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Adverse Childhood Experiences and Substance Use across Diverse Neighborhoods

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Abstract

Adverse Childhood Experiences and Substance Use across Diverse Neighborhoods

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Adverse childhood experiences (e.g., abuse, substance abuse or mental illness in the household, incarceration of a family member) have gained prominence in the medical and epidemiological literature in recent years due in part to the implications these experiences have for later adult health. One pathway by which adverse childhood experiences influence later health is through the development of problematic health behaviors that serve as coping mechanisms, such as drinking alcohol and smoking. Individuals typically initiate these behaviors in one form or another during adolescence, a time of experimentation and increased autonomy. Accordingly, the first aim of this study analyzes the extent to which adverse childhood experiences are linked with later substance use during adolescence and the transition to adulthood. In addition to the household environment, neighborhood context may also play a role in adolescents' substance use behaviors. Protective resources in youth's neighborhood, such as collective efficacy, might buffer the effects of growing up in a troubled household, although

other neighborhood environments may contribute to youth's substance use. The second aim of this study explores how the neighborhood social context moderates the association between adverse childhood experiences and later substance use. Lastly, as substance use shows systematic age-related patterns, the third aim of this study tests if the foregoing relationships vary by age.

This study uses the Project on Human Development in Chicago Neighborhoods data to estimate multi-level models predicting three health behaviors during adolescence: drinking, cigarette smoking, and drug use. Results showed consistent associations between adverse childhood experiences and the amount of cigarettes smoked and the likelihood of illicit drug use, although not the amount of days drunk in the past year. Second, neighborhood interaction effects operated unexpectedly so that some neighborhood resources increased substance use among youth with adverse childhood experiences. Third, adverse childhood experiences and neighborhood resources were the most salient for substance use at the older ages. This examination of how childhood experiences relates to substance use behaviors in adolescence provides additional insight into the family and neighborhood contexts of adolescent substance use as well as how adverse childhood experiences matter across the life course.

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Introduction

Adverse childhood experiences have garnered substantial attention in the medical and epidemiological literature due to their implications for lifelong health. This umbrella term encompasses a wide range of events and household environments, including abuse and neglect, incarceration of a family member, substance abuse or mental illness within the household, and parental divorce (Brown et al., 2009). One pathway by which such experiences undermine later health is through youth's own substance use, which may be a short-term coping mechanism with long-term health risks (Compas et al., 2001). Because initiation of smoking, drinking, and drug use typically occurs during adolescence (Chassin et al., 2004), investigating how adolescent substance use may connect early experiences to later outcomes captures a life course process and identifies critical points of intervention. Such an investigation, however, must take into account the potential variation in the link between adverse childhood experiences and adolescent substance use across diverse neighborhoods (e.g., are some neighborhoods more or less able to protect children from the behavioral risks of adverse experiences?) and as young people age (e.g., are there some points where the risks of adverse experiences, the protection of neighborhood organization, and the link between the two are more or less pronounced?).

This study, therefore, will draw on the Project on Human Development in Chicago Neighborhoods (PHDCN), a longitudinal study of youth, families, and neighborhoods, to ask and answer three questions: 1) Are young people with adverse childhood experiences more likely to engage in substance use during adolescence and the transition to adulthood? 2) Are adverse childhood experiences more or less linked to later substance in neighborhoods with abundant social resources? 3) Are these linkages among adverse childhood experiences, neighborhood resources, and later substance more pronounced for older vs. younger youth?

Such research expands the literature on childhood adversity and later health outcomes in three major ways. First, this study builds upon prior literature linking adverse childhood experiences to problematic adult health outcomes by narrowing in on the initiation of substance use in adolescence as a potential mechanism. Most scholarship to date fails to address the why these factors are linked. Second, this study moves beyond documenting how adverse childhood experiences can be detrimental for adult health by identifying neighborhood resources that promote resilience as well as potential sites for intervention. Third, this study uses primary caregiver reports of youth's adverse childhood experiences while they are still young. This addresses one major limitation of prior studies that typically rely on retrospective self-reports in which memory problems or recall bias may introduce measurement error.

Theoretical Background

Adverse Childhood Experiences and Adolescent Substance Use

A rich body of literature on the health implications of household stressors and abuse comes from the Adverse Childhood Experiences Study, conducted between 1995 and 1997 at Kaiser Permanente's San Diego Health Appraisal Clinic. As defined by this study, adverse childhood experiences include exposure to psychological, physical, and sexual abuse before age 18 as well as several dimensions of household stressors, including living with a mentally ill household member, living with someone with a substance use disorder, living with a household member who was incarcerated, and witnessing violence towards one's mother. Studying these experiences together moves away from examinations of single types of abuse to consider the multiple dimensionality of child maltreatment and household stress and their implications for adult health and mortality (Dong et al., 2004). Adverse childhood experiences are consistently associated with a wide range of poor mental outcomes such as depression (Chapman et al., 2004), attempted suicide (Dube et al., 2001), dysfunction in stress-responsive neurobiological systems (Anda et al., 2006), and worse global mental well-being scores (Edwards, Holden, Felitti, & Anda, 2003) and physical outcomes such as cancer, chronic lung disease, liver disease, ischemic heart disease, and skeletal fracture (Felitti et al., 1994). In the fifteen years following the implementation of the Adverse Childhood Experiences Study, researchers have continued to find associations between childhood adversity and a range of respiratory, cardiovascular, musculoskeletal gastrointestinal, metabolic, and gastrointestinal conditions (see Wegman & Stetler, 2009 for a review).

Hypothesized mechanisms between adverse childhood experiences and long-term health outcomes include the development of adult biological risk profiles, such as increased

inflammation and poorer cardiovascular function and lipid metabolism (Friedman, Karlamangla, Gruenewald, Koretz, & Seeman, 2015). Furthermore, adverse childhood experiences may set into motion a variety of stressors and stress responses that may accumulate over time to produce poorer adult outcomes through the influence of toxic stress and allostatic load (Gilbert et al., 2015). One study found the association between experiences and physical health to be most pronounced for the oldest individuals, which may signal a “weathering” phenomenon in which the health effects of stressors in childhood accumulate over time into the development of chronic conditions (Logan-Greene, Green, Nurius, & Longhi, 2014), net of recent life events (Hostinar, Lachman, Mroczek, Seeman, & Miller, 2015). Another set of hypothesized mechanisms focus on problematic health behaviors throughout adulthood that individuals may use as coping strategies, such as smoking, drinking alcohol, illicit drug use, and overeating (Felitti et al, 1998; Hostinar et al., 2015). Nevertheless, an exploration of causal mediating factors such as problematic health behaviors, disease outcomes, and healthcare utilization during adulthood could not fully account for the correlation between adverse childhood experiences and premature mortality (Brown et al., 2009), suggesting the need for further research on mechanisms.

In particular, substance use (i.e., cigarette smoking, drinking alcohol, and illegal drug use) initiated during adolescence may be a particularly useful mechanism to consider for a number of reasons. First, substance use during adolescence and young adulthood is associated with a number of negative outcomes in the short-term, such as increased morbidity and mortality due to unsafe and risky behaviors (Murgraff, Parrott, & Bennett, 1999), premature entry into adult roles, and foreshortened educational attainment (Newcomb & Bentler, 1988), all of which may be connected to later adult health. Second, the most consistent long-term consequence of substance use is the continued use of the same substance (Chassin et al., 2004). As mentioned

before, the association between adverse childhood experiences and greater adult mortality and disease conditions operates in part through negative health behaviors in adulthood. Adolescence and young adulthood thus may be critical periods during which initiation of long-term behaviors occurs. Third, increased substance use may signal psychological distress resulting from a problematic family environment, emphasizing that such behaviors should be addressed as health risks, rather than criminal activity. Indeed, one study found that, although the physical health effects of adverse childhood experiences may be most apparent among older individuals, the link between childhood adversity and mental health was the most pronounced for younger adults, suggesting psychological distress as a more proximate outcome (Logan-Greene et al., 2014).

Although scholars have found that adverse childhood experiences are connected to substance use during adolescence (Anda et al., 1999; Dube et al., 2003; Dube et al., 2006), these studies rely on retrospective reports from a sample of primarily white, well-educated adults (Cronholm et al., 2015). The first aim of this study, therefore, is to test the hypothesis that adverse childhood experiences will be associated with greater substance use during adolescence and the transition to adulthood using longitudinal, prospective data collected from a sample of socioeconomically, racially, and ethnically diverse children and their families.

Neighborhood Context as a Source of Variation

Ecological frameworks (Bronfenbrenner, 2009) emphasize the need to situate experiences in larger settings of daily life to better understand their consequences. For example, neighborhoods are sites of family and community processes that can lead to adverse childhood experiences as well as provide opportunity structures for substance use. Neighborhoods may also provide resources that can promote resilience and better health outcomes among adolescents. As Sampson (2003) argues, just as outcomes systematically vary across communities, so too do the

social characteristics of the community with direct effects on individuals' health (e.g., Yen & Kaplan, 1999; Steptoe & Feldman, 2001; Messer, Kaufman, Dole, Savitz, & Laraia, 2006).

While prior research indicates that adverse childhood experiences are associated with adolescent substance use, this study expands this perspective to consider how the neighborhood environment interacts with the family environment to shape this risk. Specifically, I consider how three neighborhood resources—collective efficacy, youth services, and norms against risky adolescent behavior—may benefit youth in particularly stressful home environments.

Collective efficacy refers to the extent to which the members of the community can monitor and supervise youth and intervene in the presence of risk or physical threat (Sampson, Raudenbush, & Earls, 1997). It is associated with a number of positive health outcomes, such as less depression (Ahern & Galea, 2011), better self-rated health (Browning & Cagney, 2003), and lower rates of obesity (Cohen, Finch, Bower, & Sastry, 2006). Through mechanisms such as increased social support (Ahern & Galea, 2011), self-efficacy (Dupéré, Leventhal, and Vitaro, 2012), emotional resilience (Jain, Buka, Subramanian, & Molnar, 2012), better monitoring and supervision (Sampson et al., 1997), and informal social control provided by other adults in the neighborhood (Sampson, Morenoff, & Earls, 1999), collective efficacy can mitigate other environmental or individual risks. For example, Maimon and Browning (2012) showed that collective efficacy attenuates the positive association between the number of alcohol retail outlets in a community and rates of underage drinking. Collective efficacy may be particularly beneficial for youth who experience trauma at home or elsewhere. Researchers have shown that collective efficacy attenuates the correlations between childhood neglect and later externalizing behaviors (Yonas et al., 2010) and between violent victimization and adolescent substance use (Fagan, Wright, & Pinchevsky, 2014). A high level of collective efficacy also reflects a

community's mobilization capacity to procure high-quality services (Sampson et al., 1997; Browning & Cagney, 2003), which may benefit youth for reasons discussed below.

Youth services encompass a wide range of organizations that include structured, monitored environments for youth to spend their free time (e.g., recreational programs), mentoring organizations (e.g., the Big Brother Big Sisters program), and mental health services (e.g., crisis intervention and counseling centers). As an illustrative example, a recent report from Mathematica Policy Research (Verbitsky-Savitz et al., 2016) demonstrates the efficacy of a wide variety of trauma-informed programs in encouraging resilience and better outcomes among youth who have experienced adverse childhood experiences. Such institutional resources provide opportunities for participation in meaningful activities and to build relationships with supportive peers and other adults (Jain et al., 2012). The social support facilitated by these organizations may buffer the stressors associated with dysfunctional home environments, thereby reducing their negative impact on physical and mental health (Logan-Greene et al., 2014). Social support can also translate into self-efficacy (Berkman, Glass, Brissette, & Seeman, 2000), which may increase adolescents' likelihood of seeking out healthy coping behaviors.

Strong norms against adolescent risky behavior among residents of a neighborhood can also be considered as a type of neighborhood resource. Normative expectations about behavior can include both injunctive norms that prescribe what is morally wrong or correct (e.g., smoking as an adolescent is wrong) and descriptive norms that encompass beliefs about what is actually done (e.g., adolescents typically try smoking during high school) (Cialdini, Reno, & Kallgren, 1990). A neighborhood context characterized by strong norms against adolescent substance use and high informal social control may also be associated with less adolescent substance use simply because there are fewer opportunities for youth to access and partake in substances and

because the normative climate discourages this behavior (Musick, Seltzer, & Schwartz 2008). For example, a more permissive normative climate regarding sexuality has been associated with an increase in adolescents' odds of sexual debut and casual sex as well as number of partners (Warner, Giordano, Manning, & Longmore, 2011). Vulnerable youth in risky family environments may benefit from attention from neighborhood residents attuned to the well-being of other community members (Browning & Cagney, 2003). A neighborhood's normative expectations may also reflect more proximate processes within its schools, particularly the availability and acceptability of substance use (Ennett, Flewelling, Lindrooth, & Norton, 1997).

Through a variety of potential mechanisms, these aforementioned neighborhood resources may help to buffer the stress associated with adverse childhood experiences, promote healthier coping strategies other than substance use, and thus reduce the risk of developing long-term adverse health behaviors. The second aim of this study, thus, is to test the hypothesis that positive neighborhood resources attenuate the association between adverse childhood experiences and adolescent substance use.

The Importance of Age and Timing

An ecological framework also emphasizes how the interplay of a person with their context depends on their own individual characteristics. One way in which timing matters focuses on how the link between difficult experiences in the family and community and subsequent behavior can depend on one's age, as young people bring to these experiences differing developmental capacities (and opportunities) for understanding, coping, and adaptation (Masten, 2004) as well as differential abilities to draw on and ecological resources, such as neighborhood social ties (Fagan et al., 2014). In other words, the linkage between substance use and adverse childhood experiences may differ depending on when these experiences occur. For

example, adverse childhood experiences that occur in adolescence as opposed to early childhood may be more consequential for substance use if youth turn to smoking, drinking, or illicit drugs as coping mechanisms for proximal stressors. In this study, youth were approximately 9, 12, and 15 years old when their primary caregiver reported any adverse childhood experiences.

Furthermore, substance use follows systematic age-related patterns (Chassin et al., 2004), with the onset of “legal” (e.g., tobacco and alcohol) substance use occurring during early adolescence, illegal drug use onset occurring during the later high school years, and the quantity and frequency of substance use peaking during the late teens and early twenties. A second way to consider timing is to understand at what ages the link between adverse childhood experiences, regardless of when they occur throughout childhood and adolescence, may be the strongest or weakest. In this study, youth were 15, 18, and 21 years old when they report their substance use behavior, the younger ages representing approximately the typical onset of substance use and the older ages representing the peak of use (Johnston, O’Malley, & Bachman, 2000). Relatively early onset of substance use, particularly illegal drug use, may signal affective and behavioral dysregulation, which could arise from adverse childhood environments (Tarter et al., 1999). Early adolescence, then, may represent a critical period for community interventions for these youth. Alternatively, the older ages in this sample represent a developmental period in which adolescents and young adults are seeking more independence, moving out of their parents’ home (and thus away from parents’ watchful eyes) and transitioning into new adult roles. As parents lose influence in these young adults’ lives, the influence of peers and other adults might be more consequential. This influence could be negative, in the case of unstructured socializing with older, delinquent peers (Harding, 2009; Maimon & Browning, 2010) or affiliation with a substance-using peer group (Hawkins, Catalano, & Miller, 1992), or positive, in the case of a

relationship with an adult mentor (Beier, Rosenfeld, Spitalny, Zansky, & Bontempo, 2000). As parental influence wanes during the transition to adulthood, neighborhood influences may become more consequential and community interventions may need to target somewhat older adolescents to be most effective.

The third aim of this study, therefore, is to test the hypothesis that the interactions between adverse childhood experiences and neighborhood resources in predicting substance use will vary by age; specifically that these linkages will be more pronounced in a cohort of young adults who experienced adverse experiences in childhood and/or adolescence vs. younger cohorts. Testing this hypothesis may help to identify particularly sensitive developmental periods in which intervention might be most helpful.

Data and Methods

Data and Sample

The PHDCN was an interdisciplinary data collection focused on the influences of family, school, and neighborhood contexts on child and youth development. This study draws on two components of the PHDCN: neighborhood-level data comes from the Community Survey and data on youth and their families comes from the Longitudinal Cohort Study. The Community Study took place in 1994-1995, while the Longitudinal Cohort Study took place over three waves of data collection in 1994-1997, 1997-1999, and 2000-2001.

In order to define neighborhoods, the PHDCN Scientific Directors collapsed 847 census tracts in Chicago into 343 neighborhood clusters. Neighborhood clusters consisted of geographically contiguous census tracts that were internally homogenous with respect to racial/ethnic and socioeconomic composition. About 8,000 individuals resided in each neighborhood cluster. For the Community Survey, sampling took place in three stages: city blocks were sampled within each neighborhood cluster, dwelling units were sampled within each block, and then one adult resident was randomly selected within each dwelling unit for an interview. A total of 8,782 individuals completed interviews regarding several aspects of their neighborhood environment, such as cultural values, social control, and the political and organizational structure. These answers were then aggregated to the neighborhood cluster level.

For the Longitudinal Cohort Study, 80 of the 343 neighborhood clusters were selected for sampling on the basis of maximizing variability in racial/ethnic composition and socioeconomic status. Again, the PHDCN used a three-stage sampling design to select 800-900 participants in each of seven age groups (within six months of birth, ages 3, 6, 9, 12, 15, and 18) from households in these neighborhood clusters. First, block groups were selected randomly within

neighborhood clusters, dwelling units were selected randomly within blocks, and residents with children in the above age groups were selected for study. A total of 6,228 individuals participated in the first wave of data collection, with a 78.2% response rate at the third wave of data collection.

For this study, the sample was limited to cohorts who were 9, 12, and 15 years old at Wave 1 and approximately 15, 18, and 21 years old at Wave 3 ($n = 2,344$) in order to capture ages when the onset of substance use generally occurs and frequency of use tends to peak (Chassin et al., 2004). The sample was further limited to youth with valid reports on the focal predictor variable (i.e., adverse childhood experiences; see below), resulting in a total analytical sample of 1,658 individuals. The sample was racially diverse: about 15% were White, 46% were Latino/a, 35% were Black, and 4% identified as another race/ethnicity. About 58% of youth lived with married parents, the average age of the primary caregiver was about 38 years old, and youth lived on average lived in households with about five members.

Measurement

Adverse childhood experiences. The independent variable of interest was modeled after Felitti and colleagues' (1994) ACE Study questionnaire, which asked respondents whether they experienced each of three categories of abuse (physical, psychological, and sexual) and four categories of household stress (violent treatment of mother or stepmother, exposure to substance use, mental illness, or incarceration in the household) before age eighteen. Other versions of the ACE Study questionnaire also include divorce or separation of parents, parental neglect, and lack of warmth in the family (Murphy et al., 2014; Dube et al., 2013). Based on the availability of questions in the PHDCN, an index of adverse childhood experiences comprised seven categories (data on sexual abuse was not available) derived from primary caregiver reports at Wave 1. This

measure improves over many past studies by capturing more temporally proximate experiences, rather than relying on retrospective reports of events more distant in the past.

If the primary caregiver responded affirmatively to any of the questions within each category, individuals received a “1” for that category, so that the final adverse childhood experience index could range from 0 to 7. First, psychological abuse included a report of whether or not the primary caregiver ever insulted or swore at the child, threatened to hit or throw something at the child, or threw, smashed, hit, or kicked something during an argument with the child. Second, physical abuse included whether or not they ever threw something at the child; pushed, grabbed, or shoved the child; slapped or spanked the child; kicked, bit, or hit child with a fist; hit or tried to hit the child with an object; beat the child up; or burned or scalded the child. Third, the primary caregiver also reported whether or not her partner or spouse ever threatened to hit or throw something at her; thrown, smashed, hit, or kicked something; thrown something at her; pushed, grabbed, or shoved her; slapped her; kicked, bit, or hit her with a fist; hit or tried to hit her with an object; beat her up; choked her; threatened her with a knife or gun; or used a knife or fired a gun at her. Fourth, substance abuse in the household was based on five questions: if drinking caused anyone in the family to have problems with their health, family, or police, if drug use caused any similar problems, if anyone talked to a doctor or counselor about problems with drugs or alcohol, or if anyone was hospitalized due to substance use problems. Fifth, similar questions regarding mental illness ask if anyone in the family ever suffered from severe depression, had frequent legal or disciplinary problems, had problems with their nerves or suffered a nervous breakdown, ever attempted suicide, or ever committed suicide. Sixth, incarceration was based on one question asking if any family member was currently in prison or jail. Seventh, divorce/separation was based on the primary caregiver’s relationship history.

Adolescent substance use. Three substance use variables measuring tobacco, alcohol, and illegal drug use were based on youth's self-reports. A continuous variable ranging measuring *number of cigarettes smoked* in the past year was created by multiplying the average number of cigarettes smoked per day and the number of days smoked in the past year, with those who never smoked or did not smoke in the past year coded as "0." This variable ranged from 0 to 637.5 cigarettes smoked in the past year. The *number of days drunk* in the past year was also a continuous variable based on a single question and ranged from 0 to 150, with those who never drank alcohol, never got drunk, or did not get drunk in the past year coded as "0." Because illicit drug use was a rarer occurrence, its operationalization captured lifetime use rather than past year use in order to capture more variability. *Lifetime illicit drug use* was a dichotomous variable capturing whether or not youth ever used an illegal drug, such as marijuana, cocaine, or heroin.

Neighborhood resources. The PHDCN Scientific Directors created and standardized each of the three neighborhood resource scales included in this study. First, neighborhood *collective efficacy* added the social cohesion and informal social control scales (Sampson et al., 1997). Social cohesion measured the extent to which individuals felt they lived in a close-knit neighborhood, neighbors were willing to help each other, get along with each other, share the same values, and could be trusted. Informal social control captured the extent to which neighbors would intervene if a group of children skipped school and hung out on the street corner, spray-painted graffiti on a local building, showed disrespect to an adult, if a fight broke out in front of a house, or if the city threatened to close down the closest fire station. Collective efficacy ranged from -2.432 to 3.139, with higher numbers indicating more collective efficacy. Second, the measure of *youth services* was derived from questions asking if the following were present in a neighborhood: a youth center, recreation programs offered outside of school, after-school

programs, mentoring or counseling services, mental health services for youth, and crisis intervention services for youth. The youth services scale ranged from -2.039 to 2.847, with higher numbers indicating a greater number of services. Third, *normative expectations* was based on a series of questions asking respondents how wrong it was for teenagers around age 19 to smoke cigarettes, use marijuana, drink alcohol, and get into fist fights (extremely wrong, very wrong, wrong, a little wrong, and not wrong at all). The normative expectations scale ranged from -2.403 to 2.045 with higher numbers indicating less tolerance of these behaviors.

Covariates. Three sets of covariates measured potential confounds at different levels of analysis. Individual-level covariates included a dichotomous *gender* variable (“1” for female; “0” for male), three *age* dummy variables for the age 9, 12, and 15 cohorts, and four dummy variables for *race/ethnicity* (white, Latino, black, and other). Covariates at the household level include *primary caregiver’s marital status* (“1” for married; “0” for not currently married), *family size*, *primary caregiver’s age* divided by ten, and *family socioeconomic status*. All household variables were measured at Wave 1. PHDCN Scientific Directors created the socioeconomic status variable using the principal component of the highest education level of the primary caregiver or partner, household income, and the highest socioeconomic index of the primary caregiver or partner’s occupation.

Lastly, three commonly used neighborhood covariates (e.g., Sampson et al., 1997; Molnar et al., 2003; Kirk & Papachristos, 2011) derived from the 1990 Census and generated by the PHDCN Scientific Directors were included in the multi-level models in order to isolate the effects of the neighborhood resources above and beyond their association with neighborhood socioeconomic composition. *Concentrated disadvantage* was a composite measure reflecting the percentage of individuals living below the poverty line, individuals receiving public assistance,

percent unemployed, the density of children, percentage of African-American residents, and percentage of female-headed families. *Residential instability* captured the percentage of residents living in the same house between 1985 and 1990 and the percentage of housing occupied by owners in 1990. *Immigrant population concentration* measured the percentage of Latino/o and foreign-born residents in 1990.

Plan of Analyses

A set of nested models were estimated for each substance use outcome. Model 1 estimated the focal association between adverse childhood experiences and substance use with the individual covariates and family-level covariates, using the Mplus command CLUSTER and the neighborhood identification variable to adjust the standard errors for neighborhood clustering. The next set of models (Models 2-7) brought in neighborhood “effects” more explicitly, incorporating a multi-level framework by specifying individual and family variables at the “within” level and neighborhood variables at the “between” level. Iteratively, these models estimated the main effect of each neighborhood resource followed by the interactions of each neighborhood resource with adverse childhood experiences. For example, Model 2 added neighborhood collective efficacy (in addition to adverse childhood experiences and all covariates), and Model 3 added the interaction between collective efficacy and adverse childhood experiences. Models for number of cigarettes smoked and days drunk in the past year used linear regression, and models for lifetime illicit drug use used logistic regression.

A final step for each outcome was to estimate a series of multiple-group models, which tested whether focal associations among adverse childhood experiences, substance use, and neighborhood resources differed across the three age cohorts. The multiple-group models retained the multi-level structure, included all covariates, and allowed the adverse childhood

experiences main effect and interactions to vary across cohorts. All other coefficients were constrained to be equal across the three age cohorts.

These models were estimated in Mplus version 7.31 (Muthén & Muthén, 1998-2012) using full-information maximum likelihood procedures to account for missing data (Enders & Bandalos, 2001). Once sample restrictions were applied, missing data were minimal. The greatest amount, 10.37%, was for the number of cigarettes smoked variable. All other variables ranged from 0% to 7% missing.

Results

Descriptive Overview of the Sample

Table 1 displays the descriptive statistics for the full sample as well as by age cohort. On average, youth experienced approximately three of the seven types of adverse childhood experiences by Wave 1. There were no clear substantive patterns in neighborhood contexts across the three cohorts.

Turning to substance use, youth smoked an average of 20 cigarettes in the past year and were drunk about two and a half days in the past year, although there was large variation in both behaviors. Nearly a third had ever tried an illegal drug, with increasing use in the older cohorts. Those in Cohort 9, who were approximately 15 years old when the Wave 3 substance use measures were collected, only smoked on average one cigarette in the past year and were drunk almost no days in the past year. Only 7% had tried an illicit drug by Wave 3. In contrast, those in Cohort 15, who were approximately 21 years old at Wave 3, smoked an average of 53 cigarettes in the past year and were drunk a little over six days in the past year. Over half of Cohort 15 had any lifetime use of illegal drugs.

Connecting Adverse Childhood Experiences to Later Substance Use, by Neighborhood

Beginning with the basic association between adverse childhood experiences and three forms of substance use in adolescence and young adulthood, Table 2 presents Model 1 for each outcome. Each adverse childhood experience was associated with an increase of 3.386 cigarettes smoked in the past year. Such experiences, however, were not associated with drinking, net of family and individual covariates. Yet, each adverse childhood experience was associated with a 15% ($e^{0.140}$) increase in the odds of likelihood of lifetime illicit drug use. These results partially support the first hypothesis that adverse childhood experiences are related to later substance use.

As for the potential for neighborhood resources to moderate the association between adverse childhood experiences and three forms of substance use in adolescence and young adulthood, Table 3 reveals no significant associations between any of the neighborhood resources with the number of cigarettes smoked in the past year (Model 2) but a significant positive interaction term between adverse childhood experiences and neighborhood youth services (Model 3). For ease of interpretation, this interaction is displayed in Figure 1. Among youth with no adverse childhood experiences, more youth services in the neighborhood were associated with fewer cigarettes smoked in the past year. When youth had more adverse childhood experiences, however, more youth services in a neighborhood were associated with a greater number of cigarettes smoked in the past year. This cross-over point occurred at approximately three types of adverse childhood experiences, the mean number of experiences in this sample. In other words, youth services were associated with less cigarette smoking for youth with fewer than average adverse childhood experiences, but more cigarette smoking for youth with a greater than average number of adverse childhood experiences.

In neither Table 4 nor 5 did any of the neighborhood resources predict the number of days drunk in the past year or lifetime illicit drug use as either main or interactive effects. Recall that the second hypothesis was that neighborhood resources would attenuate the positive association between substance use and adverse childhood experiences. These results do not support and even contradict, in the case of youth services and cigarette smoking, this hypothesis.

Differences by Cohort

Turning to the third hypothesis, did the associations among adverse childhood experiences, neighborhood resources, and substance use vary across the different cohorts? Table 6 displays the main effects and interaction term of adverse childhood experiences and each

neighborhood resource for each substance use outcome by cohort. A similar pattern as depicted in Figure 1 emerged for collective efficacy among the oldest age cohort. In other words, among members of Cohort 15, the combination of adverse childhood experiences with more neighborhood collective efficacy predicted more cigarettes smoked in the past year. This interaction term is only marginally significant. The multiple-group models of the interaction between adverse childhood experiences and youth services add further specificity to the pattern illustrated in Figure 1. Specifically, as with collective efficacy, a higher level of youth services combined with more adverse childhood experiences predicted more cigarettes smoked. This association was driven primarily by Cohorts 12 and 15. The interaction term between adverse childhood experiences and youth services was only marginally significant for Cohort 9.

In Column 2, the multiple-group models for number of days drink were similar to the full sample model. Adverse childhood experiences and neighborhood resources largely did not explain any variation in the number of days drunk in the past year for any age cohort.

Turning to Column 3 of Table 6, neighborhood resources were not significantly related to illicit drug use, except for one marginally significant interaction term between normative expectations and adverse childhood experiences for Cohort 15 only.

These results are consistent with the hypothesis that the interactions between neighborhood resources and adverse childhood experiences in predicting substance use vary by age, with generally stronger effects apparent among the middle and oldest cohorts.

Discussion and Conclusion

This study fills in gaps in the literature relating childhood adversity to later adult health outcomes by examining one mechanism by which the two may be related (adolescent substance use), using a more temporally proximate measure of adverse childhood experiences, and considering a potential site for intervention and resilience: neighborhood resources. The first hypothesis connecting adverse childhood experiences to substance use was partially supported: adverse childhood experiences were associated with an increase in smoking in the last year and lifetime illicit drug use, but not number of days drunk in the past year. The second aim considered the degree to which neighborhood resources might moderate these associations. There was no evidence for the second hypothesis that neighborhood resources would play a protective role by moderating the correlation between adverse childhood experiences and later substance use. On the contrary, for smoking, this correlation was even stronger in the presence of a high number of youth services in the neighborhood.

There was some support for the third hypothesis that the associations among adverse childhood experiences, neighborhood resources, and substance use would differ across cohorts with different windows of time for having adverse experiences and for measuring substance use. One marginally significant interaction between adverse childhood experiences and norms against deviant adolescent behavior suggests that norms attenuate the positive association between adverse childhood experiences and likelihood of lifetime illicit drug use, but only for the oldest cohort. In other words, young adults exposed to adverse childhood experiences but living in neighborhoods where substance use was more stigmatized had less lifetime illicit drug use than their similarly exposed peers in other neighborhoods. Otherwise, neighborhood resources had the strongest moderating role for older cohorts, but in the opposite direction than hypothesized as

discussed above. Furthermore, the multiple group models revealed an interaction with collective efficacy that operated the same way as with youth services so that adverse childhood experiences were associated with even greater cigarette smoking among youth in neighborhoods with higher collective efficacy, but again only for the oldest cohort.

These results point to three main themes. First, adverse childhood experiences are a salient risk factor for some types of substance use. This study showed consistent associations between adverse childhood experiences and the amount of cigarettes smoked and the likelihood of illicit drug use, although not the amount of days drunk in the past year. These results are consistent with other studies linking adverse childhood experiences to smoking and illicit drug use (Anda et al., 1999; Dube et al., 2003), but not drinking alcohol (Dube et al., 2006). Previous studies that found associations between adverse childhood experiences and substance use were based on a disproportionately white and well-educated sample of adults; importantly, this study strengthens the case for this link (at least for smoking and illicit drug use) by demonstrating its existence in a sample of racially and socioeconomically diverse adolescents and young adults in a different region of the country.

Adverse childhood experiences may be connected to substance use and initiation during adolescence for a few different reasons. Experiencing childhood adversity may signal a risky home environment characterized by household and economic instability, conflict, neglect, and a lack of support or cohesion. Youth may experience less monitoring and supervision in such contexts, allowing them more latitude to traverse riskier environments and peer groups where substance use is more common. Furthermore, such family contexts may introduce changes in youth's emotion processing, heightening stress responses and straining positive coping skills (Repetti, Taylor, & Seeman, 2002). Adverse childhood experiences may also be related to

substance use via negative affect and stress pathways in which youth turn to substance use as a way to at least temporarily quell the physical and emotional pain resulting from these experiences (Kilpatrick et al., 2000; Fagan et al., 2014). Finally, because adverse childhood experiences include living with a family member who has a substance abuse problem, youth's own substance use may be due in part to some shared genetic component. Whatever the specific mechanisms, the association between adverse childhood experiences and adolescent substance use likely indicates a stressful experience or environment whereby youth turn to smoking, drinking, or drug use to regulate their mood. Furthermore, initiation and use of these substances during adolescence sets the stage for more sustained use during adulthood, representing one mechanism through which adverse childhood experiences have long-term effects on adult health and mortality outcomes (e.g., Brown et al., 2009).

One limitation of this study is its inability to describe heterogeneity in the effects of different kinds of adverse childhood experiences as well as the timing of these experiences. For example, experiencing the incarceration of a family member in early adolescence may be more consequential for substance use because it is a more proximal stressor. Divorce was included as an adverse childhood experience; however, the effects of divorce on youth may not necessarily be negative (Amato, 2010). This study also relied on primary caregiver reports of adverse childhood experiences, which may produce an underestimate of these experiences due to social desirability bias. If that is the case, model results represent a conservative estimate of effects.

Second, the neighborhood context has implications for youth's substance use and not in necessarily positive or protective ways. Specifically, one kind of neighborhood resource, availability of youth services, was actually associated with an increase in cigarette smoking among youth with adverse childhood experiences. This somewhat counterintuitive result could

be due to a number of reasons. A high level of youth services in a neighborhood may not necessarily cause more substance use, but instead may reflect a demand for counseling and mental health services in a neighborhood. Rather than signaling a community's capacity to mobilize to procure high-quality services, a high level of youth services in a neighborhood might indicate that youth face a number of strains in their lives that could increase their substance use. Another possibility may be that the availability of youth services in a community increases the amount of time youth can spend with other peers without parental supervision but under the guise of a safe environment. These peers could offer models and opportunities for substance use (see O'Donnell, Schwab-Stone & Muyeed, 2002 for an example of the sometimes problematic nature of peer support). In addition, adolescents may not benefit from neighborhood resources that promote social support if adverse childhood experiences are also linked with mistrust of others and impaired social relationships (Repetti et al., 2002; Miller, Chen & Parker, 2011). Another limitation of this study is that neighborhood characteristics could only be captured at one point in time. Thus, this study cannot assess change in neighborhood characteristics over time or, if youth moved residences, the characteristics of the neighborhood into which they moved. Nevertheless, the characteristics of the neighborhood environment experienced in childhood appears to have long-lasting implications throughout the life course (Sampson, 2006).

Third, the association between adverse childhood experiences and substance use varied by type of substance and by age. Specifically, youth with adverse childhood experiences smoked more and were more likely to have used illegal drugs in the past year, but they did not differ in the number of days drunk compared to their peers with no reported adverse experiences. This may reflect a different etiology of drinking versus smoking and drug use among adolescents. In particular, drinking alcohol represents a more normative "rite of passage" during a

developmental period of increased independence and experimentation (Ennett et al., 1997), particularly among more socioeconomically advantaged youth (Humensky, 2010). In contrast to drinking, cigarette smoking and illicit drug use may represent more stigmatized behaviors. If most adolescents generally perceive drinking alcohol to be a normative part of becoming an adult, then youth may drink to socialize or “fit in” with their peer groups (Elek, Miller-Day, & Hecht, 2006), regardless of the stress experienced in their home environment. Indeed, Dube et al. (2006) found that the association between adverse childhood experiences and initiation of alcohol use later adolescence was relatively modest compared to initiation during early and middle adolescence. This finding is consistent with the idea that adverse childhood experiences may be more strongly associated with more stigmatized substance use behaviors (i.e., drinking during early adolescence, smoking cigarettes, or illicit drug use), but more weakly associated when the outcome is a more normative behavior (i.e., drinking during late adolescence).

The association between substance use and adverse childhood experiences appeared to be the strongest among the middle and oldest cohorts, who were approximately ages 18-21 when they reported their substance use and had a longer period of the early life course in which to report adverse experiences. This pattern may be due to the greater variation in the substance use behaviors in the oldest cohort. Similarly, younger teenagers likely have less access and to drugs, alcohol, and cigarettes and fewer opportunities to engage in these behaviors, particularly when still in close proximity to parents and other guardians. This pattern, however, is not predicted by the idea that adverse childhood experiences are most strongly linked with more stigmatized substance use behaviors because substance use during late adolescence and young adulthood is generally more prevalent and normative. If early substance use is initiated more in response to specific stressors rather than to peer pressures and widespread behavioral norms, we would

expect to see the strongest association among younger adolescents. These youth, however, may also be the most reluctant to report use if they fear repercussions from their caregivers, making it more difficult to detect this association. Furthermore, one major limitation of this dataset is the lack of information describing at what specific ages youth face these stressors; the questions used to construct the index of adverse childhood experiences ask about lifetime occurrence. As pointed out by Friedman and colleagues (2015), further research needs to consider sensitive periods in which adverse childhood experiences may be most consequential for youth's development. Analysis with a different dataset, particularly one with a greater number of youth in early to mid-adolescence, is needed to fully understand how adverse childhood experiences might influence the onset and frequency of substance use during adolescence. A final limitation of this study is that multi-level multiple group models could not be performed by gender or by race/ethnicity because there was too little variation in the substance use behaviors among boys and girls separately, as well as too little variation in the characteristics of the neighborhoods that members of the different racial groups cluster in. A sample that contains greater numbers of disadvantaged white youth and advantaged minority youth would be ideal for more completely teasing out how neighborhood context shapes substance use risk among adolescents.

Linking insights from the demography of health, neighborhood effects, and adolescent development literature, this study demonstrates the relevance of examining adolescence and the transition to adulthood as crucial developmental periods linking childhood experiences to adult health. It also offers a start to the examination of the neighborhood and household contexts of substance use trajectories; future work should consider further heterogeneity in the effects of different types of adverse childhood experiences as well as the combination of different types of neighborhood resources in varying structural contexts.

Table 1. Descriptive Statistics for Full Sample and by Cohort/Age

	Frequency (%) or Mean (Standard Deviations)			
	Total sample	Cohort 9	Cohort 12	Cohort 15
Adverse childhood experiences index	2.97 (1.64)	2.99 (1.64)	2.96 (1.54)	3.05 (1.68)
Number of cigarettes smoked in past year	19.68 (76.70)	0.60 (6.19)	13.10 (64.99)	52.73 (118.51)
Number of days drunk in past year	2.44 (10.41)	0.13 (1.32)	1.69 (6.41)	6.24 (17.38)
Ever used illegal drugs	29.23%	6.95%	32.10%	52.80%
Gender (female)	50.72%	46.95%	53.17%	52.48%
Race				
White	15.51%	14.26%	15.67%	17.36%
Latino/a	45.68%	48.39%	44.54%	44.42%
Black	34.88%	32.94%	36.27%	34.71%
Other	3.92%	4.41%	3.52%	3.51%
Age cohort				
Cohort 9	35.93%	100.00%	0.00%	0.00%
Cohort 12	34.59%	0.00%	100.00%	0.00%
Cohort 15	29.48%	0.00%	0.00%	100.00%
Family variables at Wave 1				
Parents married	57.85%	61.86%	57.27%	53.62%
Age of primary caregiver	37.60 (6.24)	35.03 (5.84)	37.77 (5.86)	40.50 (5.80)
Household socioeconomic status	-0.06 (1.43)	-0.05 (1.43)	-0.10 (1.44)	-0.03 (1.41)
Family size	5.39 (2.05)	5.55 (2.13)	5.34 (1.97)	5.25 (2.02)
Neighborhood variables				
Concentrated poverty	-0.03 (0.71)	-0.008 (0.70)	-0.03 (0.73)	-0.08 (0.71)
Immigrant concentration	0.42 (1.04)	0.44 (1.02)	0.42 (1.07)	0.41 (1.02)
Residential stability	-0.004 (0.97)	-0.02 (0.97)	-0.04 (0.99)	0.03 (0.94)
Collective efficacy	0.009 (1.00)	-0.04 (0.97)	-0.03 (1.01)	0.09 (1.01)
Youth services	0.02 (0.99)	0.01 (1.02)	0.03 (0.97)	0.02 (0.98)
Norms about 19 year olds	-0.01 (1.00)	-0.008 (1.00)	-0.01 (1.02)	-0.02 (0.98)
<i>n</i>	1,658	590	568	484

Note: 16 cases are missing on the cohort/age variable.

Table 2. Results from Ordinary Least Squares and Logistic Regression Models Predicting Substance Use Outcomes

	Unstandardized Coefficients (Standard Errors)		
	Number of Cigarettes	Number of Days Drunk	Lifetime Illicit Drug Use
	(1)	(2)	(3)
Adverse childhood experiences index	3.315* (1.591)	0.228 (0.162)	0.140** (0.051)
Individual characteristics			
Female	-11.924** (4.005)	-1.869*** (0.518)	-0.624*** (0.121)
Race (reference: White)			
Latino/a	-28.098*** (7.526)	-0.289 (0.847)	-0.088 (0.195)
Black	-26.819** (7.725)	-0.491 (0.874)	-0.301 (0.205)
Other	-13.225 (13.931)	-1.662* (0.839)	-0.291 (0.386)
Age (reference: Cohort 9)			
Cohort 12	12.322*** (2.962)	1.454*** (0.246)	1.927*** (0.206)
Cohort 15	49.085*** (6.915)	5.692*** (0.834)	2.783*** (0.207)
Family characteristics			
Parents married	-3.148 (3.688)	0.249 (0.503)	-0.458** (0.158)
Age of primary caregiver	2.691 (3.372)	0.762 (0.503)	0.037 (0.122)
Socioeconomic status at Wave 1	1.248 (1.531)	0.334 (0.204)	0.059 (0.055)
Family size	-0.124 (0.866)	-0.128 (0.106)	0.036 (0.034)

Note: † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3. Results from Multilevel Models Predicting Number of Cigarettes Smoked in Past Year

	Unstandardized Coefficients (Standard Errors)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Adverse childhood experiences index	3.315* (1.591)	3.098* (1.567)	3.063* (1.548)	3.099* (1.573)	2.938† (1.499)	3.084* (1.559)	3.082† (1.571)
Individual characteristics							
Gender (female)	-11.924** (4.005)	-12.247** (4.030)	-12.502** (4.140)	-12.242** (4.007)	-12.332** (4.012)	-12.190** (4.060)	-12.185** (4.051)
Race (reference: White)							
Latino/a	-28.098*** (7.526)	-25.832** (8.430)	-25.736** (8.346)	-25.796** (8.715)	-26.495** (8.577)	-25.465** (8.493)	-25.453** (8.495)
Black	-26.819** (7.725)	-26.998** (8.681)	-26.364** (8.675)	-26.985** (9.213)	-27.053** (9.016)	-26.538** (9.054)	-26.547** (9.054)
Other	-13.225 (13.931)	-12.541 (15.139)	-11.610 (15.171)	-12.503 (15.277)	-13.625 (14.943)	-12.244 (15.264)	-12.244 (15.277)
Age (reference: Cohort 9)							
Cohort 12	12.322*** (2.962)	12.309*** (2.922)	12.378*** (2.941)	12.309*** (2.926)	12.307*** (2.876)	12.287*** (2.923)	12.288*** (2.931)
Cohort 15	49.085*** (6.915)	48.860*** (6.872)	49.112*** (6.930)	48.873*** (6.904)	48.856*** (6.895)	48.837*** (6.863)	48.841*** (6.864)
Family characteristics							
Parents married	-3.148 (3.688)	-3.704 (3.663)	-3.814 (3.679)	-3.698 (3.662)	-3.184 (3.645)	-3.698 (3.681)	-3.695 (3.667)
Age of primary caregiver	2.691 (3.372)	1.715 (3.545)	1.747 (3.549)	1.709 (3.495)	1.206 (3.508)	1.675 (3.531)	1.664 (3.529)
Socioeconomic status at Wave 1	1.248 (1.531)	0.259 (1.699)	0.287 (1.699)	0.258 (1.700)	0.357 (1.718)	0.267 (1.698)	0.266 (1.695)
Family size	-0.124 (0.866)	-0.395 (0.841)	-0.417 (0.835)	-0.393 (0.823)	-0.208 (0.826)	-0.398 (0.823)	-0.400 (0.821)
Neighborhood characteristics							
Concentrated disadvantage		-2.677 (3.417)	-2.858 (3.352)	-2.685 (3.064)	-2.909 (3.071)	-3.026 (3.065)	-3.030 (3.092)

Table 3 continued on next page.

Table 3 continued.

	Unstandardized Coefficients (Standard Errors)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Neighborhood characteristics							
Immigrant population		-1.527 (2.227)	-1.440 (2.257)	-1.489 (2.159)	-1.629 (2.161)	-0.982 (2.373)	-0.993 (2.356)
Residential instability		2.724 (2.436)	2.596 (2.473)	2.833 (2.370)	2.688 (2.298)	3.181 (2.094)	3.174 (2.094)
Neighborhood resources							
Collective efficacy		0.102 (3.903)	-4.495 (4.439)				
Collective efficacy x ACE			1.575 (1.852)				
Youth services				0.168 (2.100)	-9.580* (4.052)		
Youth services x ACE					3.222* (1.366)		
Normative expectations						-1.174 (2.293)	-1.278 (3.833)
Norms x ACE							0.026 (1.587)

Note: † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4. Results from Multilevel Models Predicting Number of Days Drunk in Past Year

	Unstandardized Coefficients (Standard Error)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Adverse childhood experiences index	0.228 (0.162)	0.154 (0.159)	0.149 (0.153)	0.158 (0.160)	0.230 (0.159)	0.158 (0.160)	0.158 (0.159)
Individual characteristics							
Gender (female)	-1.869*** (0.518)	-1.932*** (0.508)	-1.961*** (0.504)	-1.936*** (0.505)	-1.885*** (0.505)	-1.933*** (0.510)	-1.932*** (0.510)
Race (reference: White)							
Latino/a	-0.289 (0.847)	-1.055 (1.003)	-1.055 (1.014)	-1.228 (1.051)	-0.968 (1.049)	-1.127 (0.981)	-1.127 (0.982)
Black	-0.491 (0.874)	-1.116 (0.949)	-1.037 (0.961)	-1.318 (0.959)	-0.930 (0.939)	-1.230 (0.867)	-1.230 (0.866)
Other	-1.662* (0.839)	-2.234* (0.935)	-2.096* (0.907)	-2.335* (0.959)	-2.045* (0.943)	-2.256* (0.902)	-2.254* (0.895)
Age (reference: Cohort 9)							
Cohort 12	1.454*** (0.246)	1.421*** (0.250)	1.430*** (0.255)	1.425*** (0.252)	1.433*** (0.249)	1.427*** (0.252)	1.428*** (0.251)
Cohort 15	5.692*** (0.834)	5.773*** (0.810)	5.801*** (0.823)	5.779*** (0.834)	5.681*** (0.820)	5.786*** (0.825)	5.785*** (0.824)
Family characteristics							
Parents married	0.249 (0.503)	0.161 (0.484)	0.152 (0.487)	0.151 (0.483)	0.287 (0.486)	0.160 (0.486)	0.160 (0.488)
Age of primary caregiver	0.762 (0.503)	0.361 (0.468)	0.365 (0.470)	0.383 (0.473)	0.813† (0.492)	0.374 (0.471)	0.374 (0.472)
Socioeconomic status at Wave 1	0.334 (0.204)	0.445† (0.255)	0.450† (0.258)	0.460† (0.254)	0.456† (0.254)	0.454† (0.255)	0.454† (0.256)
Family size	-0.128 (0.106)	-0.214† (0.110)	-0.218* (0.110)	-0.218* (0.107)	-0.154 (0.106)	-0.215* (0.107)	-0.215* (0.108)

Table 4 continued on next page.

Table 4 continued.

	Unstandardized Coefficients (Standard Error)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Neighborhood characteristics							
Concentrated disadvantage		0.743 (0.521)	0.718 (0.515)	0.668 (0.482)	0.630 (0.480)	0.690 (0.449)	0.691 (0.455)
Immigrant population		0.481 (0.390)	0.490 (0.397)	0.395 (0.355)	0.417 (0.357)	0.455 (0.437)	0.456 (0.438)
Residential instability		0.093 (0.330)	0.078 (0.334)	0.135 (0.252)	0.124 (0.251)	0.206 (0.270)	0.206 (0.270)
Neighborhood resources							
Collective efficacy		0.214 (0.532)	-0.526 (0.446)				
Collective efficacy x ACE			0.251 (0.212)				
Youth services				-0.218 (0.322)	-0.545 (0.558)		
Youth services x ACE					0.113 (0.151)		
Normative expectations						0.003 (0.315)	-0.025 (0.532)
Norms x ACE							0.009 (0.157)

Note: † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 5. Results from Multilevel Models Predicting Lifetime Illicit Drug Use

	Unstandardized Log Odds (Standard Error)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Adverse childhood experiences index	0.140** (0.051)	0.139** (0.051)	0.139** (0.052)	0.138** (0.051)	0.138** (0.051)	0.140** (0.051)	0.138** (0.051)
Individual characteristics							
Gender (female)	-0.624*** (0.121)	-0.648*** (0.122)	-0.648*** (0.124)	-0.651*** (0.124)	-0.651*** (0.124)	-0.650*** (0.121)	-0.649*** (0.120)
Race (reference: White)							
Latino/a	-0.088 (0.195)	-0.037 (0.235)	-0.036 (0.235)	-0.123 (0.244)	-0.141 (0.273)	-0.038 (0.230)	-0.056 (0.237)
Black	-0.301 (0.205)	-0.258 (0.252)	-0.256 (0.271)	-0.316 (0.258)	-0.314 (0.265)	-0.223 (0.250)	-0.246 (0.241)
Other	-0.291 (0.386)	-0.353 (0.408)	-0.351 (0.404)	-0.395 (0.412)	-0.404 (0.414)	-0.338 (0.403)	-0.343 (0.398)
Age (reference: Cohort 9)							
Cohort 12	1.927*** (0.206)	1.973*** (0.208)	1.973*** (0.208)	1.971*** (0.210)	1.966*** (0.219)	1.977*** (0.207)	1.967*** (0.208)
Cohort 15	2.783*** (0.207)	2.831*** (0.206)	2.831*** (0.206)	2.834*** (0.209)	2.833*** (0.212)	2.832*** (0.205)	2.830*** (0.207)
Family characteristics							
Parents married	-0.458** (0.158)	-0.456** (0.161)	-0.456** (0.161)	-0.465** (0.162)	-0.465** (0.162)	-0.462** (0.162)	-0.466** (0.161)
Age of primary caregiver	0.037 (0.122)	0.070 (0.123)	0.071 (0.123)	0.066 (0.124)	0.064 (0.124)	0.074 (0.125)	0.068 (0.123)
Socioeconomic status at Wave 1	0.059 (0.055)	0.054 (0.056)	0.054 (0.056)	0.067 (0.057)	0.070 (0.062)	0.055 (0.057)	0.056 (0.057)
Family size	0.036 (0.034)	0.037 (0.033)	0.037 (0.033)	0.035 (0.033)	0.038 (0.032)	0.037 (0.033)	0.039 (0.032)

Table 5 continued on next page.

Table 5 continued.

	Unstandardized Log Odds (Standard Error)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Neighborhood characteristics							
Concentrated disadvantage		0.016 (0.136)	0.017 (0.136)	0.000 (0.127)	0.010 (0.178)	-0.047 (0.127)	-0.030 (0.116)
Immigrant population		-0.039 (0.099)	-0.037 (0.114)	-0.052 (0.104)	-0.040 (0.142)	0.026 (0.105)	0.037 (0.130)
Residential instability		-0.052 (0.120)	-0.052 (0.121)	-0.049 (0.093)	-0.048 (0.091)	0.039 (0.113)	0.050 (0.090)
Neighborhood resources							
Collective efficacy		0.082 (0.096)	0.079 (0.127)				
Collective efficacy x ACE			0.002 (0.034)				
Youth services				-0.128 (0.088)	-0.190 (0.291)		
Youth services x ACE					0.020 (0.092)		
Normative expectations						-0.104 (0.085)	0.034 (0.161)
Norms x ACE							-0.047 (0.052)

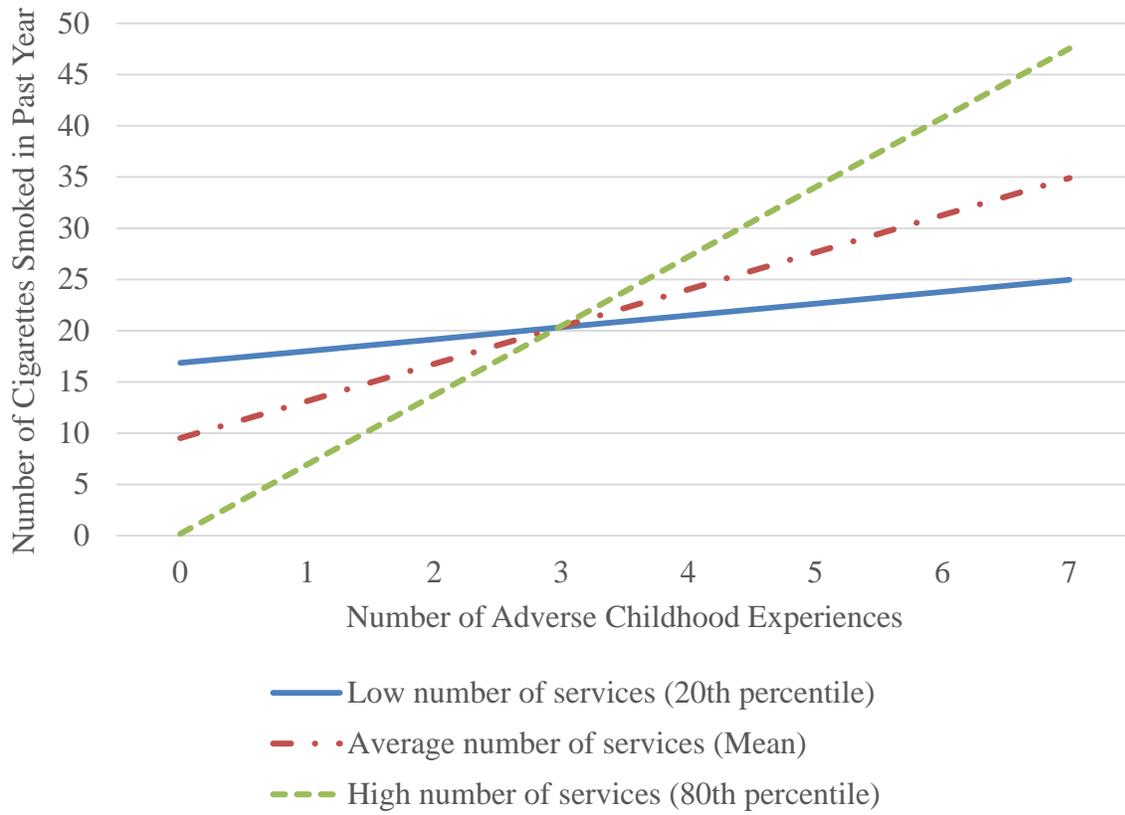
Note: † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 6. Multiple Group Models Predicting Substance Use with Neighborhood Resources, by Age/Cohort

	Unstandardized Coefficients (Standard Error)								
	Cigarettes Smoked (Column 1)			Days Drunk (Column 2)			Illegal Drug Use (Column 3)		
	Age/Cohort			Age/Cohort			Age/Cohort		
	9	12	15	9	12	15	9	12	15
Adverse childhood experiences (ACEs)	-0.138 (0.681)	2.332 (2.719)	8.511* (3.640)	0.143† (0.082)	0.272† (0.164)	0.302 (0.413)	0.145 (0.103)	0.202** (0.069)	0.105 (0.066)
Collective efficacy	-3.526 (4.479)	-3.526 (4.479)	-3.526 (4.479)	-0.466 (0.461)	-0.466 (0.461)	-0.466 (0.461)	0.110 (0.122)	0.110 (0.122)	0.110 (0.122)
Collective efficacy x ACEs	-0.600 (1.051)	-0.095 (1.899)	5.398† (3.118)	0.124 (0.109)	0.184 (0.144)	0.459 (0.430)	-0.030 (0.046)	-0.013 (0.031)	0.012 (0.034)
Adverse childhood experiences (ACEs)	-0.304 (0.747)	2.147 (2.700)	8.368* (3.533)	0.127 (0.086)	0.275 (0.173)	0.298 (0.418)	0.123 (0.100)	0.204** (0.071)	0.103 (0.067)
Services	-9.871* (3.994)	-9.871* (3.994)	-9.871* (3.994)	-0.460 (0.601)	-0.460 (0.601)	-0.460 (0.601)	-0.112 (0.135)	-0.112 (0.135)	-0.112 (0.135)
Services x ACEs	1.829† (0.955)	3.299** (1.080)	5.217* (0.041)	0.076 (0.141)	0.006 (0.211)	0.196 (0.260)	0.071 (0.053)	-0.017 (0.049)	-0.002 (0.049)
Adverse childhood experiences (ACEs)	-0.121 (0.696)	2.459 (2.856)	8.639* (3.762)	0.142† (0.084)	0.256 (0.158)	0.317 (0.426)	0.145 (0.101)	0.200** (0.068)	0.108 (0.066)
Normative expectations	-1.949 (3.922)	-1.949 (3.922)	-1.949 (3.922)	-0.062 (0.552)	-0.062 (0.552)	-0.062 (0.552)	0.042 (0.132)	0.042 (0.132)	0.042 (0.132)
Norms x ACEs	0.755 (1.061)	-0.201 (0.374)	-1.363 (2.515)	0.042 (0.143)	-0.044 (0.159)	0.011 (0.280)	-0.022 (0.064)	-0.033 (0.043)	-0.073† (0.040)

Note: All models control for gender, race, primary caregiver's marital status, age of primary caregiver, Wave 1 socioeconomic status, family size, neighborhood concentrated disadvantage, immigrant population, and residential instability; † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 1. Predicted Number of Cigarettes Smoked by ACEs and Youth Services



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