting to explore how results varied by selection into family structure. In both countries, single parenthood, regardless of its timing during childhood, consistently predicted adolescent substance use when samples were re-weighted to resemble the overall population. However, when samples were re-weighted so that their background characteristics resembled those of actual single parent families, there was little evidence that single parenting posed risks, suggesting that single parenting might matter less for adolescents who are likely to experience it (and vice versa). In addition, more generous welfare policy in the U.K. than in the U.S. did not appear to have ameliorated the observed role of single parenting in adolescent substance use. Findings supported a model of disadvantage saturation, where single parenting has little additional impact over the myriad other disadvantages that single parent families tend to experience, rather than a model of cumulative disadvantage, where single parenting compounds or adds to other disadvantages. Policy and interventions might more valuably focus on these other disadvantages than on family structure.

Keywords: substance use, family structure, adolescence, cross-national comparison

## **Introduction**

Single mother families represent one of the most contested dimensions of family structure in the U.S. and other countries (Heuveline, Timberlake, and Furstenberg 2003). One significant factor fueling scientific research on single parent families has been the empirical evidence linking this family structure to poorer health and health behavior among adolescents, such as higher rates of substance use (Cavanagh 2008; Brown and Rinelli 2010). Young people may turn to substance use as a response to family-related experiences in ways that undermine their future adjustment and functioning (Schulenberg et al. 2014; Bolland et al. 2016; Crosnoe 2021). Theoretically grounded approaches to studying early substance use among adolescents in single parent families can fine-tune understanding of this issue to better inform policy intervention. This study uses a life course approach (Crosnoe 2021; Elder Jr. 1998) that treats the association between early adolescent substance and a single parent family structure as dynamic (e.g., fluctuating by the timing of exposure to this family structure) and contextualized (e.g., fluctuating according to individual pathways into this family structure as well as national contexts). Specifically, it examines differences in the cigarette, alcohol, and marijuana use of 14-15 year olds by whether they lived with a single or partnered mother at various developmental periods since birth and compares these differences across nationally representative samples from the U.S. (National Longitudinal Survey of Youth 1979 Children and Young Adults, or NLSY79-CYA) and the U.K. (Millennium Cohort Study, or MCS). In addition, it uses inverse probability of treatment weighting to assess variability in the association between environment and behaviors by selection into that environment (Morgan and Todd 2008).

## **Theoretical Background**

### **The Connection between Family Structure and Early Adolescent Substance Use**

Roughly a third of U.K. children and half of U.S. children spend some time living with a single parent (Heuveline et al. 2003; Harkness and Salgado 2018), and the empirical evidence linking a single parent family structure to poorer developmental outcomes for youth, such as lower academic achievement and greater problem behavior, is fairly consistent. However, this research has also been criticized for emphasizing the socializing effects of family structure over the confounding role of background selection into family structure, overlooking circumstances in which single parenthood is not necessarily harmful (Rabindrakumar 2017; Carroll and Yeadon-Lee 2022), and neglecting how the socializing effects of family structure may vary across diverse background circumstances (Smith, Crosnoe, and Cavanagh 2017).

Health is a less common but growing focus of this literature. Some evidence suggests that cigarette, alcohol, and drug use are more likely to be initiated among adolescents in single parent families, which then predicts escalating usage into adulthood (Brown and Rinelli 2010; Hoffmann 2017). These patterns are particularly pronounced for earlier initiation (i.e., in pre- and early adolescence), which is especially indicative of distress (versus experimentation) and signals long-term adjustment problems (Paxton, Valois, and Drane 2007). Efforts to explain these patterns often center on *mediational mechanisms* that tap socialization processes, such as the challenges unpartnered parents face supervising adolescents' activities as they spend more time with peers and encounter more opportunities to engage in substance use (Hemovich, Lac, and Crano 2011). Others focus on *confounding factors* that tap selection processes, such as the economic hardships and related disadvantages (e.g., low education, lack of services) that can simultaneously undermine parental relationships and pose developmental risks (Panico et al. 2019). Less often considered is how the socializing mechanisms may differ depending on selection processes. For example, mothers are more likely to be single if they were single at a

child's birth, and these mothers may have adapted strategies and support for solo parenting more than mothers who unexpectedly divorce when a child is older (Fomby and Cherlin 2007).

This study builds on prior research on family structure and adolescent health by using life course theory (LCT). A core principle of LCT is linked lives, which emphasizes how the developmental pathways of youth (in this case, early substance use) are connected to the institutional and interpersonal pathways of their parents (in this case, romantic and socioeconomic experiences). Importantly, LCT stresses that linked lives need to be studied as *dynamic* across developmental time and/or societal history, *contextualized* within larger social structures and systems, and emerging from the *interplay of selection and socialization* (Crosnoe 2021). Such an approach has the potential to identify groups at heightened health risk and innovative ways to address risky health behaviors.

### **The Dynamic Nature of Family Structure Differences in Substance Use**

One form of dynamic variability in the link between single mother families and early adolescent substance use concerns sensitivity to the *timing of exposure* to this family structure across the adolescent's life (Ben-Shlomo and Kuh 2002). One sensitive period could occur in early childhood, when foundational brain development sets the stage for socioemotional, physical, and mental health through adolescence and into adulthood (Institute of Medicine and National Research Council 2000). Chronic physiological stress during these early years disrupts the development of self-regulation and healthy coping (Sapolsky 2004; Evans and Kim 2012), which could predispose youth to later substance use (Chassin 2015). Another potential sensitive period is early adolescence, when adolescents strive for independence, spend more time with peers, and begin individuating from parents. These socioemotional forces can combine with rapid post-pubertal brain development to increase the drive for sensation-seeking and the need

for social approval, which tend to encourage substance use (Chassin et al. 2004; Crosnoe 2021). These common developmental processes of early adolescence may be more pronounced in single parent families if they are characterized by more stressors and less parental control (Barnes et al. 2006; Barrett and Turner 2006).

### **The Contextualized Nature of Family Structure Differences in Substance Use**

The link between single parent families and early adolescent substance use could differ between countries that share both similarities and differences in economic conditions, demographic composition, population norms, and social policies (Kalenkoski, Ribar, and Stratton 2007; Chapple 2009; Crosnoe, Johnston, and Cavanagh 2021). Among OECD countries, the U.S. and U.K. have similar economic systems (Smeeding et al. 2001), levels of inequality (OECD 2022a), neoliberal welfare regimes (Bambra 2005), norms regarding single parenthood, prevalence of single parent families (Chapple 2009), and balance of nonmarital fertility and divorce as contributing factors to the growth of single parent families (Heuveline et al. 2003). Yet, they differ in the generosity of their family and health policies in general and policy supports for socioeconomically disadvantaged families in particular.

That difference could moderate the link between single parent families and early adolescent substance use by buffering against the social and economic disadvantages experienced by single parents that are often implicated in this link (Barnes et al. 2006). Although the U.S. and U.K. are both liberal market economies, the U.K. has somewhat more generous family and welfare policies. For example, the U.K. spends 2.2% of gross domestic product (GDP) on cash assistance for families compared to 0.1% in the U.S. (OECD 2022b). Cash assistance may ameliorate economic stressors and poverty, which are often considered key sources of developmental problems among children of single parent families. The U.K. also has

broader work-family reconciliation policies, such as paid maternal leave and less stringent employment requirements for public assistance than the U.S. (Kalenkoski et al. 2007; Maldonado and Nieuwenhuis 2015), potentially reducing time burdens that single parents face. A final example concerns health care (Bambra 2005; Green et al. 2018), which differs significantly between the U.K. and U.S. and can make up a large portion of families' budgets. Health coverage in the U.K. is universal, and most services are free for families. In the U.S., access to and the quality of healthcare is tightly linked to socioeconomic, particularly employment, status, and families spend a larger proportion of their incomes on medical expenses (AHRQ 2021). Again, more generous programs may buffer the potential economic stress experienced by single parents.

### **Selection and Socialization in Family Structure Differences in Substance Use**

As already noted, family structure may be associated with adverse adolescent outcomes because: 1) it creates an ecology that directly leads to this adolescent behavior (socialization); 2) it emerges from social, economic, and personal forces that shape adolescent behavior (selection); or 3) some combination of the two. In general, the approach to this complexity—and the question of whether family structure effects are “real”—has been to focus on socialization while controlling for selection or accounting for selection as a means of discounting the importance of socialization (Cavanagh and Fomby 2019). Another approach is to consider the interplay of selection and socialization; in other words, selection into single parenthood may be a source of variability in how single parenthood leads to early adolescent substance use.

Investigating this variability could reveal that adolescents in single parent families are more likely to engage in substance use than their peers in other families when their background histories suggest that they are *least* likely to be in single parent families (i.e., they closely

resemble the population of adolescents in two-parent families), compared to those most likely to be in single parent families (i.e., they closely resemble the population of adolescents in single parent families). The former scenario suggests a specific kind of vulnerability that comes when single parenthood is less expected and less normative in the community. Consequently, the transition into this family structure is more likely to make the young person stand out from others, face a more drastic change in circumstances, and feel acute stress in ways that could lead to substance use as a coping mechanism or as a form of rebellion. In addition, children in families that are less likely to experience parental divorce may face a greater “separation penalty” in terms of income loss (Bernardi and Boertien 2016).

For adolescents most likely to live with a single parent, this family structure occurs in concert with other types of instability, stress, and economic hardships. According to the disadvantage saturation hypothesis (Hannon 2003), the marginal effect of an additional form of disadvantage—divorce or single parenthood—may be negligible for these youth. Furthermore, any parental marriage may provide less of an economic benefit to youth in a disadvantaged setting (Fomby and Cherlin 2007; Cross 2020). Alternatively, living with a single parent may be less risky for those who are least likely to do so if their parents can mobilize financial and social resources to compensate for the negative effect of separation (Grätz 2015). Similarly, from a cumulative disadvantage perspective (Hannon 2003), divorce may compound with the disadvantages faced by youth who are more likely to live with a single parent amplify the developmental challenges they face.

### **Study Aims and Hypotheses**

Following this theoretical approach, this study attempts to answer three questions. First, will living in a single parent family be more strongly associated with adolescent substance use at



age 14 when it is experienced during early childhood (ages 0-4) and/or early adolescence (12-14) compared to middle and late childhood? Second, will the dynamic link between living in a single parent family over time and adolescent substance use at age 14 be stronger in the less generous policy context of the U.S. relative to the U.K.? Third, will the dynamic and contextualized link between living in a single parent family over time and adolescent substance use at age 14 be stronger for youth who less closely fit the background profile of the population of adolescents living in single parent families in their respective countries?

## **Methods**

### **Data**

The NLSY79-CYA follows 11,521 children born to U.S. mothers in the original National Longitudinal Survey of Youth 1979 cohort. For this intergenerational study conducted by the U.S. Bureau of Labor Statistics, mothers filled out a Child Survey as a part of their biennial interview starting in 1986 for each child under age 10. Children ages 10 and older completed the Child Survey themselves. Starting in 1994, children ages 15 and older completed a lengthier biennial Young Adult survey. The analytical sample for this study ( $n = 6,236$ ) included all youth who were born following the start of the NLSY79 and who completed a survey at approximately age 14, i.e., children born between 1979 and 2000. This study used data from survey years 1979-1993 and every other year between 1994 and 2014. To facilitate cross-national comparison, variables were constructed to represent the time points at which youth were 0-1, 2-3, 4-5, 6-7, 8-9, 10-11, 12-13, and 14-15. Due to the biennial timing of the surveys, some youth participated at even years of age and others at the odd years.

The MCS is a nationally representative sample of 18,980 children born between September 2000 and January 2002 in the U.K. (Joshi and Fitzsimons 2016). A stratified clustered

design oversampled children living in Wales, Scotland and Northern Ireland, disadvantaged areas, and, within England, areas with high proportions of ethnic minority groups. Families were selected through Child Benefit Records, and initially contacted for opt-out by the Department for Work and Pensions. The analytical sample for this data set ( $n = 11,095$ ) excluded the 7,885 youth who were not interviewed at 14 years or did not have the mother as the main respondent. The time points in the data were approximately infancy and ages 3, 5, 7, 11, and 14.

## **Measurement**

**Substance use in early adolescence.** Substance use in both samples was measured as three dichotomous, time-invariant variables representing whether youth had ever smoked a cigarette, drank alcohol, and used marijuana at the time of their age 14-15 survey. Depending on the specific year and survey form used, some U.S. youth answered their lifetime usage of each substance at age 14-15 (in which case we dichotomized responses to never or at least one occasion of usage at their age 14-15 survey) or the age at which they started such use (in which case we dichotomized responses to never or use after age 15 versus use before or at age 15).

**Maternal partnership through childhood and adolescence.** Family structure was based on maternal partnership (i.e., single, cohabiting, or married). The MCS included mother's self-reported partnership status, and the NLSY79-CYA included a derived maternal partnership variable based on the mother's household roster at each wave. From these data, we created a set of time-varying dichotomous variables measuring single parenthood (1 = mothers reported no spouse or partner present in the household, 0 = spouse or partner present). Because the NLSY79-CYA is an intergenerational study focused on the children of mothers in the NLSY79, children who lived with single fathers were not included in the sample. Correspondingly, children in the MCS whose mothers were not the main respondent were excluded.

**Confounds.** To capture factors that might confound the associations between family structure and substance use, we measured two sets of variables across the two data sets. First, *time-invariant confounds* included the youth's race/ethnicity (NLSY79-CYA: Hispanic, non-Hispanic Black, non-Hispanic/non-Black; MCS: White, South Asian, Black, Mixed/Other), gender, mother's education at the child's birth (NLSY79-CYA: less than high school, high school, some college, more than college; MCS: less than GCSE, GCSE, A-Level, or degree, including equivalents for each), mothers' age at first birth (< 19, 20-24, 25+), and mother's cigarette and alcohol use in the year prior to the child's birth (binary variables indicating engagement in each behavior versus no such engagement). Time-invariant confounds specific to each data set included birth year for NLSY79-CYA and U.K. country (England, Scotland, Wales, Northern Ireland) for MCS. Second, *time-varying confounds* measured at every time point within each data set were household size (number of adults and children in the household aside from the child and parents: 0, 1, 2 or 3+) and poverty status (a dichotomous indicator of a total family income at or below 60% of the national median income for that year and household size).

### **Plan of Analyses**

Studying the effects of family structure on individual outcomes is challenging given the many pathways of selection into specific family structures that could also influence outcomes or moderate associations between family structure and outcomes. In other words, associations between single parent families and adolescent substance use might arise simply because some common factor leads to both rather than the former actually affecting the latter. In recent years, social scientists have taken more concrete steps to address such threats to causal inference, including marginal structural models, twin designs, and fixed effects models (Cavanagh and Fomby 2019). Another strategy not commonly used in this literature is inverse probability (IP) of

treatment weighting, which attempts to simulate the structure of an experiment by re-weighting treatment and/or control groups to resemble each other (Morgan and Todd 2008). In the context of employing this method, “treatment” has a similar meaning as in the experimental methods literature and refers to the effect, or comparison, we are interested in. Specifically, the “treatment” in this study is living with a single mother or not (not, for example, being in therapeutic treatment for substance abuse).

To begin with the logic of IP weighting, consider the hypothetical scenario in which young people could be randomly assigned to living with a single mother or partnered mother, ignoring the obvious ethical and logistical issues. That hypothetical random assignment could take three forms. In the first, randomization to these two types of families would be drawn from the general population of youth, so any resulting difference in substance use could be interpreted as an average treatment effect (ATE), or the average effect on substance use of living with a single mother among all youth. In the second, randomization would be undertaken from the specific subpopulation of youth currently living with single mothers, who likely have considerably different characteristics from the general population. Any resulting differences in substance use could then be interpreted as the average treatment effect among the treated (ATT), or the average effect on substance use of living with single mothers among those who actually do live with single mothers. In the third, randomization would be undertaken from the specific subpopulation of youth who currently do not live with single mothers. Any resulting differences in substance use could then be interpreted as the average treatment effect among the untreated (ATU), or the average effect on substance use of living with single mothers among those who live with partnered mothers. Randomization would be expected to lead to similar distributions of background characteristics across the treatment group (living with single mothers) and

comparison group (living with partnered mothers) within each of these three trials, but the populations enrolled in each trial could differ considerably in respondents' background characteristics. The estimates from these three trials would be identical if the real effects of living with single mothers on early adolescent substance use were uniform, regardless of background. They could differ if those effects were heterogeneous (i.e., varying with the background factors that predict single mother family structures).

Turning to the calculation of these three treatment effects, we estimated the association between single mother family structure at each time point and the odds of adolescent substance use at ages 14-15 in a series of logistic regressions that were weighted by the IP of "treatment" (i.e., single parent family). These IP weights were calculated by deriving predicted probabilities for living with a single mother at each time point from logistic models including the time-invariant covariates, concurrent measures of family poverty and household size, and all prior measures of mother's partnership status, family poverty, and household size. Depending on the specific treatment effect being calculated, weights were set either to one or to a function of the predicted probability of being in the treatment group (see Figure 1). Reweighting the analytical sample created pseudo-populations in which there was little to no association between the confounds and maternal partnership status (Cole and Hernán 2008).

At each time point, we reweighted the sample three ways to estimate the treatment effect of living with single mothers on early adolescent substance use: 1) reweighting the sample to estimate the ATE, or the average effect in the general population of youth regardless of mothers' partnership status; 2) reweighting the sample to estimate the ATT, or the effect among youth who had the typical background characteristics of youth who lived with single mothers; and 3) reweighting the sample to estimate the ATU, or the effect among youth who had the typical

background characteristics of youth who lived with partnered mothers. The extent to which the ATT, ATE, and ATU differed indicated that the treatment effect of living with single parents on early adolescent substance use varied as a function of youths' background propensity to live in that family structure at that age (Sato and Matsuyama 2003). Supplementary figures show how the distribution of the confounds changes according to each of these three weighting schemes.

We followed this IP weighting procedure to calculate ATE, ATT, and ATU for each of the three forms of substance use, separately for the U.S. and U.K. data sets. Prior to calculating weights, we used chained multiple imputation equations to impute missing data in all outcome and predictor variables in the two samples. Weights were calculated within each of 25 multiply imputed data sets, multiplied by sampling weights to adjust for oversampling and differential attrition, and trimmed at the 99<sup>th</sup> percentile to improve precision of the final estimates (Lee, Lessler, and Stuart 2011).

## **Results**

Table 1 describes the characteristics of the U.S. and U.K. samples. Across the two countries, adolescents spent a comparable amount of their lives in single mother families (22% and 19% of waves, respectively). In the U.S., 29% of adolescents drank alcohol by ages 14-15, compared to 50% of U.K. adolescents. Adolescents in the U.S., however, were more likely to smoke cigarettes by ages 14-15 than their peers in the U.K. (25% and 15%, respectively) and use marijuana (10% and 5%, respectively). Below, we describe findings from ATE estimates for each outcome and then turn to differences between the ATE estimate and the ATT/ATU estimates.

### **Family Structure Differences in Early Adolescent Substance Use**

First, ATE estimates assessed how developmental timing and country context shape the associations between family structure and adolescent substance use in the overall U.S. and U.K. adolescent populations. Supplementary Table S1 shows the odds ratios and 95% confidence intervals for the ATE estimates for all three outcomes across the two countries. Figure 2 displays the odds ratios from the IP weighted models for cigarette smoking by age 14-15 by family structure since birth in the U.S. According to the ATE estimates, U.S. adolescents who lived with a single mother during early childhood (ages 0-4), middle childhood (age 8), and early adolescence (age 14) had 44%-92% greater odds of smoking cigarettes at ages 14-15 compared to their peers living with two parents at those ages. Figure 3 shows these results for the U.K. sample, where, similarly, living with a single mother at ages 0, 3, 7, and 11 was associated with significantly higher odds of smoking (ranging from 50% to 66%) at age 14.

Figures 4 and 5 display the odds ratios from the IP weighted models for alcohol use by age 14-15 by family structure since birth in the U.S. and U.K., respectively. The U.S. results were similar to the corresponding pattern for cigarette smoking, with ATE estimates indicating that living with a single mother at ages 2, 4, 10, and 14 significantly predicted a greater likelihood of drinking (42%-59% greater odds) by age 14-15. The ATE estimates in the U.K. were similar. Compared to living with a partnered mother, living with a single mother at ages 5, 7, 11 and 14 significantly predicted 21-45% greater odds of alcohol use at age 14.

Regarding marijuana use, ATE estimates for the U.S. sample indicated that living with a single mother at ages 0-4 and 12-14 was associated with up to 120% greater odds of marijuana use by ages 14-15 (see Figure 6). In the U.K. (see Figure 7), living with a single mother at ages 0, 3, 7, and 11 significantly predicted a greater risk of marijuana use at age 14. Youth who lived with a single mother at age 7 in particular had 145% greater odds of using marijuana. In contrast

to the U.S., living with a single mother at age 14 in the U.K. was not associated with greater marijuana use at this age.

As a sensitivity analysis, we constructed an alternative set of inverse probability of treatment weights. These alternative weights were identical to the weights in the main analyses except that they excluded measures of concurrent poverty and household size. Using these weights tested the less conservative assumption that family structure affects concurrently measured poverty and household size, rather than vice versa. These alternative results were substantively similar to the original results and are not shown here.

Taken together, these results did not strongly support the hypothesis regarding sensitive periods in early childhood and early adolescence. Rather, the observed effect of living with a single mother on adolescent substance use was largely independent of timing. They also did not strongly support the second hypothesis regarding country-level differences in the observed effect of living with a single mother (see Supplementary Table S2 for a formal comparison of the magnitude of coefficients across countries; Clogg, Petkova, and Haritou 1995). The one statistically significant difference was that youth who lived with a single mother at age 14 had nearly twice the odds of using marijuana as their peers with partnered mothers in the U.S., while there was no such association in the U.K.

### **Issues of Selection and Moderation**

In addition to the average treatment effects, Figures 2-7 show the ATT and ATU for all three outcomes in the U.S. and U.K. Supplementary Tables S3 and S4 show the odds ratios and 95% confidence intervals for the ATT and ATU estimates for all three outcomes across the two countries. Recall that the ATT estimates reweighted the sample to sociodemographically



resemble the adolescents living with single mothers, and the ATU estimates reweighted the sample to resemble adolescents living with two parents.

Across all outcomes and in both countries, ATT estimates tended to be weaker than the ATE estimates and did not indicate clear effects of living with a single mother at most ages. In the U.S., ATT estimates only indicated higher odds of substance use in early adolescence for having a single parent at age 4 (for marijuana), age 10 (for smoking), and age 14 (for marijuana). At no age was there a clear effect on alcohol use. In the U.K., ATT estimates only indicated higher odds of marijuana use in early adolescence for living with a single mother at age 11. There were no effects for smoking or drinking at any age. ATU estimates, in which youth were reweighted to sociodemographically resemble the population of youth who lived with a partnered mother, were generally similar to and at least as strong or slightly stronger than the ATE estimates. Collectively, these results supported our hypothesis that the association between living with a single mother during childhood and substance use at age 14 was generally stronger for youth who were sociodemographically least likely to be living with a single mother (and, conversely, generally weaker for those who were sociodemographically most likely to be living with a single mother).

## **Discussion**

This study used cross-national longitudinal data and inverse probability of treatment weighting to identify how the developmental timing of living with a single mother was associated with early adolescent substance use in two countries with similar liberal welfare regimes but key differences in family policy. Living with a single mother in both early childhood and early adolescence was generally associated with greater substance use at age 14. The same pattern, however, extended to living with a single mother during middle and late childhood,

suggesting a more general developmental significance of this family structure rather than the existence of specific sensitive periods. In other words, these results do not point to any particular age-graded mechanism, nor to any clear differentiation across types of substance use. As hypothesized, associations between living with a single mother and greater substance use were stronger among those who were the least sociodemographically likely to live with one (i.e., youth living in higher-income families, with a history of living with two parents). Unexpectedly, there were few differences between the U.S. and U.K. in these patterns.

The consistent associations between living with a single mother in different developmental periods and early adolescent substance use—and the similarity of these associations across countries—suggest the potential for multiple age-graded mechanisms underlying the health significance of family structure. The link between living with a single mother in early childhood and substance use at age 14, particularly for cigarettes and marijuana, supports the argument that early family structure has a “long arm” for health. For example, young children living with a single mother are more likely to experience material deprivation, which in turn creates chronic physiological stress that impedes the development of self-regulation mechanisms (Evans and Kim 2012). For adolescents living with a single mother, particularly those experiencing this family structure as a result of a recent divorce, acute stress may be the more dominant mechanism linking family structure and substance use. Acute stress during adolescence increases risky decision-making, including greater substance use (Galván and Rahdar 2013). A single mother family during early adolescence (ages 11-14) also suggests disrupted parental monitoring of behavior, creating greater social opportunities for such risky decision-making. This synergistic combination of mechanisms might explain the significant treatment effects during this age range—a period often marked by risky health behavior—even

among youth who were the most sociodemographically likely to live with a single mother. The consistency across developmental periods in both countries points to the need to also consider mechanisms specific to middle childhood, such as conduct problems, academic difficulties, and deviant peer affiliation in elementary school (Dishion, Capaldi, and Yoerger 1999).

The associations between family structure and adolescent substance use were not only consistent across developmental periods but also largely between countries. This finding did not support our hypothesis that more generous social policy in the U.K. buffers the economic stress associated with single parenthood, which would in turn buffers the stress mechanisms linking family structure to adolescent substance use. Perhaps the dominant mechanism through which single parenthood serves as a context for the etiology of adolescent substance use is the availability of a parent to provide caring and emotional support, monitor adolescents' activities, and maintain some control over their peer associations, rather than economic stress.

Alternatively, social policy in the U.K. is simply not generous enough to counteract the economic stress faced by single parents. For example, paid family leave may be disproportionately used by socioeconomically advantaged married women, rather than low-income single mothers (Hanratty and Trzcinski 2009). Moreover, neoliberal welfare reform in the past two decades in the U.K. has reduced economic support for single mothers, resulting in poorer mental health for this population (Webb and Lorant 2018). A final possibility is that the lower legal age for drinking alcohol in the U.K. versus U.S. (18 versus 21 years old) creates more opportunities for and engenders greater permissiveness towards such behaviors, which may offset any buffering effect of social policy. Future research should test these findings in a greater number of countries with a wider variability in the generosity of social welfare policies.

Despite the overall country-level similarity, results in the U.S. and U.K. did clearly differ in one way. Living with a single mother at age 14 was associated with an increased risk of marijuana use across all three sets of estimates in the U.S. but in no set of estimates in the U.K. One possible reason for this difference is that rates of adolescent marijuana use tend to be lower in the U.K. Between 2001 and 2014, 6.7%-13.4% of U.K. students versus 21.4%-27.5% of U.S. students reported using marijuana in the last year (Johnston et al. 2019; NHS Digital 2019), and this difference extends to our two study samples. Perceived social norms about a substance are a strong predictor of adolescents' use of that substance (Keyes et al. 2012); if youth in the U.K. perceive greater social disapproval of marijuana than youth in the U.S., then they may be less likely to use it regardless of family structure. Marijuana may also be more accessible in the U.S. than the U.K., thus the additional monitoring and supervision provided by a second coresidential parent would be particularly important for preventing marijuana usage in the former than the latter. In one U.K. study, socioeconomic disadvantage was not strongly predictive of adolescent marijuana usage, but having a mother who uses substances and/or having an older sibling were both predictors (Taylor et al. 2017). These findings, taken together with ours, suggest that the availability of marijuana and modeling of marijuana use may be more important factors than economic stress-related mechanisms.

The differences among the ATE, ATT, and ATU estimates within each country highlight the importance of considering the connections among socioeconomic status, single parenthood, and health behaviors when assessing the developmental significance of single parenthood. Many researchers approach the link between socioeconomic disadvantage and single parenthood as a confound that must be controlled in order to accurately estimate the causal effect of living with a single parent on children's health. They less often consider how such disadvantage may

moderate this developmental significance. A benefit of inverse probability of treatment weighting is that it can assess how living with a single parent means different things depending on the youth's background likelihood of living in a single parent household. The differences across our estimate treatment effects suggest that single mother families mattered most when they were not coupled with other social and economic disadvantages. Indeed, the negative effects of living with a single mother were stronger for youth in the general population (i.e. where youth are likely to be higher-income, to be white, and to have a history of living with two parents) than compared to the weaker effects among populations with backgrounds characteristics typical of youth with single parents (e.g., more likely to live in poverty, to be Black, to have a less educated and younger mother, and to have a longer duration of living with a single mother. This finding is consistent with past research suggesting that family instability matters most to the development of the children least likely to experience it (Cavanagh and Fomby 2019). For those most likely to live with a single mother, actually living with a single mother presented little additional risk over and above an already disadvantaged and marginalized background, thus supporting a model of disadvantage saturation rather than cumulative disadvantage (Hannon 2003). This finding, in turn, is in line with prior research indicating that the benefits of marriage for child development were limited to those who are sociodemographically likely to be married in the first place (Ryan 2012; Wasserman 2020).

When youth were likely to be living with a married mother, living with a single mother constituted a risk factor for substance use, perhaps because it was more disruptive or represented greater relative social disadvantage in their communities. This pattern suggests that a key mechanism linking family structure to adolescent substance use, at least for youth in relatively socioeconomically stable positions, could be acute stress that promotes risky decision-making

during a period of heightened sensation-seeking and need for peer approval. In addition, in the case of a divorce, youth in middle-to-high income families (i.e., less likely to be single mother) may also face a more drastic change in circumstances, such as a greater loss of income, than youth who sociodemographically resemble the average adolescent with a single mother (Bernardi and Boertien 2016). Future research should investigate how much of this discrepancy in the negative effect of living with a single mother can be attributed to economic mechanisms (e.g., greater income loss following a divorce for middle-to-high income families, fewer economic benefits of marriage for low-income families) and/or social reasons (e.g., greater social consequences of divorce for children and less kin support in middle-to-high income families).

In addition to allowing the exploration of selection processes as a source of moderation, IP weighting has several features that position it as an attractive option for studying the links between family structure and health. It allows for more formally defined estimands that more clearly identify the target population to which the effect estimate refers (e.g., the general population versus the population who tends to experience the exposure or not). It also more flexibly models the association between confounds and the outcome without the assumption of linearity that regression adjustment requires (Thoemmes and Ong 2016).

Nevertheless, this study had some limitations that need to be addressed to extend this line of research. First, residual confounding and selection bias from unobserved covariates could still exist. Second, the U.S. and U.K. data were not from comparable periods (U.S. youth were born between 1979 and 2000, and U.K. youth were born between 2000 and 2002), so some differences may be due more to historical than country differences. In the last two decades, adolescent substance use has declined across industrialized countries (Anyanwu et al. 2020; Holmes et al. 2022). Despite these historical changes, drinking alcohol was still more prevalent

at age 14 in the U.K. sample than in the U.S. sample, where the legal age for purchase is higher. Third, because of the structure of the data (the NLSY79-CYA follows the children of the female NLSY79 respondents only), we could not study youth in single father families. These limitations aside, there is no other longitudinal and nationally representative data set in the U.S. with as rich prospective intergenerational data since birth as the NLSY79-CYA with cohorts as close in age as the MCS sample. Fourth, we did not differentiate between cohabiting and married couples or between biological and social fathers, instead focusing on the difference between having a second parent in the household or not. Because cohabiting and/or stepfathers may be less likely to pool resources with mothers and/or invest in parent-child relationships with a non-biological child, our estimates suggesting a potential protective role of a second parent were conservative. Lastly, our treatment effect estimates were based on the assumptions that parental partnerships can be manipulated in some way to change family structures and that doing so would produce similar responses in adolescents to what happens when parental partnership and resulting family structures emerge naturally. Of course, such an intervention would be unrealistic and unethical. Nevertheless, the “thought experiment” of producing these counterfactual estimates can highlight who may be most affected by a family structure and, therefore, who needs most support.

Using robust causal inference techniques for observational data and large cross-national, longitudinal samples, this study illustrated the continuing importance of single parenthood to adolescent health and health behavior. These findings have implications for policy and program implementation. Contrary to expectations, living with a single parent was just as health-relevant in the U.K. as in the U.S., despite more generous family-work policies and a decommodified healthcare system in the former. The weaker ATT estimates suggest that interventions to encourage marriage among existing populations of single mother families might not be an

effective means of reducing adolescent substance use (Brown 2010), over and above the myriad disadvantages already being experienced by this group. The ATE estimates, on the other hand, indicate that a rise in the prevalence of single mother families whereby it becomes more normative might have deleterious implications for adolescent substance use. Efforts to curb adolescent substance use might more effectively address the myriad social and economic disadvantages experienced by single mothers rather than single motherhood itself. These findings show that the importance of socioeconomic disadvantage in linking single parenthood and adolescent health cannot be understated, although the strongest associations were for adolescents who lived with a single parent without a history of socioeconomic disadvantage. These results highlight not only a need for wider support for disadvantaged families, but also mental health and peer mentorship programs supporting all adolescents who may be at risk for substance use due to stressors at home.



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Table 1. Descriptive Statistics for the U.S. and U.K. Samples

	U.S.	U.K.
Adolescent drank alcohol by age 14-15	28.9%	50.2%
Adolescent smoked cigarettes by age 14-15	25.1%	15.5%
Adolescent used marijuana by age 14-15	9.5%	4.9%
Waves in single parent family since birth	21.9%	19.1%
Waves in two-parent family since birth	78.1%	80.9%
Waves in family poverty since birth	33.6%	24.9%
Race/ethnicity		
Hispanic	7.4%	NA
Non-Hispanic Black	14.5%	NA
Non-Hispanic and non-Black	78.1%	NA
White	NA	86.1%
South Asian	NA	5.5%
Black	NA	2.6%
Mixed/Other	NA	5.9%
Adolescent gender (female)	48.7%	48.7%
Mother's age at first birth		
14-19	7.3%	7.4%
20-24	28.5%	16.2%
25 or older	64.2%	76.3%
Mother's education at child's birth		
Less than high school/GCSE	15.5%	16.9%
High school/GCSE	44.6%	45.3%
Some college/A-Level	20.2%	19.4%
College degree or more	19.7%	18.4%
Number of other adults/children in household		
0	19.9%	18.1%
1	39.1%	43.9%
2	23.8%	23.6%
3 or more	17.2%	14.4%
Mother drank alcohol during pregnancy	50.2%	33.9%
Mother smoked cigarettes during pregnancy	31.0%	33.5%
<i>n</i>	6,236	11,095

Note: Descriptive statistics are weighted to account for attrition and over-sampling, and averaged across 25 imputed data sets.

Figure 1. Construction of Inverse Probability of Treatment Weights

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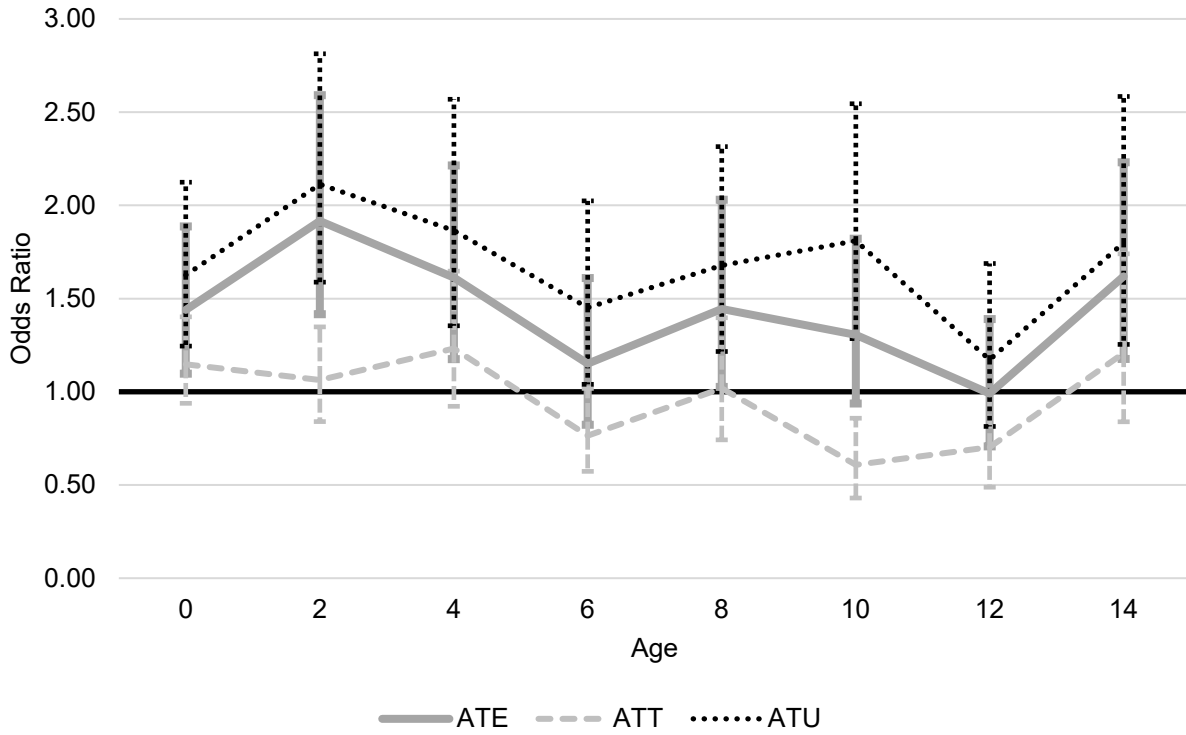
Treated = lived with single mother at time T  
 Untreated = lived with two parents at time T  
 $p$  = adjusted probability of living with a single mother at time T

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Treatment effect	IP weights assigned	Sample reweighted to sociodemographically resemble...
ATE	Single mother = $1/p$ Two parents = $1/(1-p)$	The full population
ATT	Single mother = 1 Two parents = $p/(1-p)$	The population of youth living with a single mother
ATU	Single mother = $(1-p)/p$ Two parents = 1	The population of youth living with two parents

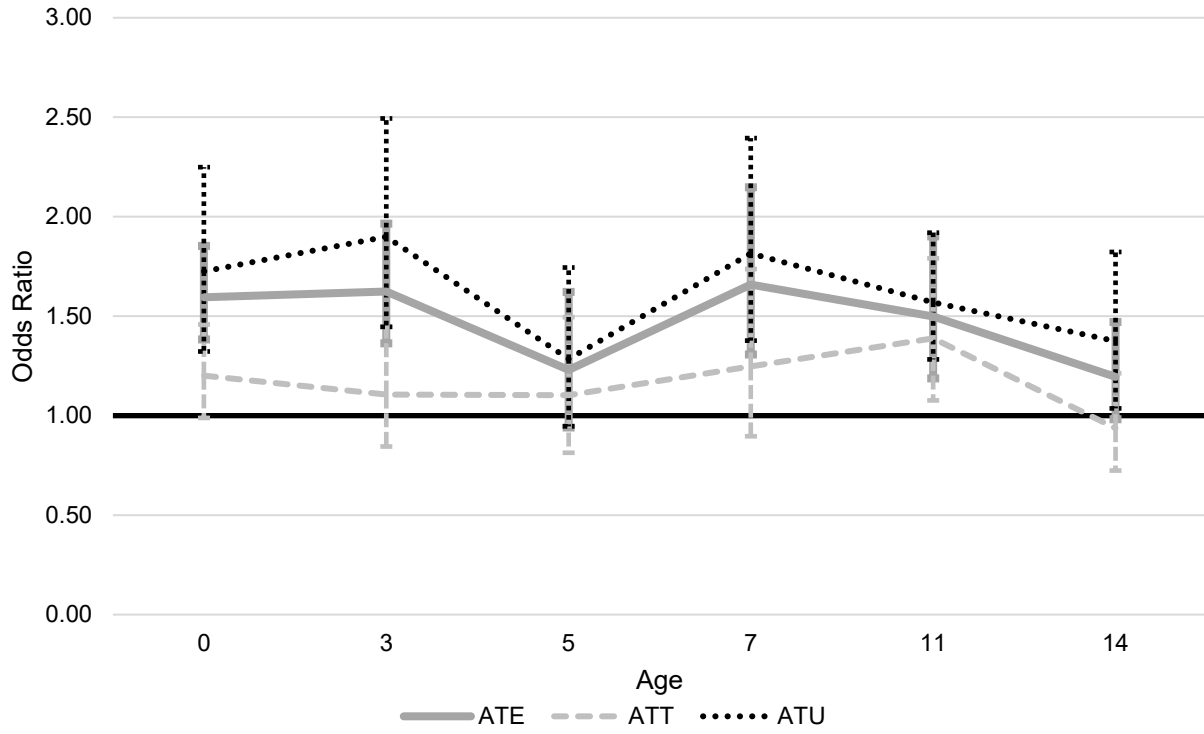
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Figure 2. Treatment Effects of Living with a Single Mother versus Two Parents on Cigarette Smoking at Age 14 in the U.S., by Age



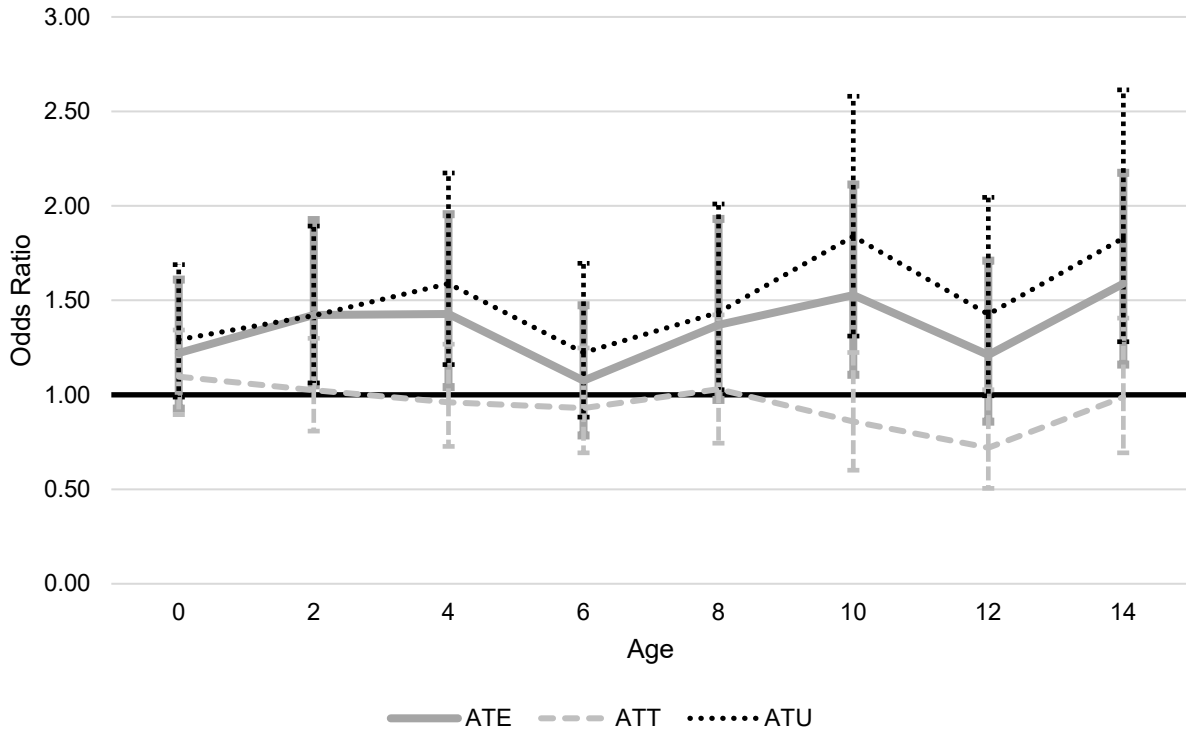
Note: ATE = average treatment effect; ATT = average treatment effect on treated; ATU = average treatment effect on untreated.

Figure 3. Treatment Effects of Living with a Single Mother versus Two Parents on Cigarette Smoking at Age 14 in the U.K., by Age



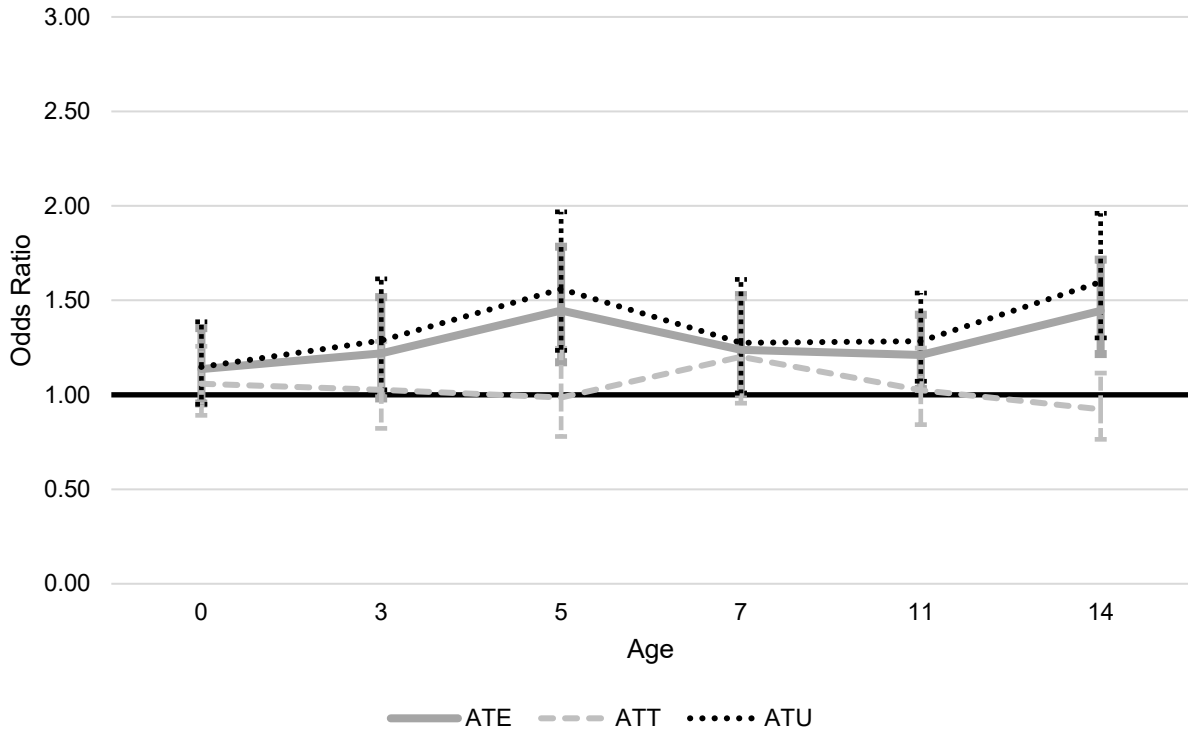
Note: ATE = average treatment effect; ATT = average treatment effect on treated; ATU = average treatment effect on untreated.

Figure 4. Treatment Effects of Living with a Single Mother versus Two Parents on Drinking at Age 14 in the U.S., by Age



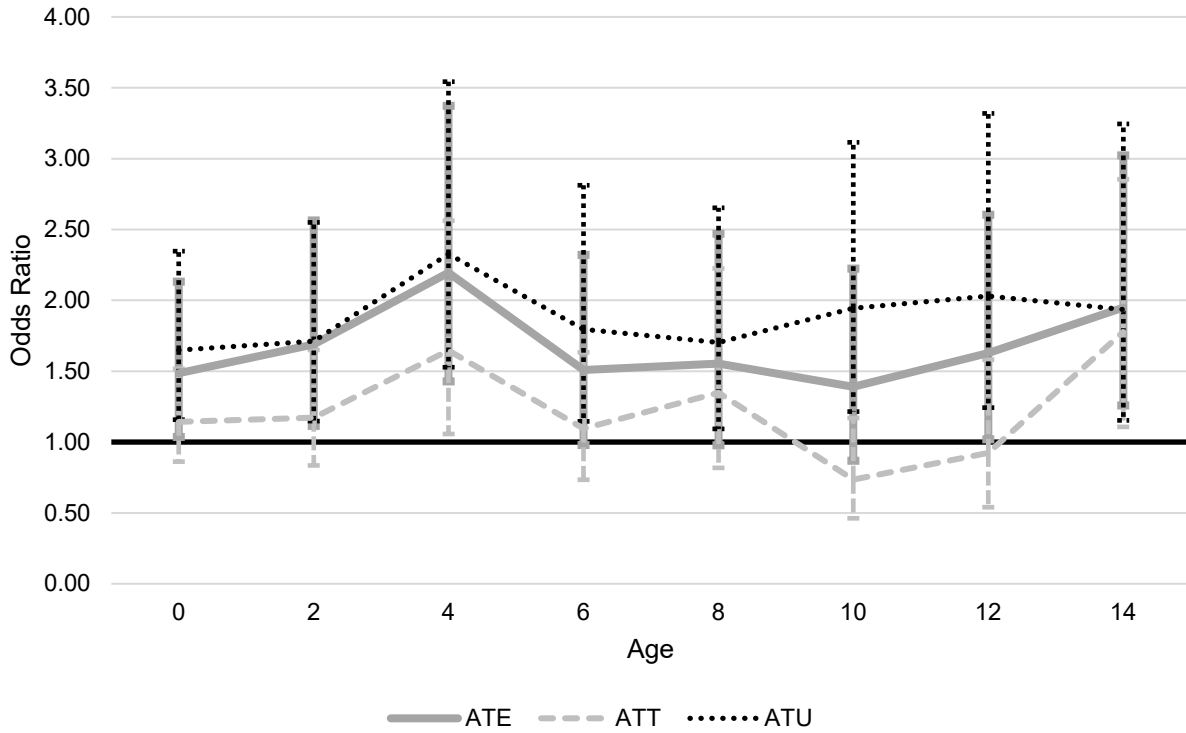
Note: ATE = average treatment effect; ATT = average treatment effect on treated; ATU = average treatment effect on untreated.

Figure 5. Treatment Effects of Living with a Single Mother versus Two Parents on Drinking at Age 14 in the U.K., by Age



Note: ATE = average treatment effect; ATT = average treatment effect on treated; ATU = average treatment effect on untreated.

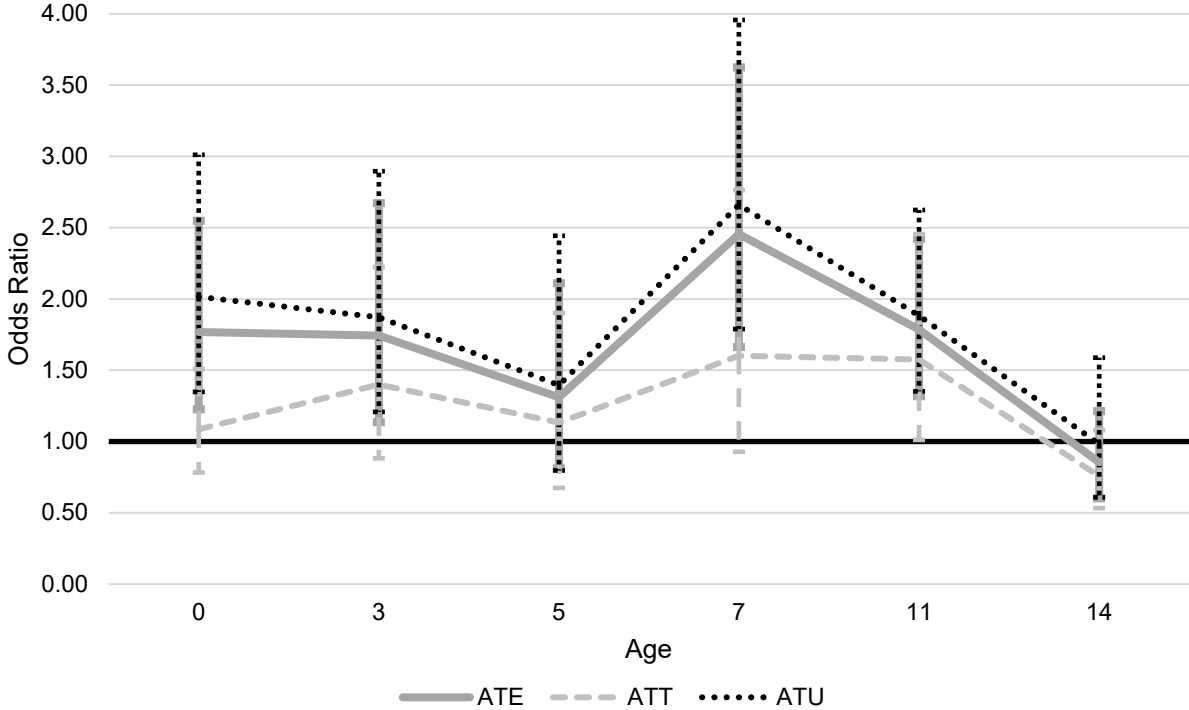
Figure 6. Treatment Effects of Living with a Single Mother versus Two Parents on Marijuana Use at Age 14 in the U.S., by Age



Note: ATE = average treatment effect; ATT = average treatment effect on treated; ATU = average treatment effect on untreated.



Figure 7. Treatment Effects of Living with a Single Mother versus Two Parents on Marijuana Use at Age 14 in the U.K., by Age



Note: ATE = average treatment effect; ATT = average treatment effect on treated; ATU = average treatment effect on untreated.