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Effects of Prenatal Alcohol Exposure in a Prospective Sample of Young Adults: Mental Health, Substance Use, and Difficulties with the Legal System

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Abstract

Introduction—Few studies have focused on the transition to adulthood in adults with prenatal alcohol exposure (PAE). In this study, we examine the occurrence of problem behavior at this transition, including mental health problems, substance use, and difficulties with the legal system. The sample is prospective and provides an opportunity to examine effects of a wide range of prenatal exposure. Adults with PAE were expected to show more problem behavior; the impact of level of exposure was examined as well.

Method—The sample was drawn from a predominantly low-income, African-American population. Mothers of the alcohol-exposed participants (n = 123) and those in the non-exposed SES-Control group (CONT) (n = 59) were recruited at a prenatal visit when information on alcohol and drug use during pregnancy was collected. A disability contrast group (n= 54) was recruited at adolescence. The adults with PAE were assigned to three groups varying in physical and cognitive effects of exposure. This report is based on the adults' responses to interviews or questionnaires on problem behavior and laboratory tests related to substance use.

Results—Adults with PAE showed more problem behavior in all three areas than adults from the CONT group. For mental health problems, the exposed group showing cognitive, but not physical effects, had the highest scores; their scores were similar, however, to those of the disability contrast group on several scales. Results for outcomes on substance use and legal difficulties were less consistent, but, when significant effects occurred, the group that was exposed, but neither physically nor cognitively affected, was more likely to show negative outcomes. Males in this group were most involved in these behaviors.

Conclusion—Effects of PAE continue into early adulthood and affect mental health problems, substance use, and interactions with the legal system. Adults who are exposed, but less physically affected, seem to be the most involved in problem behavior. More research is necessary to examine

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environmental effects in conjunction with PAE on these outcomes and to provide a basis for developing potential interventions.

Keywords

prenatal alcohol exposure; mental health; substance use; legal difficulties; transition to adulthood

1. Introduction

While effects of prenatal alcohol exposure (PAE) have been studied extensively in children (e.g., Kodituwakku, 2007; Flak et al., 2014; Mattson et al., 2011), there has been relatively little research on effects of PAE on adaptive development and problem behavior in adults, particularly at the transition to adulthood (Lynch et al., 2015; Day et al., 2013). This is a topic of great interest given the frequently expressed concern that PAE is associated with increased rates of substance abuse and criminal behavior (Streissguth et al., 1996; Fast et al., 1999).

PAE is related to a variety of physical and neurodevelopmental problems (e.g., Riley et al., 2011; Mattson et al., 2011). Jones and Smith (1973) first described fetal alcohol syndrome (FAS), the most severe outcome of prenatal alcohol exposure, more than forty years ago; effects include a specific pattern of dysmorphic facial characteristics, slow or delayed physical growth, and neurodevelopmental problems related to effects of PAE on the central nervous system. Since that time, a range of effects varying in severity on physical, cognitive, and behavioral development has been described and defined collectively as fetal alcohol spectrum disorders (FASDs) (Warren, Hewitt, & Thomas, 2011; Senturias, 2014; Riley et al., 2011). According to the Centers for Disease Control and Prevention (CDC) (2016), prevalence estimates for FAS based on record reviews in previous surveillance studies (CDC, 2002; 2015) suggest a rate of .2 to 1.5 per 1,000 infants born. Recent studies by May and colleagues (May, Gossage et al., 2009; May et al., 2014) suggest that estimates for prevalence for the full FASD spectrum may be as high as 2–5% in the U.S. and in some western areas of Europe. The CDC (2016) reports this estimate as well.

Streissguth et al. (1996) also introduced the concept of PAE-related secondary disabilities (as compared to primary disabilities that affect physical and intellectual characteristics). These disabilities are not present at birth, but develop over time and may be responsive to interventions; problem behaviors such as substance use, mental health problems or involvement in criminal behavior are considered secondary disabilities. Severity of these disabilities also is related to risk and protective factors occurring in the individual's environment.

The transition from adolescence to adulthood presents critical challenges to individuals with FASDs; their ability to navigate this transition is likely to affect adaptive behavior throughout the adult years. Osgood et al. (2005) have discussed the difficulties young people with disabilities face in meeting the challenges of this transition due to limitations in their abilities and skills. In addition, as they reach adulthood, educational supports and services that may have been helpful in childhood and adolescence are often no longer available to them. Osgood described the challenges as including both 1) difficulties in entering adult

educational, work, and family roles, and 2) structuring or managing adult life, which includes learning to avoid problem behaviors independently. Young adults with FASDs are vulnerable in both these areas due to limitations in cognitive and behavioral capabilities. While Lynch et al. (2015) focused on difficulties faced by young adults affected by PAE on adaptive function and entry into adult roles, this companion paper focuses on the transition to adulthood in the same individuals and effects on problem behavior. Prior work on problem behavior suggests that the areas of mental health, substance use, and legal difficulties will be particularly relevant for young adults with FASDs (e.g., Streissguth et al., 1996, 2004; Famy et al., 1998; Fast et al., 1999; Baer et al., 2003; Alati et al., 2006).

1.1. Mental health issues

Several studies based on a variety of data sources show a strong relationship between PAE and mental health problems in adults (O'Connor & Paley, 2009; Streissguth et al., 1996; Famy et al., 1998; Freunscht & Feldmann, 2011; Rangmar et al., 2015; Day et al., 2013; Barr et al., 2006). Streissguth et al., and Famy et al., both examined rates of mental health problems in samples of adults with PAE-related diagnoses and reported that large proportions experienced difficulties in this area. Streissguth et al. found that, based on informant ratings of adults aged 21–51, more than 50% had experienced problems with depression, 29% had psychotic symptoms, and 23% had attempted suicide. In their examination of records from national health registers in Sweden, Rangmar et al. (2015) reported that 32.9% of the FAS group had received hospital care for a psychiatric disorder and 57.3% had been prescribed at least one psychotropic medication between 2005 and 2011 as compared to 4.7% and 26.5% respectively for the comparison group.

Both Barr et al. and Day et al. focused on younger adults in their studies. Barr et al. reported that, in their analysis of data from a non-clinical sample, binge-drinking in pregnancy was related to psychiatric problems in early adulthood; the odds ratios for six psychiatric disorders were at least two times higher for offspring of mothers who binged in pregnancy when compared to adults whose mothers did not. It should be noted that Barr et al. controlled for a number of other potential factors that may influence development of psychiatric disorders, including family history of psychiatric problems, in their analysis. Day et al. analyzed self-report data on behavior problems at 22 years of age for their prospective longitudinal sample. They administered the Adult Self Report (Achenbach & Rescorla, 2003), a standardized measure of behavior problems that yields summary scores on Total Problems, Internalizing and Externalizing as well as scores on subscales. Results showed that, with relevant covariates controlled, prenatal exposure was related significantly to higher scores on Internalizing, Externalizing, Total Problems, Critical Items, and Attention scales.

1.2. Substance Abuse

Several studies support a relationship between PAE and substance use in adulthood (e.g., Alati et al., 2006; Baer et al., 2003; Famy et al., 1998; Streissguth et al., 2004, 1996; Yates et al., 1998), although not all studies are consistent (Freunscht & Feldmann, 2011). Streissguth et al. reported that about 46% of the adults in their clinical sample had experienced alcohol or drug problems. Binge drinking and consumption of higher amounts (i.e., three or more drinks per occasion) of alcohol by mothers during pregnancy have been related to increased

risk for alcohol disorders in adulthood (Baer et al., 2003; Alati et al., 2006). Rangmar et al., in their study based on Swedish health registries, reported higher rates of hospital treatment for alcohol-related disorders and drug use for adults in the FAS group (8.9% and 6.3%) as compared to the control group (1.6% and 2.5%).

1.3. Difficulties with the legal system

Studies of participation in criminal activity and incarceration by the criminal justice system suggest that PAE is associated with legal difficulties (Fast & Conry, 2009; Streissguth et al., 1996; 2004). Streissguth et al., reported that, for the 90 adults with PAE included in their sample, 58% reported having experienced “trouble with the law,” defined as having been in trouble with authorities, charged, or convicted of criminal behavior ranging from crimes against persons or property to less serious offenses such as escape or parole violations. Crimes against persons (e.g., assault, burglary, theft (including shoplifting), murder) were the most frequently reported crimes. When incarceration rates were examined, 35% of adolescents and adults included in the sample had been incarcerated at some point. On the other hand, Rangmar’s examination of the Swedish Registry of Criminal Offenses showed that individuals diagnosed with FAS and those in the control group did not differ significantly in the rate of convictions (27.8% and 20.3% respectively) or in convictions for a serious crime (6.3% vs. 4.0%).

One possible explanation for these results is that Streissguth’s sample includes both individuals with FAS and FAE, a less severe PAE diagnosis, while Rangmar’s includes only adults with FAS. Both Fast & Conry and Streissguth et al., have pointed out that higher IQ is not protective when considering difficulties with the legal system and the odds ratios examining IQ as a predictor of these outcomes in Streissguth’s study support this assertion. Inclusion of more participants who were less affected by PAE (and a large proportion with IQs over 70) in the Streissguth study is likely to have contributed to the higher reports of criminal behavior.

In summary, there is support in the literature for a relationship between PAE and problems related to mental health, substance use, and illegal behavior in adults. Few studies have focused on the transition to adulthood as a developmental period; and many have been based only on clinical samples (e.g., Streissguth et al., 1996). Outcomes for less severely affected young adults who have been exposed, but seem to be unaffected physically or cognitively, have not been thoroughly explored (Lynch et al., 2015). This prospective community sample of exposed adults, as opposed to samples in several previous studies, is not limited to clinically diagnosed participants and allows examination of problem behavior in young adults who represent a wide range of prenatal exposure to alcohol.

As discussed in detail in our companion paper (Lynch et al., 2015), there are three exposed groups in the analysis. The groups are defined by physical and cognitive effects of PAE: 1) the Dysmorphic group (DYSM) is most severely affected and shows dysmorphology associated with PAE; 2) the Cognitively Affected (COG-AFF) group includes participants with cognitive effects only; and 3) the Cognitively Unaffected (COG-UNAFF) participants do not show physical or cognitive effects of PAE. Please note that the exposed groups are not defined by amount of reported prenatal alcohol exposure, although the DYSM group’s

exposure is higher than that of the two nondysmorphic (COG-AFF, COG-UNAFF) groups (see Table 1).

In addition, two control groups are included in the sample: One group includes adults whose mothers did not drink during pregnancy and were recruited at the same time and place as the exposed participants; this group (CONT) will control for effects of socioeconomic status (SES). The second group, the Special Education Contrast (SPEC) group, was recruited at adolescence and is used to provide a comparison to adults with learning problems or disabilities.

We investigated two alternative hypotheses:

1a) Adults with PAE will show more involvement in problem behavior than those in the unexposed control group (CONT):

1b) The severity of PAE effects will be positively related to the severity of problem behavior (DYSM>COG AFF> COG UNAFF).

Prior studies have shown that lower IQ is protective against problem behavior (e.g., Streissguth et al., 1996; Fast & Conry, 2009) and our own work (Lynch et al., 2015) on adaptive behavior showed that participants who were less affected by PAE (COG-AFF group) had more negative outcomes than the DYSM group in some areas. In this study we will also examine outcomes for a group that seems to be neither physically nor cognitively affected by PAE and for whom outcomes have seldom been explored (COG-UNAFF). Prior studies suggest that higher IQ will not be protective against involvement in problem behavior; this group, therefore, may be most at risk in this area. For this reason, we would like to offer the following alternative hypotheses:

2a) Adults with PAE will show more involvement in problem behavior than those in the unexposed control group (CONT);

2b) The severity of problem behavior will be inversely related to severity of effects (COG-UNAFF> COG AFF > DYSM). The less severe the PAE and IQ effects, the more likely problem behavior will occur. This hypothesis effectively includes higher IQ as a risk factor.

The Special Education Contrast (SPEC) group has been included so results for the PAE groups can be viewed in relation to those of young adults with disabilities or learning problems; no hypotheses are offered concerning this group. The group is included to provide context for interpreting the results for the PAE groups.

2. Method

2.1 Participants

The sample for this study includes young adult participants previously enrolled in a longitudinal study on effects of prenatal alcohol exposure on development. The procedures and study were approved by the Emory Institutional Review Board. The full sample for this follow-up includes 236 participants; initial recruitment for 182 (59 unexposed and 123 alcohol-exposed) infants born between 1980 and 1986 took place at an Atlanta hospital

serving a lower socioeconomic status (SES), African-American community (Coles et al., 1985, 1987). Mothers completed an interview at a prenatal visit where questions were asked about alcohol and drug use in pregnancy. Based on the maternal responses to questions on frequency and quantity of alcohol use, the alcohol-exposed sample included children of mothers who drank at least one ounce of absolute alcohol (AA) per week (about two drinks). As can be seen in Table 1, mothers in all alcohol-exposed groups drank much greater amounts on average. Young adults whose mothers reported abstaining during pregnancy compose the unexposed or SES-control group.

The method for defining the groups is described in detail in Lynch et al. (2015). Briefly, three factors were used to define groups from the original sample: 1) maternal alcohol use in pregnancy, 2) highest score on a checklist for dysmorphology (Coles et al., 2016) at prior follow-up visits, and 3) full-scale intelligence quotient (FSIQ) scores at the adult visit. The groups were defined in the following way:

1. *SES-Control (CONT)* (n = 59): Mothers of participants in this group reported that they did not drink at all during pregnancy. The Mean FSIQ for this group was 86.07; the standard deviation (SD) = 11.56.
2. *Exposed, Dysmorphic (DYSM)* (n = 48): To meet criteria for this group, the participant must have had at least one dysmorphology score at one of three prior visits that was one standard deviation or more above the mean for the full sample. This was the most severely affected group as more physical dysmorphology is associated with greater cognitive deficits (Coles et al., 1997). Individuals in this group are likely to show both physical and cognitive effects of PAE. The mean FSIQ for this group was 75.66; SD = 13.02;
3. *Exposed, Cognitively Affected (COG- AFF)* (n = 37): All participants were considered nondysmorphic (did not meet criteria for the DYSM group). Based on a median split of IQ scores for all nondysmorphic participants, these participants were below the median (IQ< 84) and, so, showed cognitive, but not physical effects of PAE (Mean FSIQ = 73.62; SD = 8.37);
4. *Exposed, Cognitively Unaffected (COG-UNAFF)* (n = 38): All participants were nondysmorphic as above and scored above the median for nondysmorphic participants on FSIQ (IQ ≥ 84). These participants showed neither physical nor cognitive effects of PAE. The mean FSIQ for this group was 95.00; SD = 9.27.
5. *Special Education Contrast (SPEC)* (n = 54): This group was included as a control for disability status. The group includes participants who were enrolled in special education classes in public schools when they were recruited at adolescence; they are similar demographically to the original sample. The mean FSIQ for this group was 84.94; SD = 13.9.

Demographic, background, and prenatal exposure characteristics are displayed for each group in Table 1.

2.2. Procedure

The procedure is the same as that described in Lynch et al. (2015), but will be described briefly here. Adults were invited to participate in a day-long data collection session that included a neurocognitive evaluation, a medical evaluation, and an interview session on adaptive behavior, problem behavior, and background characteristics. The outreach staff members discussed the study with potential participants and obtained consent using the IRB-approved form and procedure. Interviews or questionnaires were read to adults who were not able to read well enough to comprehend the questions themselves. Blood and urine samples were obtained during the medical evaluation so tests related to substance use could be completed. Grouping by cognitive status for nondysmorphic adults was based on the full-scale IQ score (WASI, Wechsler, 1999) obtained during the neurocognitive testing session. Participants were compensated with $100; transportation and lunch also were provided.

The initial pool of participants included 427 adults. Of these, 319 (74.7%) were located during recruitment for the study. The final sample included 236 (74% of those located) adults who participated in the interview and medical evaluation segments of the study. Those who were located, but did not participate, included nine (2.8%) who were deceased, 23 (7.2%) who had moved out of the geographic area, 19 (6%) who were unavailable at the time of data collection (criminal justice system (n = 11), military (n = 5), college (n = 3)), and 31 (9.7%) who refused to participate. One additional participant (from SPEC group) also was excluded due to severe mental health problems that prevented him from completing the data collection.

2.3 Measures

Outcome measures include several interview and questionnaire measures of mental health problems, substance use, and difficulties with the legal system. Laboratory test results on substance use also were included. A table displaying instruments and outcome variables is included in the Appendix.

2.3.1. Mental health problems—Adults completed the Adult Self Report (ASR) (Achenbach and Rescorla, 2003), a self-report measure of behavior problems, as a measure of mental health problems. This measure includes 126 problem behavior items that are rated by the participant as “Not true,” “Sometimes or Somewhat True,” or “Very True or Often True.” As Achenbach and Rescorla report, the measure is standardized, has been widely used, and has ample supporting reliability and validity data. Although this instrument focuses on ratings of behavior problems, the authors report that significant differences occurred on all problem behavior scales in validation studies between adults referred for mental health or substance use services and those who were not referred. Construct validity evidence included positive relationships with diagnostic assessments. Dependent variables based on this measure are T-scores on the following summary scales: Total Problems, Internalizing, and Externalizing. The Internalizing summary score includes scores on the Anxious/Depressed, Withdrawn, and Somatic Complaints subscales; the Externalizing summary score summarizes scores on the Aggressive Behavior, Rule-breaking Behavior, and Intrusive subscales. Three additional subscales (Attention, Thought Problems, and Critical Items) are not included on either the Internalizing or Externalizing summary scales. The

Critical Items scale includes 19 items rated by expert clinicians as being of great clinical concern. According to the authors, all 19 items were rated as “definitely critical” or of high clinical concern by at least 62% of the expert clinical raters. Raw scores on these nine subscales also will be dependent variables in the analysis. Both Achenbach & Rescorla and Day et al., (2013) recommend use of raw scores for analyses of subscales. The T-score ranges for the subscales are truncated at 50, so the raw scores assure that the full range of scores (including lower scores) are included in the analyses.

2.3.2. Substance use—Both laboratory tests for evidence of alcohol and drug use and self-reports of use were included in the protocol. Urine samples were tested for evidence of use of seven drugs: amphetamines, benzodiazepines, barbiturates, cocaine, opiates, marijuana, and phencyclidine. Blood samples also were analyzed for level of gamma glutamyl transferase (GGT); high levels of this enzyme are associated with excessive alcohol use. The Drug Grid (Coles et al., 1992), a short self-report measure used to collect information on current and historic substance use, also was administered. The measure provides information on current use as well as frequency and amount of use for tobacco, alcohol, and several other drugs. The variable used in the analysis to indicate amount of alcohol consumption by the adult was the amount of absolute alcohol consumed per week (AA per week). This variable is based on a quantity X frequency calculation using information obtained in the Drug Grid on how much the adult consumed per occasion and frequency of drinking. The calculation results in a standard measure of amount of absolute alcohol per week (AA per week); one ounce of absolute alcohol is regarded as equivalent to two drinks.

2.3.3. Difficulty with the legal system—Questions on difficulty with the legal system were drawn from responses to the Legal Status section of the Addiction Severity Index (ASI) (McLellan et al., 1985). Outcomes in this analysis include whether the adult was currently on probation or parole, the number of times arrested and charged with a series of crimes, number of charges resulting in convictions, whether the adult was ever incarcerated, and, if so, the amount of time incarcerated.

2.3.4. Potential covariates—Potential covariates have been chosen based on our prior work with this cohort (Lynch et al., 2003; 2015) and on significance of relations to the grouping variable as seen in Table 1. Potential covariates include adult’s report of negative life stress, adult educational level achieved, and other prenatal exposures (tobacco, marijuana, and cocaine). Covariates were evaluated for inclusion in each analysis separately; the evaluation process is described in the data analysis section.

2.3.4.1. Life stress: As life stress was significantly related to behavioral outcomes previously with this sample (Lynch et al., 2003, 2015), a measure of negative life stress was included in these analyses as a covariate. Adults responded to the Life Stresses and Social Resources Inventory (LISRES) (Moos & Moos, 1994). This measure includes sixteen scales assessing resources and stresses occurring in several domains (e.g., health, home or neighborhood, spouse or partner, children, etc.) of the adult’s life. The summary T-score for

negative life events occurring across life contexts in the past year was the indicator of life stress included as a covariate in the analyses.

2.3.4.2. Adult education achieved: As adult educational level was significantly related to group in the demographic analyses, it was evaluated as a potential covariate for each analysis. The measure is the number of years of school the adult reported completing.

2.3.4.3. Other prenatal exposures: Other prenatal exposures also were significantly related to group, so these variables were examined as potential covariates. Maternal reports of prenatal exposure to tobacco, marijuana, and cocaine were drawn from the archival data set. All variables are dichotomous and, of course, available only for participants from the original sample (n = 182).

2.4. Data analysis

Both continuous and categorical outcome variables were included in this study. The generalized linear modeling approach was used first with continuous variables. Two independent variables were included: Group (5 levels) and Gender (2 levels). Gender is generally associated with the outcomes of interest in this study (e.g., Pratt & Brody, 2014; Weissman, Pratt, Miller, & Parker, 2015; National Institute of Alcohol Abuse and Alcoholism (NIAAA), 2017; U.S. Department of Justice, 2013), so it is important to account for variance due to this factor. Gender also was frequently significant in the previous analyses of adaptive behavior with young women having more positive outcomes than the young men.

A correlation matrix between potential covariates and outcome variables was used to decide which covariates should be included in each analysis. Only those that were significantly related to the outcome were included in the initial analysis. If the covariate was not significant in the model, the analysis was redone without that covariate. If no covariates were significant, the analysis was completed using only the independent variables, Group and Gender, in a two-way analysis of variance. Although prenatal exposures to tobacco, marijuana, and cocaine were evaluated as potential covariates in relation to each outcome variable, they either did not meet criteria for inclusion or did not contribute significantly to any of the models and, therefore, were not included in the final analyses.

Multivariate analyses were completed for clusters of variables (the two overall summary scales, the internalizing subscales, and the externalizing subscales) from the ASR; this is noted in the description of the results for this measure. The Bonferroni method was used for post hoc tests. For categorical variables, the relation between group status and outcome was examined using chi square analyses.

3. Results

3.1. Mental health problems

Dependent variables related to mental health problems are based on analyses of the adult responses to the ASR (Achenbach & Rescorla, 2003). All analyses included Group (5) and Gender (2) as independent variables; measures of negative life stress and adult education

also were included as covariates in all analyses. Univariate analyses were completed for the T-score on Total Problems and the three subscales that were not included on the Internalizing and Externalizing dimensions (Attention Problems, Thought Problems, and Critical Items). Multivariate analyses were completed for three clusters of scales: 1) T-scores for the Internalizing and Externalizing summary scales; 2) raw scores for the Internalizing subscales; and 3) raw scores for the Externalizing subscales. The analyses suggest that PAE is related to mental health outcomes in these adults when comparisons are made to the non-exposed CONT group. The COG-AFF group frequently had the highest score on these variables. The scores for the PAE groups were similar in range to those of individuals in the Special Education (SPEC) group for several scales (e.g., Total Problems, Internalizing Problems, Externalizing Problems, Critical Items). The analyses are discussed in detail below and results by group are displayed in Table 2.

The generalized linear model was used to analyze the T-score for Total Problems. The group effect was significant with the COG-AFF group showing the highest or most negative score (Wald $X^2_{(4)} = 16.69$; $p = .002$); covariates, life stress and adult education, also were significant. Bonferroni multiple comparisons showed that the COG-AFF and SPEC groups had significantly higher scores than the CONT group; the COG-AFF and SPEC groups did not differ from each other.

Multivariate analysis of variance with the same independent variables and the two covariates was completed with the Internalizing and Externalizing T-scores as dependent variables; results were similar to those for Total Problems. The group effect was significant for both Internalizing ($F_{(4, 217)} = 4.428$, $p = .002$) and Externalizing Problems $F_{(4, 217)} = 2.593$, $p = .038$) with the COG-AFF group having the highest or most negative score on each variable; post hoc tests were significant for Internalizing with SPEC significantly higher than the CONT and COG-UNAFF groups; the COG-AFF group was marginally higher than CONT ($p = .092$). For Externalizing, both COG-AFF and SPEC were marginally higher than CONT ($p \leq .097$). Males scored significantly higher ($p = .051$) than females on Externalizing Problems. Life stress was a significant covariate for both Internalizing and Externalizing; adult education was a significant covariate for Externalizing and marginally significant for Internalizing. Estimated marginal means, standard errors, and statistical tests are displayed in Table 2.

Analyses of subscale scores were conducted on the raw scores as recommended by Achenbach & Rescorla (2003) and Day et al., (2013). Multivariate analyses of variance were completed for the three Internalizing subscales (Anxious/Depressed, Withdrawn, and Somatic Complaints) and separately for the three Externalizing subscales (Aggressive Behavior, Rule-Breaking Behavior, and Intrusive). On the Internalizing dimension, group was significant for the Anxious/Depressed subscale ($F_{(4,217)} = 5.01$, $p = .001$) and marginally significant for the Withdrawn subscale ($F_{(4,217)} = 2.07$, $p < .086$). Life stress was a significant covariate on all three scales; adult education was a significant covariate only for the Withdrawn subscale. For Anxious/Depressed, the post hoc test showed that the SPEC group had significantly higher scores than the CONT or COG-UNAFF groups. For both the Withdrawn and Anxious/Depressed scales, the score for the COG-AFF group was higher or more negative than those for other groups from the original sample, but post hoc tests were

not significant. Gender was not significant in any analysis. For the Externalizing subscales, group was significant for the Aggressive Behavior ($F_{(4,217)} = 2.669$, $p = .033$) and Intrusive ($F_{(4, 217)} = 2.82$, $p = .026$) subscales. Post hoc tests showed the COG-AFF group was significantly higher than the CONT group on both subscales. Males had significantly more negative scores on Rule-breaking Behavior ($F_{(1,217)} = 15.32$, $p < .001$) and Intrusive ($F_{(1,217)} = 12.88$, $p < .001$) subscales than females. The covariate, life stress, was significant for all three subscales; adult education was significant for Aggression and marginally significant for Rule-breaking ($p = .07$).

Results of the univariate analyses using the generalized linear model for each of the other three subscales (Attention Problems, Thought Problems, and Critical Items) showed that the group effect was significant for Attention (Wald $X^2_{(4)} = 20.11$, $p < .001$) and Critical Items (Wald $X^2_{(4)} = 16.67$, $p = .002$) and marginally significant for Thought Problems (Wald $X^2_{(4)} = 8.8$, $p = .066$) with the COG-AFF group having the highest or most negative score on two of the three scales (Attention and Thought Problems). Post hoc tests were significant for Attention (COG-AFF and SPEC > CONT) and for Critical Items (CONT < SPEC). Marginally significant post hoc effects also occurred for Attention (COG-UNAFF < COG-AFF and SPEC) and for Critical Items (CONT < COG-AFF and DYSM < SPEC). Males scored significantly higher than females on Thought Problems (Wald $X^2_{(1)} = 6.71$, $p = .01$) and Critical Items (Wald $X^2_{(1)} = 7.937$, $p = .005$). Life stress and adult education were significant covariates in each of the three analyses. Estimated marginal means, standard errors, statistical tests and post hoc test results for each analysis are displayed in Table 2.

3.2. Substance Use

Dependent variables related to substance use include both laboratory test results of biological samples and self-reports of tobacco, alcohol, and drug use. Chi square analyses with group as the independent variable were completed for laboratory tests for evidence of drug use and for self-reported current use of tobacco, alcohol, and other drugs. For alcohol, the continuous variables, GGT level and amount used, were initially analyzed using the generalized linear model described above with Group (5) and Gender (2) as the independent variables and covariates included. The covariates were not significant in either model, so two-way analyses of variance were completed with Group and Gender included as the independent variables.

For laboratory tests for drug use, there were no significant effects of group for use of any of the seven drugs tested. For three drugs, there were no positive results for any participants in the sample. Marijuana use was high for all groups, ranging from 25.9% positive in the CONT group to 50% positive in the SPEC group. Results for self-report, however, were significant for group for current use of tobacco ($X^2_{(4)} = 9.802$, $p = .044$) and marijuana ($X^2_{(4)} = 10.375$, $p = .035$). For groups from the original sample, a larger percentage of participants in the DYSM and COG-AFF groups reported that they currently used tobacco than in the CONT and COG-UNAFF groups. For marijuana use, those in the DYSM and COG-UNAFF groups reported higher use than those in the CONT and COG-AFF groups. For both substances, results for groups with higher use were similar in level to use reported

by the SPEC group. Percentages and statistical tests for each variable are included in Table 3.

For alcohol use, both the laboratory results for level of GGT, an enzyme associated with excessive alcohol use, and the self-reports of alcohol use and amount used, were analyzed. For the laboratory test on alcohol use, two dependent variables were examined: 1) per cent of "out of range" results that occurred and 2) numerical values reported. The chi square analysis of the relation between group and "out of range" results was significant ($X^2_{(4)}$ = 10.335, p = .035); the COG-UNAFF group showed the highest percentage. The Group X Gender analysis of variance of the GGT values showed that there were significant gender ($F_{(1,203)}$ = 19.76, p < .001) and interaction ($F_{(4, 203)}$ = 2.63, p = .036) effects as well as a marginal effect for group (COG-UNAFF highest). Males had higher GGT results than females and the interaction effect suggested that males in the COG-UNAFF group had especially high scores.

For current use of alcohol, the chi square analysis was marginal ($X^2_{(4)}$ = 8.372, p = .079) with adults in the COG-UNAFF and SPEC groups more likely to report current use than adults in other categories. For amount of alcohol use, the calculated quantity X frequency variable, ounces of absolute alcohol per week (AA per week), was the dependent variable. The Group X Gender analysis of variance yielded significant group, gender, and interaction effects. For group ($F_{(4,221)}$ = 3.514, p = .008), participants in the COG-UNAFF and SPEC groups reported consuming higher amounts of alcohol; the Bonferroni post hoc test for group differences showed that the difference between the CONT group and the SPEC group was significant. For gender ($F_{(1,221)}$ = 18.49, p < .001), males reported consuming more alcohol than females. The interaction effect ($F_{(4,221)}$ = 2.545, p = .041) was driven by the higher levels of drinking in males in the COG-UNAFF (average of 9–10 drinks per week) and SPEC (average of 8–9 drinks per week) groups. Percentages by group as well as group means, standard deviations, and statistical tests are included in Table 3.

3.3 Difficulties with the legal system

Adult self-reports of interactions with the legal system were the dependent variables in this section. Young adult outcomes in this area include 1) the number of times they had been arrested and charged for a series of crimes, 2) the number of charges resulting in convictions, 3) whether they were currently on probation or parole, 4) whether they had ever been incarcerated, and 5) total amount of time incarcerated. The continuous variables for this outcome area were transformed to correct for positive skew. A (log10 + 1) transformation was applied to data on total number of times arrested and charged, number of convictions, and length of incarceration. The covariate, adult education, was significant and included in the models for the continuous variables. The generalized linear model was used for all three of these analyses.

For the number of times the adults reported being arrested and charged, the group, gender, and interaction effects were all significant. For the group effect (Wald $X^2_{(4)}$ = 25.71, p < .001), Bonferroni tests showed that the COG-UNAFF group was significantly higher than the CONT, DYSM, and COG-AFF groups. The SPEC group was marginally higher than the CONT group. For gender (Wald $X^2_{(1)}$ = 37.63, p < .001) males were more likely to be

arrested and charged than females. The significant interaction effect (Wald $X^2_{(4)} = 12.74$, p = .013) seemed to be due to the greater likelihood that males in the COG-UNAFF and SPEC groups would report that they had been arrested and charged than females. The analysis for number of charges resulting in convictions also showed significant group, gender, and interaction effects; the pattern of the means was similar to that of the arrest variable. For group (Wald $X^2_{(4)}$, = 10.34, p = .035), adults in the COG-UNAFF and SPEC groups reported the largest number of convictions, although no post hoc tests were significant. For gender (Wald $X^2_{(1)} = 21.81$, p < .001), males reported more convictions than females. The interaction effect (Wald $X^2_{(4)} = 11.74$, p = .019) again seemed to be due to the larger number of convictions reported by males in the COG-UNAFF and SPEC groups.

Self-reports of whether adults were currently on probation or parole, had ever been incarcerated, and the length of the incarceration also were examined. Chi square analyses for effect of group were not significant for percentage of adults currently on probation or parole or for whether they reported that they had ever been incarcerated. The generalized linear analysis for length of incarceration showed that effects for group, gender, and the interaction of these variables were all significant. For group (Wald $X^2_{(4)} = 17.15$, p < .001), the adults in the COG-UNAFF group reported longer incarcerations than those in the other groups; post hoc tests showed that the differences between this group and each other group were significant. For gender (Wald $X^2_{(1)} = 42.1$, p < .001), males reported significantly longer periods of incarceration than the females. The interaction effect (Wald $X^2_{(4)} = 12.87$, p = .012) appeared to be related to the longer incarceration times reported for males in the COG-UNAFF group. Estimated marginal means, standard errors, percentage by group for categorical variables, and statistical tests are displayed in Table 4.

It is important to note that, although there were no group differences on whether adults had ever been incarcerated, the overall proportion was high. For the total sample, 42.7% reported that they had been incarcerated. The average number of months incarcerated for those 99 participants, ranged from .06 for women in the CONT group to 20.39 for young men in the COG-UNAFF group. The overall mean was 6.3 months.

4. Discussion

In general, the results support the first part of both hypotheses (1a and 2a) stating that prenatal alcohol exposure is related to problem behavior in early adulthood. There were results for all three areas (mental health, substance use, and difficulties with the legal system) suggesting that the adults less physically affected by alcohol were more likely to show problem behavior than those in the DYSM group. This result is consistent with the spirit of alternative hypothesis (2b), but, the group most severely affected (COG-AFF vs. COG-UNAFF) varied by the type of problem behavior examined. For mental health problems, the COG-AFF group showed higher (more negative) scores on all three summary scales (Total Problems, Internalizing, and Externalizing) as well as on several of the subscales. The COG-UNAFF group, who showed neither physical nor cognitive effects of prenatal exposure, however, showed stronger effects, especially among the males, in the areas of amount of alcohol use and difficulties with the legal system.

The difference in severity of outcome may be related to the difference in IQ between the COG-AFF and COG-UNAFF groups. Prior researchers (e.g., Streissguth et al., 1996; Fast & Conry, 2009) have suggested that higher IQ is not protective when engagement in illegal activities is the outcome of interest. As shown in Table 1, the average IQ scores of the DYSM and COG-AFF groups were significantly lower than that of the COG-UNAFF group. These young adults may be more vulnerable to environmental influences associated with substance use and legal difficulties. As they show neither physical signs of dysmorphology nor cognitive effects on development, they may be less likely to be regarded as in need of guidance and services that may have been protective to those showing more clear signs of physical or cognitive developmental problems.

The results for mental health problems are consistent with those reported for this sample on adaptive behavior in early adulthood (Lynch et al., 2015); the adults in the COG-AFF group were likely to have higher (more negative) scores on the mental health problem scales and also had the most difficulty with achieving adaptive outcomes. The results for the COG-UNAFF group were not consistent with the previous findings and showed higher involvement in behaviors related to alcohol use and legal difficulties. The role of gender in the different spheres of behavior also seemed to differ. In findings on adaptive function, Lynch et al. found that the young women in the COG-UNAFF group did especially well. For the outcomes on substance use and difficulties with the legal system, however, the young men in the COG-UNAFF group showed more negative outcomes and were more likely to engage in problem behavior.

At the same time, however, it should be noted that there were some outcome variables in the areas of substance use and legal difficulties where no significant group effects occurred. Studies from other longitudinal samples have shown that many environmental factors such as parental characteristics (substance use, criminal behavior, and mental health), family conflict and child-rearing practices, and low socioeconomic status (SES) and neighborhood characteristics increase the risk for occurrence of problem behavior in adolescence and early adulthood (e.g., Alati et al., 2005; Buu et al., 2008; Farrington, 2015; Fergusson et al, 2008; Herrenkohl et al., 2012; Salom et al., 2015). Farrington (2015) also has noted that the impact of some of the more distal risk factors, such as SES and neighborhood characteristics, may be indirect and occur through their influence on the family and individuals.

The sample in the present study is drawn from an extremely low-SES, high risk environment and the characteristics of this environment, including associated parental and family characteristics described above, may be impacting all young people in the sample, alcohol-exposed or not. As suggested by Lynch et al., environmental factors associated with the low-income, urban background of this sample may be especially influential for young men, who in general are likely to be more vulnerable to risks than young women (Newsome et al., 2016; Shulman et al., 2015). As they reach the transition to adulthood, they are likely to find limited options for employment and few resources available; these factors may contribute to development of more high-risk behaviors in this group. While individuals in the COG-UNAFF group have less severe cognitive deficits, they also are encountering very limited opportunities to achieve in traditional ways.

It is also relevant that a number of potential participants were not available to volunteer for the study due to involvement with the criminal justice system. All 11 of these participants were male; six were alcohol-exposed and nondysmorphic, two were alcohol-exposed, but had no dysmorphology assessment available, and three were originally recruited at adolescence as part of the SPEC group. This information also contributes to the data suggesting that exposed individuals who are less physically affected are likely to have more difficulties with the transition to adulthood.

Although the level of involvement in legal difficulties is high, it should be noted that the outcomes in this area are, to some extent, interdependent. Participants who had never been arrested or charged also had no convictions and spent no time incarcerated. So, although three separate analyses were completed, there is a cascading effect of outcomes; the adult's arrest history affects status on the conviction and incarceration outcomes.

The SPEC group was included to provide some insight into how the alcohol-affected groups compared to young adults with learning problems or disabilities. For most variables, the mean scores for this group were similar to the most severely involved of the prenatally exposed groups. Adults in the SPEC group had scores similar to those in the COG-AFF group on several of the scales on the ASR measuring mental health outcomes. While gender differences were reported for several problem behavior outcomes, the males in the SPEC group reported outcomes at the higher end of the range reported. Males reported alcohol consumption similar to the males in the COG-UNAFF group which reported the highest average use. For total number of times arrested and charged, the males in this group again exceeded males in every group except the COG-UNAFF group.

The similarity between these groups suggests that, while the alcohol-affected groups showed more problem behavior than the control group, their behavior is not extremely deviant; it is similar to that of young adults with learning problems from the same population. The similarity between the alcohol-affected and SPEC groups suggests that effects of PAE on mental health outcomes may be associated with the effect on intellectual capability for the COG-AFF group. This explanation does not, however, explain the higher levels of substance use and illegal behavior in the COG-UNAFF and SPEC groups, especially among the males; these results are more likely related to increased vulnerability in both COG-UNAFF and SPEC groups to the socio-environmental factors related to poverty and the urban setting that were discussed above.

This study provides a summary of how young adults affected by PAE are dealing with the transition to adulthood in the areas of mental health, substance use, and difficulties with the legal system. Data suggest that those who are less physically affected by PAE are more likely to show involvement in problem behavior. Even though the effect of PAE is not physically apparent, the behavior of these young adults is affected in important ways. The study is limited in generalizability by the characteristics of the sample which is drawn from a predominantly low SES, urban environment with increased risks and decreased opportunities for those coming of age in that setting. This report, however, in combination with the earlier report on adaptive function in this sample, provides initial data on how young adults with PAE are managing this transition.

Future investigations in this area might focus more clearly on environmental influences that increase or decrease involvement in problem behavior. As shown in our analyses, negative life stress and education achieved are clearly related to problem behavior outcomes, and were included as covariates where significant. Study of specific risk or protective factors, would be helpful in determining how the transition to adulthood can be moderated to decrease occurrence of problem behavior. As discussed above, possible factors to examine include family of origin influences (parental characteristics, child-rearing practices) and socioeconomic status as well as interventions or special services that may have been received. Individual characteristics, such as substance use during adolescence and externalizing behavior, should be considered as potential sources of influence as well (Fergusson et al., 2008; Salom et al., 2015).

In summary, this paper makes an important contribution to the sparse literature on effects of PAE on problem behavior outcomes during the transition to adulthood. The results suggest that PAE is related to higher levels of problem behavior and that the adults who are less physically affected by PAE may be most at risk for problem behavior at this time of life. These data may be useful in designing interventions or preventive measures to support alcohol-affected adults as they make the transition to adulthood.

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Appendix

Table Showing Instruments and Outcome Variables.

Outcome Area	Instrument	Outcome Variables
Mental Health	Adult Self-Report (Achenbach and Rescorla, 2003)	Summary scores (T-scores[a]) Total Problems Internalizing Problems Externalizing Problems Internalizing subscales (Raw Scores[b]) Anxious//Depressed (0–36) Withdrawn (0–18) Somatic Complaints (0–24) Externalizing subscales (Raw Scores[b]) Aggressive Behavior (0–30) Rule-breaking Behavior (0–28) Intrusive (0–12) Other subscales (Raw Scores[b]) Attention Problems (0–30) Thought Problems (0–20) Critical Items (0–38)
Substance Use	Laboratory Test	

Outcome Area	Instrument	Outcome Variables
	Results Urine Drug Screen	Positive result –Yes/No Amphetamines Barbiturates Benzodiazepines Cocaine Marijuana Opiates Phencyclidine
	Gamma Glutamyl Transferase (GGT) Blood test for enzyme associated with excessive alcohol use	Numerical test result Out of range – Yes/No
	Drug Grid (Coles et al., 1992)	Self- Report of Substance Use Current Use – Yes/No Tobacco Alcohol Marijuana Cocaine Amphetamines Ecstasy AA per week—Amount of absolute alcohol used per week
Difficulties with the Legal System	Addiction Severity Index (McLellan, et al, 1985)	Number of times arrested and charged with a series of crimes Number of charges resulting in convictions Currently on probation or parole Ever incarcerated Total amount of time spent incarcerated

[a] T-scores are standard scores; the mean for each of these T-scores = 50 and the standard deviation = 10.

[b] The range for each raw score is shown in parentheses.

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Highlights

- Prenatal alcohol exposure (PAE) was related to problem behavior in young adults
- Adults less physically affected by PAE showed more problem behavior
- Cognitively-affected adults had more negative scores on mental health measures
- Adults with PAE who seemed unaffected had more substance and legal problems

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Table 1

Demographic, Background and Prenatal Exposure Characteristics for Young Adults (N = 236)[a]

Variables	Groups						
	(1) Control CONT (n = 59)	(2) Dysmorphic DYSM (n = 48)	(3) Exposed, Cognitively Affected COG-AFF(n = 37)	(4) Exposed, Not Cognitively Affected COG-UNAFF(n = 38)	(5) Special Education Contrast SPEC (n=54)	Statistical Test	p- value[f]
Ethnicity (% African-American)	100	97.9	100	97.4	85.2	$X^2_{(8)} = 23.52$	p = .003
Gender (% male)	39.0	47.9	29.7	36.8	53.7	$X^2_{(4)} = 6.62$	ns[g]
Age at Follow-up (years) M, (SD)	22.80 (1.75)	22.65 (2.08)	22.59 (1.64)	22.32 (1.93)	23.31 (1.39)	$F_{(4,231)} = 2.08$	p = .085
Years of Formal Schooling (N = 233), M (SD)	12.32 (1.68)	11.73 (1.39)	11.15 (1.34)	12.77 (1.71)	12.08 (1.47)	$F_{(4,228)} = 6.22$	p < .001 3<1,4,5;2<4
Current Monthly Income (total $), M (SD) (n = 229)	1191 (1453)	1011 (967)	570 (437)	946 (920)	1293 (1596)	$F_{(4,224)} = 2.17$	p = .074
Adult Dysmorphology Score[b] M (SD), (n = 226)	3.12 (3.30)	9.72 (7.64)	5.24 (3.63)	3.73 (3.14)	4.67 (4.22)	$F_{(4,221)} = 14.63$	p = .000; 2>1,3,4&5
WASI FSIQ [c] M (SD), (n =233)	86.07 (11.56)	75.66 (13.02)	73.62 (8.37)	95.00 (9.27)	84.94 (13.90)	$F_{(4,228)} = 21.62$	p = .000; 2,3<1,4,&5; 4>1,2,3&5
Negative Life Events T-score (Life Stress-LISRES)[d] M (SD), (n = 231)	58.08 (11.92)	56.32 (10.90)	60.09 (10.62)	58.57 (10.80)	59.15(10.54)	$F_{(4,226)} = .696$	ns[g]
Birthweight (gms) M (SD), (n = 182)	3216.14 (490.25)	2505.58 (631.28)	3245.14 (556.00)	3113.95 (578.43)	NA	$F_{(3,178)} = 18.14$	p = .000; 2<1,3&4
AA/oz/wk[e] in pregnancy M (SD), (n=182)	0 (0)	13.33 (13.01)	8.09 (13.11)	7.95 (7.55)	NA	$F_{(3,178)} = 17.84$	p = .000; 1<2,3,4;4<2
Cigarette Use in Pregnancy (% yes) (n = 174)	31	86.4	61.1	66.7	NA	$X^2_{(3)} = 33.21$	p < .001
Marijuana Use in Pregnancy (% yes) (n = 174)	12 .1	29.5	36.1	52.8	NA	$X^2_{(3)} = 18.46$	p < .001
Cocaine Use in Pregnancy (% yes) (n = 173)	0	4.8	5.4	20.0	NA	$X^2_{(3)} = 15.18$	P = .002

[a] If data are not available for some participants, the n used for the analysis is noted next to the variable name.

[b] Dysmorphology score is based on 25th percentile, African-American norms.

[c] WASI FSIQ = Wechsler Abbreviated Scale of Intelligence – Full Scale IQ.

[d] LISRES = Life Stressors and Social Resources Inventory

[e] Ounces of absolute alcohol per week.

[f] Post-hoc comparisons were completed with Tukey HSD test.

[g] ns = not significant

Table 2

Mental Health Outcomes: Adult Self-Report—T-scores for Summary Scales and Raw Scores for Subscales (n = 229)

Variables	Groups						
	(1) CONT (n = 58)	(2) EXPOSED, DYSM (n = 47)	(3) EXPOSED, COG-AFF (n = 34)	(4) EXPOSED, COG-UNAFF (n = 37)	(5) SPEC (n = 53)	Statistical Test	p- value
Summary Scales (EMM, SE)							
Total Problems T[a]	M[c] = 50.76 (2.09)	M = 52.41 (2.04)	M = 61.47 (3.46)	M = 51.79 (2.71)	M = 56.39 (1.85)	Group Wald $X^2_{(4)}$ = 16.69	p = .002 (3,5 > 1)[b]
	F[c] = 48.26 (1.63)	F = 53.88 (2.01)	F = 52.43 (1.97)	F = 50.39 (2.06)	F = 55.57 (1.97)	Gender Wald $X^2_{(1)}$ = 3.067	p = .08
	T[c] = 49.51 (1.33)	T = 53.14 (1.44)	T = 56.95 (2.00)	T = 51.09 (1.70)	T = 55.98 (1.34)	Interaction Wald $X^2_{(4)}$ = 4.87	ns[d]
						Life stress Wald $X^2_{(1)}$ = 20.73	p < .001
						Years of Education Wald $X^2_{(1)}$ = 5.86	p = .015
Internalizing T[e]	M =49.45 (2.33)	M = 54.24 (2.27)	M = 62.44 (3.85)	M = 50.29 (3.02)	M = 56.20 (2.06)	Group $F_{(4,217)}$ = 4.428	p = .002 (1,4 < 5)
	F =51.09 (1.81)	F = 57.31 (2.24)	F = 52.24 (2.20)	F = 49.17 (2.30)	F = 57.27 (2.19)	Gender $F_{(1,217)}$ = .5	ns
	T = 50.27 (1.48)	T = 55.78 (1.60)	T = 57.34 (2.23)	T = 49.73 (1.89)	T = 56.74 (1.50)	Interaction $F_{(4,217)}$ = 1.71	ns
						Life stress $F_{(1,217)}$ = 15.33	p < .001
						Years of Education $F_{(1,217)}$ = 3.311	p = .07
Externalizing T[e]	M =53.46 (2.05)	M = 54.35 (2.00)	M = 61.7 (3.39)	M = 55.52 (2.66)	M = 57.93 (1.81)	Group $F_{(4,217)}$ = 2.593	p = .038
	F =50.42 (1.60)	F = 54.98 (1.97)	F = 55.13 (1.93)	F = 53.34 (2.02)	F = 55.61 (1.93)	Gender $F_{(1,217)}$ = 3.84	p = .051
	T = 51.94 (1.30)	T = 54.66 (1.41)	T = 58.42 (1.96)	T = 54.43 (1.67)	T = 56.77 (1.32)	Interaction $F_{(4,217)}$ = .597	ns
						Life stress $F_{(1,217)}$ = 23.26	p < .001
						Years of Education $F_{(1,217)}$ = 10.555	p = .001

Variables	Groups						
	(1) CONT (n = 58)	**(2) EXPOSED, DYSM (n = 47)**	**(3) EXPOSED, COG-AFF (n = 34)**	**(4) EXPOSED, COG-UNAFF (n = 37)**	**(5) SPEC (n = 53)**	**Statistical Test**	**p- value**
Internalizing Subscales(EMM, SE)							
Anxious/Depressed Raw Score[f]	M =4.74 (1.29)	M = 7.66) (1.26)	M = 11.99 (2.13)	M =5.11 (1.67)	M = 9.27 (1.14)	Group $F_{(4,217)} = 5.01$	p = .001 (5> 1,4)
	F =6.10 (1.00)	F =9.40 (1.24)	F = 6.52 (1.21)	F = 5.38 (1.27)	F = 9.79 (1.21)	Gender $F_{(1,217)} = .133$	ns
	T = 5.42 (.82)	T = 8.53 (.89)	T =9.25 (1.23)	T = 5.24 (1.05)	T = 9.53 (.83)	Interaction $F_{(4,217)} = 1.68$	ns
						Life stress $F_{(1,217)} = 12.93$	p < .001
						Years of Education $F_{(1,217)} = 1.78$	ns
Withdrawn Raw Score[f]	M = 3.12 (.63)	M = 4.28 (.62)	M = 5.73 (1.05)	M = 3.36 (.82)	M = 4.31 (.56)	Group $F_{(4,217)} = 2.07$	p = .086
	F = 3.30 (.49)	F = 4.18 (.61)	F =4.06 (.60)	F = 3.77 (.63)	F = 4.66 (.60)	Gender $F_{(1,217)} = .148$	ns
	T = 3.21 (.40)	T = 4.23 (.44)	T = 4.90 (.61)	T = 3.56 (.52)	T = 4.49 (.41)	Interaction $F_{(4,217)} = .573$	ns
						Life stress $F_{(1,217)} = 4.46$	p = .036
						Years of Education $F_{(1,217)} = 8.98$	p = .003
Somatic Complaints Raw Score[f]	M = 2.77 (.80)	M = 3.03 (.78)	M = 5.63 (1.32)	M = 3.80 (1.04)	M = 3.22 (.71)	Group $F_{(4,217)} = .785$	ns
	F = 3.86 (.62)	F = 5.50 (.77)	F = 3.22 (.75)	F = 2.48 (.79)	F = 4.32 (.75)	Gender $F_{(1,217)} = .121$	ns
	T = 3.32 (.51)	T = 4.26 (.55)	T = 4.42 (.76)	T = 3.14 (.65)	T = 3.77 (.51)	Interaction $F_{(4,217)} = 2.40$	p = .051
						Life stress $F_{(1,217)} = 13.55$	p < .001
						Years of Education $F_{(1,217)} = .53$	ns
Externalizing Subscales (EMM, SE)							
Aggressive Behavior Raw Score[g]	M =5.61 (1.08)	M = 6.74) (1.06)	M = 11.28 (1.80)	M =7.23 (1.41)	M = 8.39 (.96)	Group $F_{(4,217)} = 2.669$	p = .033 (3 > 1)

Variables	Groups						
	(1) CONT (n = 58)	**(2) EXPOSED, DYSM (n = 47)**	**(3) EXPOSED, COG-AFF (n = 34)**	**(4) EXPOSED, COG-UNAFF (n = 37)**	**(5) SPEC (n = 53)**	**Statistical Test**	**p- value**
	F =6.07 (.85)	F = 8.52 (1.04)	F = 7.80 (1.02)	F =5.94 (1.07)	F = 7.56 (1.02)	Gender $F_{(1,217)} = .843$	ns
	T = 5.84 (.69)	T =7.63 (.75)	T = 9.54 (1.04)	T = 6.59 (.88)	T = 7.97 (.70)	Interaction $F_{(4,217)} = 1.29$	ns
						Life stress $F_{(1,217)} = 14.63$	p < .001
						Years of Education $F_{(1,217)} = 13.20$	p < .001
Rule-breaking Behavior Raw Score[g]	M =4.99 (.73)	M =5.12 (.71)	M = 6.00 (1.20)	M = 5.33 (.94)	M = 6.32 (.64)	Group $F_{(4,217)} = 1.83$	ns
	F = 2.57 (.57)	F = 3.65 (.70)	F = 2.99 (.69)	F = 4.29 (.72)	F = 4.70 (.69)	Gender $F_{(1,217)} = 15.32$	p < .001
	T = 3.78 (.46)	T = 4.38 (.50)	T = 4.49 (.70)	T =4.81 (.59)	T =5.51 (.47)	Interaction $F_{(4,217)} = .436$	ns
						Life stress $F_{(1,217)} = 25.12$	p < .001
						Years of Education $F_{(1,217)} = 3.32$	p = .07
Intrusive Raw Score[g]	M = 2.23 (.48)	M = 2.40 (.47)	M = 4.68 (.79)	M =3.76 (.62)	M = 3.00 (.42)	Group $F_{(4,217)} = 2.82$	p = .026 (3 > 1)
	F = 1.77 (.37)	F = 1.85 (.46)	F =2.65 (.45)	F =1.76 (.47)	F = 2.29 (.45)	Gender $F_{(1,217)} = 12.88$	p < .001
	T = 2.00 (.30)	T = 2.13 (.33)	T =3.67 (.46)	T = 2.76 (.39)	T = 2.64 (.31)	Interaction $F_{(4,217)} = 1.12$	ns
						Life stress $F_{(1,217)} = 12.26$	p = .001
						Years of Education $F_{(1,217)} = .017$	ns
Other Subscales (EMM, SE)							
Attention Problems Raw Score[h]	M =6.03 (.99)	M = 6.16 (.97)	M = 10.55 (1.65)	M = 5.11 (1.29)	M = 8.87 (.88)	Group Wald $X^2_{(4)} = 20.11$	p < .001 (3,5 > 1)
	F = 4.90 (.77)	F = 7.35 (.96)	F = 7.88 (.937)	F = 6.74 (.98)	F = 8.57 (.94)	Gender Wald $X^2_{(1)} = .147$	ns
	T = 5.46 (.63)	T = 6.76 (.68)	T = 9.21 (.95)	T = 5.92 (.81)	T = 8.72 (.64)	Interaction	ns

Variables	Groups						
	(1) CONT (n = 58)	**(2) EXPOSED, DYSM (n = 47)**	**(3) EXPOSED, COG-AFF (n = 34)**	**(4) EXPOSED, COG-UNAFF (n = 37)**	**(5) SPEC (n = 53)**	**Statistical Test**	**p- value**
						Wald $X^2_{(4)} = 4.55$	
						Life stress Wald $X^2_{(1)} = 8.25$	p = .004
						Years of Education Wald $X^2_{(1)} = 3.83$	p = .05
Thought Problems Raw Score[h]	M = 3.97 (.56)	M = 3.51 (.55)	M = 6.59 (.93)	M = 4.78 (.73)	M = 4.89 (.50)	Group Wald $X^2_{(4)} = 8.8$	p = .066
	F = 3.01 (.44)	F = 4.08 (.54)	F = 3.52 (.53)	F = 3.89 (.56)	F = 4.32 (.53)	Gender Wald $X^2_{(1)} = 6.71$	p = .01
	T = 3.49 (.36)	T = 3.80 (.39)	T = 5.06 (.54)	T = 4.33 (.46)	T = 4.60 (.36)	Interaction Wald $X^2_{(4)} = 7.79$	p = .099
						Life stress Wald $X^2_{(1)} = 21.05$	p < .001
						Years of Education Wald $X^2_{(1)} = 10.76$	p = .001
Critical Items Raw Score[h]	M = 5.56 (.97)	M = 5.38 (.95)	M = 10.56 (1.61)	M = 6.87 (1.26)	M = 8.06 (.86)	Group Wald $X^2_{(4)} = 16.67$	p = .002 (1 < 5)
	F = 4.09 (.76)	F = 5.63 (.94)	F = 5.03 (.92)	F = 4.71 (.96)	F = 7.77 (.92)	Gender Wald $X^2_{(1)} =7.937$	p = .005
	T = 4.83 (.62)	T = 5.50 (.67)	T = 7.79 (.93)	T = 5.79 (.79)	T = 7.92 (.63)	Interaction Wald $X^2_{(4)} = 7.619$	p = .107
						Life stress Wald $X^2_{(1)} = 21.09$	p < .001
						Years of Education Wald $X^2_{(1)} = 8.776$	p = .003

[a] Analysis used generalized linear model with Total Problems as the dependent variable (DV) and Life Stress and Adult Education as covariates.

[b] Post hoc comparisons completed with Bonferroni test (p < .05).

[c] M = male, F = female, T = total

[d] ns = non-significant.

[e] MANOVA with Internalizing and Externalizing as DVs and Life Stress and Adult Education as covariates.

[f] MANOVA with three internalizing raw scores (Anxious/Depressed, Withdrawn, Somatic Complaints) as DVs and Life Stress and Adult Education as covariates

[g] MANOVA with three externalizing scale raw scores (Aggressive, Rule-breaking, Intrusive) as DVs and Life Stress and Adult Education as covariates

[h] Separate analyses were completed for each of the remaining subscales (Attention Problems, Thought Problems, and Critical Items). Generalized linear model was used with each subscale with Life Stress and Adult Education as covariates.

Table 3

Substance Abuse Outcomes: Laboratory Tests and Self-Reports of Use (N = 236)[a]

Variables	Groups						
	(1) CONT (n = 59)	**(2) EXPOSED, DYSM (n = 48)**	**(3) EXPOSED, COG-AFF (n = 37)**	**(4) EXPOSED, COG-UNAFF (n = 38)**	**(5) SPEC (n = 54)**	**Statistical Test**	**p- value[e]**
(Males: Females within group)	23:36	23:25	11:26	14:24	29:25		
I. Drug Use							
Urine Drug Screens (n = 233) (% positive)							
Amphetamines	0	2.1	0	0	3.7	X^2 = 4.46 (4)	ns[b]
Barbiturates	0	0	0	0	0	No analysis[c]	No analysis
Benzodiazepines	0	0	0	0	1.9	No analysis[c]	No analysis
Marijuana	25.9	36.2	38.9	39.5	50	$X^2_{(4)}$= 7.05	ns
Cocaine	1.7	10.6	13.9	7.9	9.3	$X^2_{(4)}$ = 5.26	ns
Opiates	0	0	0	0	0	No analysis[c]	No analysis
Phencyclidines	0	0	0	0	0	No analysis[c]	No analysis
Current Self-reported Drug Use (n = 235) (% yes)							
Tobacco (N = 234)	25.9	51.1	45.9	31.6	46.3	$X^2_{(4)}$= 9.802	p = .044
Marijuana	22.0	44.7	24.3	42.1	42.6	$X^2_{(4)}$= 10.375	p = .035
Cocaine	0	2.1	5.4	2.6	3.7	$X^2_{(4)}$= 3.078	ns
Amphetamines	0	0	0	0	1.9	No analysis[c]	No analysis
Ecstasy	1.7	4.3	8.1	7.9	1.9	$X^2_{(4)}$ = 4.298	ns
II. Alcohol Use							
GGT Blood Analysis (n = 213)							
(males:females -group)	22:31	23:20	10:23	14:22	26:22		
GGT-mg (M, SD)	M[d] = 26.41 (12.15)	M = 25.39 (13.79)	M = 24.6 (10.56)	M = 44.64 (36.82	M = 27.0 (21.87)	Group- $F_{(4, 203)}$ =2.138	p = .077
	F[d] = 18.71 (6.06)	F = 20.3 (13.59)	F = 20.57 (17.08)	F = 18.45 (13.31)	F = 17.73 (9.49)		

Variables	Groups						
	(1) CONT (n = 59)	**(2) EXPOSED, DYSM (n = 48)**	**(3) EXPOSED, COG-AFF (n = 37)**	**(4) EXPOSED, COG-UNAFF (n = 38)**	**(5) SPEC (n = 54)**	**Statistical Test**	**p- value[e]**
	T[d] = 21.91 (9.77)	T = 23.02 (13.77)	T = 21.79 (15.35)	T = 28.64 (27.88)	T = 22.75 (17.79)		
						Gender $F_{(1, 203)}$ = 19.76	p < .001
						Interaction $F_{(4, 203)}$= 2.63	p = .036
% Out of range	1.9	4.7	3.0	16.7	4.2	$X^2_{(4)}$= 10.335	p = .035
Self-reported Alcohol Use							
Current Use (n = 235) (% yes)	59.3	66.0	48.6	73.7	74.1	$X^2_{(4)}$ = 8.372	p = .079
Current Amount Used (oz. AA/wk)[f] (N = 231) (M, SD)	M[d] = 1.18 (2.7)	M = 1.07 (1.28)	M = 2.32 (3.79)	M = 4.88 (6.3)	M = 4.35 (7.35)	Group- $F_{(4,221)}$= 3.514	p = .008 (1 < 5)[e]
	F[d] = .34 (1.10)	F = .79 (1.93)	F = .70 (1.38)	F = 1.03 (2.3)	F = .67 (.99)		
	T[d] = .67 (1.92)	T =.93 (1.63)	T = 1.18 (2.42)	T = 2.49 (4.6)	T = 2.65 (5.7)		
						Gender – $F_{(1,221)}$= 18.49	p < .001
						Interaction – $F_{(4,221)}$= 2.545	p = .041

[a] If data are not available for some participants, the n used for the analysis is noted next to the variable name.

[b] ns = not significant

[c] No analysis—too few positive results or —yes‖ responses for analysis

[d] M = male, F = female, T = total.

[e] Post hoc comparisons were completed with Bonferroni test (p < .05).

[f] Ounces of absolute alcohol per week.

Table 4

Outcomes Related to Difficulties with Legal System (N = 232)[a]

Variables	Groups						
	(1) CONT (n = 58)	**(2) EXPOSED, DYSM (n = 47)**	**(3) EXPOSED, COG-AFF (n = 35)**	**(4) EXPOSED, COG-UNAFF (n = 38)**	**(5) SPEC (n = 54)**	**Statistical Test**	**p- value[d]**
(males: females within group)	22:36	23:24	9:26	14:24	29:25		
Total Times Arrested and Charged[b] (n = 232)(EMM, SE)	M[c] = .18 (.05)	M = .25 (.05)	M = .15 (.08)	M = .55 (.06)	M = .35 (.04)	Group – Wald $X^2_{(4)}$ = 25.71	p < .001 (1,2,3 <4)[d]
	F[c] = .06 (.04)	F = .11 (.05)	F = .09 (.05)	F = .14 (.05)	F = .11 (.05)		
	T[c] = .12 (.03)	T = .18 (.03)	T = .12 (.04)	T = .34 (.04)	T = .23 (.03)		
						Gender – Wald $X^2_{(1)}$ = 37.63	p < .001
						Interaction – Wald $X^2_{(4)}$ = 12.74	p = .013
						Education- Wald $X^2_{(1)}$ = 10.67	p = .001
Number of charges resulting in convictions[b] (n = 228) (EMM, SE)	M[c] = .11 (.04)	M = .08 (.04)	M = .12 (.06)	M = .28 (.05)	M = .23 (.03)	Group – Wald $X^2_{(4)}$ = 10.34	p = .035
	F[c] = .03 (.03)	F = .09 (.04)	F = .03 (.04)	F = .05 (.04)	F = .06 (.03)		
	T[c] = .07 (.02)	T = .08 (.03)	T = .08 (.03)	T = .17 (.03)	T = .14 (.02)		
						Gender – Wald $X^2_{(1)}$ =21.81	p < .001
						Interaction – Wald $X^2_{(4)}$ = 11.74	p = .019
						Education- Wald $X^2_{(1)}$ =6.62	p = .01
Currently on probation or parole (n = 231) (% yes)	12.1	13.0	14.3	21.1	13.0	$X^2_{(4)}$ = 1.789	ns[e]
Ever incarcerated? (n = 232) (% yes)	31.0	48.9	37.1	44.7	51.9	$X^2_{(4)}$ = 6.329	ns
Total time incarcerated (in months)[b] (n = 232) (EMM, SE)	M[c] = .36 (.08)	M = .31 (.07)	M = .14 (.12)	M = .78 (.09)	M = .36 (.07)	Group – Wald $X^2_{(4)}$ = 17.15	p < .001 (4> 1,2,3,5)[d]
	F[c] = .01 (.06)	F = .08 (.07)	F = .09 (.07)	F = .11 (.07)	F = .04 (.07)		
	T[c] = .19 (.05)	T = .20 (.05)	T = .12 (.07)	T = .45 (.06)	T = .20 (.05)		

Variables	Groups						
	(1) CONT (n = 58)	(2) EXPOSED, DYSM (n = 47)	(3) EXPOSED, COG-AFF (n = 35)	(4) EXPOSED, COG-UNAFF (n = 38)	(5) SPEC (n = 54)	Statistical Test	p- value[d]
						Gender – Wald $X^2_{(1)} = 42.1$	p < .001
						Interaction – Wald $X^2_{(4)} = 12.87$	p = .012
						Education- Wald $X^2_{(1)} = 9.47$	p = .002

[a] If data are not available for some participants, the n used for the analysis is noted next to the variable name.

[b] Raw data have been transformed using a logarithmic transformation ($\log_{10} + 1$);transformed data are presented.

[c] M = male, F = female, T = total.

[d] Post-hoc comparisons were completed with Bonferroni test (p < .05).

[e] ns = not significant.