Journal of Criminal Justice 43 (2015) 229–241

Contents lists available at ScienceDirect

Journal of Criminal Justice

The Relationship between Adverse Childhood Experiences (ACE) and Juvenile Offending Trajectories in a Juvenile Offender Sample

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ARTICLE INFO

Available online xxxx

ABSTRACT

Purpose: Adverse childhood experiences have been identified as a key risk factor for offending and victimization, respectively. At the same time, the extent to which such experiences distinguish between unique groups of offenders who vary in their longitudinal offending patterns remains an open question, one that is pertinent to both theoretical and policy-related issues. This study examines the relationship between adverse childhood experiences for distinguishing offending patterns through late adolescence in a large sample of adjudicated juvenile offenders.

Methods: The current study uses data from 64,000 adjudicated juvenile offenders in the State of Florida. We use Semi-Parametric Group-Based Method (SPGM) to identify different latent groups of official offending trajectories based on individual variation over time from ages 7 to 17. Multinomial logistic regression was used to examine which measures, including the ACE score, distinguished between trajectory groups.

Results: Findings indicate five latent trajectory offending groups of offending through age 17 and that increased exposure to multiple Adverse Childhood Experiences distinguishes early-onset and chronic offending from other patterns of offending, net of several controls across demographic, individual risk, familial risk, and personal history domains.

Conclusions: Childhood maltreatment as measured by the cumulative stressor Adverse Childhood Experiences score influences official offending trajectories.

Introduction

The age-crime curve is one of the most commonly observed findings in criminology (Blumstein, 1986; DeLisi & Piquero, 2011; Farrington, 1986; Nagin & Land, 1993; Piquero, Farrington, & Blumstein, 2003; Sweeten, Piquero, & Steinberg, 2013; Tittle & Grasmick, 1998; Wilson & Herrnstein, 1998). A quarter century ago Gottfredson and Hirschi (1990:131) wrote, the "empirical fact of a decline in the crime rate with age is beyond dispute". Specifically, crime rises in early adolescence, peaks around 17 years of age, and declines significantly thereafter until reaching a stable low that levels off in young adulthood (Farrington, 1986).

An array of theoretical frameworks and explanations have been put forth to explain this aggregate relationship (cf. Sweeten et al., 2013). Yet, many other candidate explanations remain both viable and un-examined with respect to explicating the nature of the age/crime relationship. One of these in particular concerns the extent to which Adverse Childhood Experiences (ACE) influence the age/crime relationship. In this study, we draw from Moffitt's (1993) developmental taxonomy as well as DeLisi and Vaughn's (2014) temperament-based theory and consider the potential influence of a youth's home environment on longitudinal offending patterns.[1]

Individual traumas or abuses (such as neglect, or physical abuse) and their effects on offending and violence have long been recognized as important correlates of antisocial behavior and victimization (see Curtis, 1963; Widom, 2014). In particular, Widom's research on the cycle of violence has been instrumental in showcasing how children exposed to violence are at increased risk of perpetrating violence in later life (Widom & Maxfield, 2001; see also Wilson, Stover, & Berkowitz, 2009). Relatedly, childhood maltreatment has been found to increase the risk of later criminality by approximately 50% (Caspi et al., 2002). Only recently has the concept of the cumulative stressor ACE score entered the criminological discourse (Baglivio & Epps, 2015; Baglivio, Wolff, Epps, & Nelson, 2015; Baglivio et al., 2014; Fox, Perez, Cass, Baglivio, & Epps, 2015). ACEs refer to ten experiences of emotional abuse, physical abuse, sexual abuse, emotional neglect, physical neglect, domestic violence toward the youth's mother, household substance abuse, household mental illness, parental separation/divorce, and

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http://dx.doi.org/10.1016/j.jcrimjus.2015.04.012
0047-2352/

household member with a history of jail/imprisonment (Centers for Disease Control and Prevention, 2015), many of which are part and parcel of criminological/psychological theories of offending and victimization.

The current study uses a large sample of juvenile offenders from the State of Florida who have been followed through late adolescence in order to examine how a composite measure of the ten ACEs (the ACE score) distinguishes between longitudinal offending trajectories. Before we present the results of our study, we first provide a brief overview of the literature on ACEs, highlighting in particular the limited research on ACEs of juvenile offenders. Then, we discuss how ACEs may relate to distinct offending trajectories, drawing from Moffitt's taxonomy as well as DeLisi and Vaughn's temperament-based theory. We then define our measures and outline our analytic approach, followed by a presentation of results. Finally, we close with a discussion, future directions, and conclusions.

Adverse Childhood Experiences (ACE)

The proximal effects of childhood trauma include an increased risk for delinquency, fighting, dating violence, and carrying a weapon, as well as mental health issues such as substance use and conduct disorders, and suicidal ideation and attempts (Evans-Chase, 2014; see also Duke, Pettingell, McMorris, & Borowsky, 2010). The experience of trauma in a juvenile offending population has been well-documented with estimates indicating that between 75%-93% of youth entering the juvenile justice system have experienced some type of trauma, in comparison to 25%-34% of the general population (Costello, Erklani, Fairbank, & Angold, 2003; Dierkhising et al., 2013; Evans-Chase, 2014). The concept of cumulative stress and the interrelatedness of multiple forms of trauma has led to the notion of the ACE score, first described by Felitti et al. (1998; see also Rutter, 1983). The ACE score is expressed as the sum of the ten exposures, each measured dichotomously. An exposure, such as sexual abuse, is counted as one point regardless of the number of incidents of the exposure (whether sexually abused 1 or 100 times) or severity of exposure. Prior work has found types of childhood abuse and neglect are common, highly interrelated, and exert a powerful cumulative effect on human development (Anda, Butchart, Felitti, & Brown, 2010; Dong et al., 2004). This interrelatedness has recently been replicated in a juvenile offending population such that the presence of a given ACE increases the odds of having any other additional ACE by an average of 2.3 times, and up to 1,286 times for those without the given ACE (Baglivio & Epps, 2015). This "cumulative stressor approach," based on the co-occurrence and cumulative effect of these experiences, necessitates their examination as a collective composite, as opposed to the traditional approach of examining one or only a few adverse exposures, which misses the broader context in which they occur. These findings highlight the notion that ACEs should not be assumed to be isolated exposures with unique effects, and that both the negative short- and long-term influences of ACEs on health and behaviors is better conceptualized and examined as a cumulative, dose–response relationship (Anda et al., 1999; Dietz et al., 1999; Dong, Dube, Felitti, Giles, & Anda, 2003; Dong et al., 2004; Dube et al., 2001).

A vast body of medical literature has documented the implications of high ACE scores on both proximal and distal negative outcomes (Anda et al., 2010). Higher ACE scores were initially linked to increases in leading causes of death in adulthood (including heart disease, cancer, chronic lung disease, skeletal fractures, and liver disease), with the odds of experiencing these types of deaths in adulthood roughly 12 times higher for individuals who experienced four or more ACEs compared to those without such exposure (Felitti et al., 1998). Short-term negative outcomes implicated by higher ACE scores include an increase in the odds of smoking, heavy drinking, intravenous drug use, morbid obesity, incarceration, violence perpetration, and poor educational and employment outcomes (Bellis, Lowey, Leckenby, Hughes, & Harrison, 2014). Sexual promiscuity, teenage pregnancy, and intercourse prior to age 15 have also been linked to higher ACE scores (Hillis, Anda, Felitti, & Marchbanks, 2001; Hillis et al., 2004). Recent analyses conducted using samples of juvenile offenders have been observed to have ACE prevalence rates 3 times higher, and are 13 times less likely to have no ACE exposure and 4 times more likely to have ACE scores of four or above, compared to the original privately-insured ACE Study adults (Baglivio et al., 2014; Grevstad, 2010). As well, juvenile offenders with higher ACEs have a greater likelihood of being assessed as high risk to re-offend on a validated risk assessment (Baglivio et al., 2014) and a greater likelihood of being classified as serious, violent, and chronic (SVC) offenders by age 18 (Fox et al., 2015). Some research has also considered the relationship between community context and ACEs, with a recent study finding that concentrated disadvantage and affluence affect ACE exposure (Baglivio et al., 2015).

Effects of trauma on neurodevelopment

The use of the ACE score as a measure of the cumulative effect of traumatic stress exposure during childhood is consistent with the latest understanding of the effects of traumatic stress on neurodevelopment (Anda et al., 2006, 2010). While first identified as risk factors for chronic disease, more recently a dose-response relationship has been identified between ACEs with negative neurological consequences, such as chromosome damage (Shalev et al., 2013) and functional changes to the developing brain (Anda et al., 2010; Cicchetti, 2013; Danese & McEwen, 2012; Teicher et al., 2003). Child maltreatment occurring during critical periods can disrupt brain development and lead to neurobiological deficits (Painter & Scannapieco, 2013). Chronic stress, such as that suggested by multiple ACE exposures, has been found to impair brain development (Twardosz & Lutzker, 2010). Implications of traumatic exposure on the development of the prefrontal cortex and pathways between the prefrontal cortex and the amygdala have been uncovered (Anda et al., 2006; Bremner, 2003). Such changes in prefrontal maturation may impact self-regulatory behavioral and emotional responses, such as delinquency, interpersonal violence, drug and alcohol use, and suicidal or self-mutilating behaviors (Evans-Chase, 2014).

The role of adverse childhood experiences in increasing the risk of both offending and victimization is found in a range of criminological and psychological theories and, as noted above, a growing set of empirical studies. In this study, we appeal to two of these in particular, Moffitt's (1993) developmental taxonomy because of its early life-course focus as well as its identification of multiple groups of offenders who display unique risk factors and unique patterns of offending early and throughout the life course, as well as DeLisi and Vaughn's (2014) temperament-based theory due to its focus on predictors of offending chronicity.

Moffitt's Developmental Taxonomy

Moffitt's (1993) developmental taxonomy was put forth as a way to help explain the aggregate age/crime relationship within the context of two distinct trajectories of offending, life-course persistent (LCP) and adolescent-limited (AL). Individuals on the LCP-pathway are hypothesized to be subject to serious neuropsychological problems or deficits that interact with disadvantaged and/or criminogenic environments during infancy and early childhood. LCPs, compared to ALs, have been found to demonstrate a higher prevalence of "pathological" backgrounds, including inadequate parenting, neurocognitive problems, and behavioral problems during childhood (Moffitt, 2006; Moffitt & Caspi, 2001). Findings of higher levels of neurobiological adversity in childhood-onset offenders has been replicated by others (Fairchild, Van Goozen, Calder, & Goodyer, 2013). Moffitt contends that a snowball effect occurs, in which antisocial involvement leads to a condition in which the "histories and traits of life-course-persistents have foreclosed their options, entrenching them in the antisocial path" (Moffitt, 1993:691). The at-risk infant (based on neurological deficits) presents as more "difficult" in terms of irritability, impulsivity, delay in reaching

pertinent developmental milestones (walking, talking, reading, etc.), slow learning, and difficultly expressing themselves, among others. These difficulties in turn further frustrate parents who themselves then may withdraw or provide inconsistent, sporadic, or inappropriate attention and supervision. This cycle is intensified in that vulnerable children are more likely born into maladaptive, dysfunctional environments (Moffitt, 1993; see also Hertzig, 1983). LCP antisocial behavior begins early in the life course, is manifested in age-appropriate ways throughout the life course, including aggression and violence, and also extends beyond the antisocial realm to include adverse outcomes in non-crime domains (Caspi & Moffitt, 1995; Moffitt, 1993; Moffitt & Caspi, 2001; Piquero et al., 2007).[2]

Particularly relevant to the current study is the role of adverse home environments in increasing the risk for an early-onset and chronic offending pattern. Moffitt maintains that it is not simply the presence of neurological deficits, but rather that the "juxtaposition of a vulnerable and difficult infant with an adverse rearing context initiates risk" for LCP offending (1993:106). While genetic or neurological circumstances may, in part, be important, they are not entirely sufficient, as it is the addition of the adverse household situation that exacerbates LCP antisocial behavior. While an infant with a difficult temperament may be at risk for maltreatment and neglectful, inconsistent, and punitive parenting, the adverse home environment further disrupts normal neurological development. A transactional relationship between youth and his/her contextual reality exists in which causal and countercyclical mechanisms are linked to either increasingly or decreasingly probable antisocial outcomes (Duke et al., 2010; see also Lynch & Cicchetti, 1998). As these infants age, continued impulsivity, hyperactivity, and cognitive deficits, coupled with less than optimal parenting practices lead to a lack of adequate social skills, aggression, poor academic performance and continued rejection by teachers and peers, which manifests to the foreclosed options as described by Moffitt.

DeLisi and Vaughn's Temperament-based Theory

In their introduction of a temperament-based theory of antisocial behavior and criminal justice system involvement, DeLisi and Vaughn (2014) carefully drew from over 300 studies in a range of disciplines including developmental psychology, genetics, neuroscience, criminology, and psychiatry in advancing a theory that focuses on two (early childhood) temperamental constructs, effortful control and negative emotionality. Deficits in these early emerging self-regulation features affect functioning and often tend to elicit negative responses from parents or caretakers that result in ACE. Two additional features of their theory are relevant here. First, unlike most antisocial behavior theories, DeLisi and Vaughn's perspective focuses not just on understanding antisocial involvement, but also the potentially negative interactions that children with self-regulation deficits have with the criminal justice system. In this regard, their theory offers a uniquely integrated framework that is sensitive both to etiology and to policy. A second important feature of their theory, which has some overlap with Moffitt's LCP perspective, is that children are not exposed to ACE equally within a family or home environment, the most antisocial traits evoke ACEs from parents, caregivers, or adults.[3]

Although space precludes a detailed overview of their temperament-based model of antisocial behavior and criminal justice system involvement over the life course, the essence of their approach is that biological vulnerabilities (i.e., genotype and neural substrates) as well as familial, peer, school, and neighborhood relationships and interactions influence the development of the higher order construct of temperament, which is comprised of effortful control (impulsivity, low conscientiousness, boldness) and negative emotionality (anger, thin-skinned, hostility). Deficits in temperament increase the likelihood of proximal outcomes, such as aggression, substance misuse, risky sexual behavior, and victimization, as well as indirectly, to distal outcomes such as criminal justice system involvement and interactions with criminal justice personnel.

Trauma and Trajectories

Recent evaluations have examined trauma across different offending trajectories. Specifically, childhood-onset offenders were more likely to report childhood maltreatment, mental health, angry-irritableness, and substance abuse problems (Hoeve et al., 2014). Additionally, youth with trauma exposure were more likely to have mental health problems, even after controlling for ethnicity and age (Hoeve et al., 2014). Interestingly, while trauma prevalence was higher in early-onset youth, the moderation effect between trauma and mental health problems was stronger in the adolescent-onset group. Germane to the current study, upon inclusion of mental health problems (alcohol/drug use, angry-irritableness, depression/anxious) in the prediction of child-onset offending, emotional abuse and physical abuse were *not* significant. In additional work, trauma was found to be associated with comorbid internalizing disorders (such as depression and anxiety) and disruptive behavior disorders (such as conduct disorder and ADHD), while, in contrast, age of onset was unrelated to comorbidity (Hoeve, McReynolds, & Wasserman, 2015).

An earlier analysis of males in the Pittsburgh Youth Study considered the relationship between parenting styles and distinct offending trajectories (Hoeve et al., 2008). After identifying five trajectories of offenders, they examined the extent to which childhood parenting styles differentiated between the groups. Results showed that moderate to severe delinquents were more likely to be raised by neglectful families (poor supervision, physical punishment) than minor or non-delinquents, and serious persisting delinquents were more likely to be raised by authoritarian families than were non-delinquents. Analyses carried out in other samples have yielded mixed results, with some finding partial support for familial risk factors differing across trajectory groups (Chung, Hawkins, Gilchrist, Hill, & Nagin, 2002; Fergusson, Horwood, & Nagin, 2000), while others found limited or no differences (Nagin, Farrington, & Moffitt, 1995; White, Bates, & Buyske, 2001; Wiesner & Capaldi, 2003). In trying to adjudicate between the disparate sets of findings, Hoeve et al. (2008) reasoned that prior work neglected to find familial risk differences across groups due to either focusing on risks other than parenting, or including too few parenting dimensions in analyses. However, the small amount of research on this relationship leaves much to be learned.

A limiting feature of the studies by Hoeve and colleagues was its reliance on an all-male, community-based sample, thereby highlighting the need to examine such relationships within samples of female offenders as well as with male offenders to examine potential gender differences. Importantly, while Hoeve et al. (2014) dichotomized childhood onset and adolescent-onset offending boys (based on self-report), the current study extends their work by examining trauma across latent trajectory groups of official offending, and includes both male and female offenders. Those with early age of onset and chronic antisocial behavior are argued to differ across specific risk factors from adolescent/late-onset offenders. Specifically, Moffitt has implicated male gender, hyperactivity (ADHD), impulsivity, poor verbal and executive functions, inconsistent parental supervision/discipline, mental health problems, aggression (including attributing harmful intent to others' intentions), behavioral problems at school and learning disabilities, social skill deficits, substance abuse, and adverse home environments (including child abuse and neglect) to heighten the risk for early onset, LCP-styles of offending. In this study, we draw from Moffitt's taxonomy, DeLisi and Vaughn's temperament-based theory, and many of these risk factors in an effort to link them to longitudinal offending patterns in a large sample of adjudicated juvenile offenders.

Current Study

The current study examines the effect of the childhood trauma, using the ACE score composite, on the offending trajectories of a large sample of adjudicated male and female juvenile offenders from the State of

Florida. Drawing on Moffitt's taxonomy, as well as DeLisi and Vaughn's temperament-based theory, we include measures suggested to differ from early- and late-onset groups to address whether the ACE score is predictive of group membership, controlling for these additional measures across multiple domains. We group measures additional to ACE score into demographic, individual risks, familial risks, and a troubled personal history risk domains. We examine the significance of ACE in conjunction with demographics before successively adding the risk measures of each domain (individual, family, personal history), just prior to estimating a fourth comprehensive model. As such, the current study is the first to examine latent trajectories of juvenile offending using ACE scores across large samples of males and females followed into late adolescence.

Data

Data were drawn from the Florida Department of Juvenile Justice (FDJJ) archival data records. The FDJJ maintains a centralized database, the Juvenile Justice Information System (JJIS), that contains complete social, offense, placement, and risk assessment history data for all youth referred for delinquency (equivalent to an adult arrest). The individual-level measures of interest were taken from the Community Positive Achievement Change Tool (C-PACT) risk/needs assessment panel used by the FDJJ (explained below). Data for this study are inclusive of all youth within Florida with a history of an arrest who turned 18 between January 1, 2007, and December 31, 2012, that were administered the Full C-PACT. Only youth who had "aged out" of the juvenile justice system (turned 18, the age of majority in Florida) were included so as to capture the full range of delinquency referrals (arrests) for each individual. This resulted in a final sample of 64,329 unduplicated youth who were assessed with the PACT Full Assessment and had turned 18 between January 1, 2007, and December 31, 2012.

The C-PACT is the validated risk/needs assessment administered to all juveniles arrested in Florida. Only the Full C-PACT contains the necessary information to create ACE scores (therefore youth receiving only a Pre-Screen PACT assessment were not included in the current study). The Full C-PACT consists of 126 items across the following twelve domains: criminal history, school, leisure/free time, employment, relationships, family/living situation, alcohol/drugs, mental health, attitudes/behaviors, aggression, and social skills. Current FDJJ policy requires each youth receiving a Full C-PACT to be re-assessed every 90 days. However, to ensure appropriate time order of using C-PACT information to distinguish between distinct offending trajectories, only the first ever Full C-PACT information is used for each youth.

Measures

Official Offending

The FDJJ JJIS centralized database maintains records of all official delinquency referrals for law violations. Every time a youth (under 18 years of age) is arrested in Florida information is required and entered into the JJIS database. Data do not include tickets such as those for traffic violations. JJIS data extracts were used to gather every instance of arrest for each youth in the current study sample. Referral (arrest) dates and the date of birth for each youth were used to flag every age at which each youth was arrested. Each age was coded for whether the youth was (=1) or was not (=0) arrested during the given age. The official offending measure is dichotomous and does not measure frequency of arrests during a given age, only whether or not the youth was arrested. The official offending measure is used to create the offending trajectory classifications (strategy noted below), which serves as the main outcome variable.[4] Prior work has indicated early onset as one of the most consistent indicators of severity of juvenile delinquency careers (DeLisi, Neppl, Lohman, Vaughn, & Shook, 2013; Piquero et al., 2003).

Key Independent Variables

ACE Score

Although created to classify youth according to levels of risk to reoffend, C-PACT risk/needs assessment data capture items related to ACEs. These C-PACT items were used to create ACE scores for each youth. The exact items, responses, and coding used to create ACE scores from C-PACT data have been reported elsewhere (Baglivio et al., 2014). Each exposure was binary (yes/no) and exposures were summed for a cumulative ACE score ranging from 0 (unexposed to any) to 10 (exposed to all ten categories). In contrast to ACE studies with adults, the current study suffered less from the challenges of retrospective recall of childhood events, as the exposures are more contemporary for the current sample. In keeping with prior ACE studies in the social and medical sciences, we ascertained the following ten ACEs: emotional abuse, physical abuse, sexual abuse, emotional neglect, physical neglect, family violence, household substance abuse, household mental illness, parental separation or divorce, and household member incarceration.

Different from previous studies of ACE using FDJJ data, the current study uses the first ever Full C-PACT assessment for each youth to create the ACE score. This ensures appropriate time order of having the ACE score at the initial assessment and relating it to trajectories of offending measured subsequently. Prior studies had aggregated the ACE score across all C-PACT assessments for a given youth. While those studies were certain to capture the entire extent of each juvenile's trauma exposure up until age 18 (or last contact with the juvenile justice system), they could not ensure the traumatic event(s) occurred prior to the offending event(s). The current study overcomes that temporal issue.[5] A brief description of each ACE and responses indicating being exposed are:

1. Emotional abuse: Parents/caretakers were hostile, berating, and/or belittling to youth.
2. Physical abuse: The youth reported being a victim of physical abuse was victimized or physically abused by a family member.
3. Sexual abuse: The youth reported being the victim of sexual abuse/rape.
4. Emotional neglect: The youth reported no support network, little or no willingness to support the youth by the family, or that youth does not feel close to any family member.
5. Physical neglect: The youth has a history of being a victim of neglect (includes a negligent or dangerous act or omission that constitutes a clear and present danger to the child's health, welfare, or safety, such as: failure to provide food, shelter, clothing, nurturing, or health care).
6. Family violence: The level of conflict between parents included verbal intimidation, yelling, heated arguments, threats of physical abuse, domestic violence, or the youth has witnessed violence at home or in a foster/group home.
7. Household substance abuse: Problem history of parents and/or siblings in the household includes alcohol or drug problems.
8. Household mental illness: Problem history of parents and/or siblings in the household includes mental health problems.
9. Parental separation/divorce: Youth does not live with both mother and father.
10. Incarceration of household member: There is a jail/prison history of family members.

For the current study, youth with high ACE scores (greater than 5) were coded 1 (classified as "High ACE"), with all others coded 0. While traditionally, in non-delinquent samples, ACE scores of four or more are considered "high" (Centers for Disease Control and Prevention, 2015), we use ACE scores of six and higher as it represents youth who were approximately (as ACEs are whole numbers, it is approximate) two standard deviations above the mean. Furthermore, designating six or more as "high ACE" is consistent with Moffitt's

expectation that roughly 8-10% of offenders will be LCP/early-onset offenders, and similar to findings of a severe 5% (Vaughn, Salas-Wright, DeLisi, & Maynard, 2013; Vaughn et al., 2011). All analyses were first conducted using the summary ACE score (0-10) and a second time using the simplified "High ACE" (yes/no) measure.

In addition to the ACE measure, the following measures included in the current study are grouped into domains to enable examination of the importance of each domain in distinguishing between juvenile offending trajectories. We group measures into demographic, individual risks, familial risk factors, and a personal history risk factor domain. All items are collected by the C-PACT risk/needs assessment administered by the FDJJ.

Demographics

We include gender, race, and ethnicity as demographic controls. Gender was measured as female (=0, male = 1), while race–ethnicity is measured using a set of dichotomous variables with 1 = Black, 1 = Hispanic, with White being the reference group. Prior work using an adolescent sample has indicated males and Black youth more likely to be in the most severe 5% trajectory (Vaughn et al., 2013; but regarding adults see Vaughn et al., 2011).

Individual Risk Factors

Antisocial Peer Association

Antisocial peer association has consistently been shown to be among the strongest predictors of delinquency risk (Akers, 1998; Osgood, Wilson, O'Malley, Bachman, & Johnston, 1996). Recent research has proposed a two-pronged impact of peer influence with both a historical risk component through deviant normative influence, as well as a form of situational risk through immediate temptations and opportunities (Thomas & McGloin, 2013; see also Haynie & Osgood, 2005), rather than prioritizing one or the other. Antisocial peer association was examined using a self-report measure of the youth's friendship network (=1 if youth reported having exclusively antisocial peers, or associating with gang members, else = 0). Prior research has used a single self-reported item for gang membership (Melde & Esbensen, 2011) and has indicated the validity of self-report measures for gang membership (Krohn, Ward, Thornberry, Lizotte, & Chu, 2011; Thornberry, Krohn, Lizotte, & Chard-Wierschem, 1993; Thornberry, Krohn, Lizotte, Smith, & Tobin, 2003).

Impulsivity

Low self-control and impulsivity have long been considered important with respect to antisocial involvement (see Gottfredson & Hirschi, 1990; Moffitt, 1993). A large set of studies have regarded self-control as one of the most consistent predictors of offending (Pratt & Cullen, 2000) for both males and females (Burton, Cullen, Evans, Alarid, & Dunaway, 1998). Impulsivity/self-control consisted of one item measuring whether the youth was impulsive and acts before thinking. Youth rated "highly impulsive" who "usually act before thinking" were coded 1 (else = 0).

Angry-irritableness

Moffitt hypothesizes that LCPs are more likely to interpret the actions of others as hostile and to have self-regulation skill deficits. This is replicated in more recent work using the MAYSI-II measure of angry-irritableness (Hoeve et al., 2014), and is integral to temperament-based theory (DeLisi & Vaughn, 2014). In this study, we include an angry-irritableness scale, which combines the two items of tolerance for frustration and hostile interpretations of actions and intentions of others in a non-confrontational setting. Both items were initially coded 1-3, with higher scores indicating often getting upset over small things/temper tantrums, and primarily hostile interpretations of others (respectively). The additive scale was created due to perfect correlation between the two items.

Aggression

Aggression was measured as a single item measuring the youth's use of and control of aggression. The item is coded 0-2 for youth who never had problems with aggression, can control or uses alternatives to aggression, and those who lack alternatives to aggression (respectively). This item speaks to both history of aggression as well as the ability to practice pro-social alternatives as part of their behavioral repertoire, both implicated by Moffitt as characteristic of LCP offenders. Furthermore, anger is among the types of negative emotion germane to DeLisi and Vaughn's (2014) temperament-based theory.

Situational Perception

Much of Moffitt's discussion regarding LCPs involves failure to learn conventional prosocial alternatives to antisocial behavior. Situational perception measures whether the youth can analyze situations and choose the most appropriate social skill to use. This measure ranges from 0-2 for youth who can choose a prosocial skill alternative to those who cannot analyze the situation for use of a prosocial skill.

Consequential Thinking

Prior work has identified a relationship between recidivism and consequential thinking deficits for youth from 12 to 17 years of age, but a stronger relationship for younger offenders (Van der Put et al., 2012). The consequential thinking item used in the current study separates youth who understand that there are consequences to actions and act accordingly from those who do not use consequential thinking skills in their behavior (coded 0 and 1, respectively). Moffitt suggested that ALs may have more to lose than LCPs, i.e., they may have higher levels of educational/vocational achievement potential. This ability to use consequential thinking may also distinguish late-onset youth who desist faster than others.

Special Education

Moffitt's taxonomy places heavy emphasis on neurological deficits, particularly poor verbal and executive functioning. The current study uses a measure of special education needs/diagnoses as an indirect method of capturing this risk factor. Special education need/diagnosis is dichotomized separating youth without such need/diagnosis from those that are special education students or have a formal diagnosis of a special education need (coded 0 and 1, respectively). Special education needs include diagnosed learning and behavioral deficits, as well as mental retardation.

Substance Use

Childhood-onset offenders have been found to have a higher likelihood of reporting substance use problems (Hoeve et al., 2014). Moffitt has suggested that substance use may lengthen the criminal careers of later-onset youth, through her "snare" hypothesis, with a recent study showing that ALs who engaged in heavy drinking at age 18 being more likely to be convicted in early adulthood (Craig et al., 2015). Vaughn et al. (2013) found elevated levels of substance use in the "severe 5%" of youth. Substance use is coded 0 for no past use, 1 for past use, and 2 for past use where such use caused problems in family conflict, health, pro-social peer associations, withdrawal, increased tolerance to drugs/alcohol, or contributed to criminal behavior.

ADD/ADHD

Prior work has indicated ADHD to be more prevalent in childhood-onset offenders than AL offenders (DeLisi et al., 2013; Hoeve et al., 2014; Moffitt, 1993). Attention deficit disorder (ADD) and attention deficit hyperactivity disorder (ADHD) are measured as a dichotomous classification of whether the youth has been diagnosed with ADD/ADHD (ADD/ADHD diagnosed = 1).

Mental Health Problem History

Like substance use, mental health problems have been identified as a stepping stone for females and serious criminal careers (Howell, 2012). Two-thirds of males and three-quarters of female juvenile detainees have been found to have a psychiatric diagnosis (Teplin, Abram, McClelland, Mericle, Dulcan, & Washburn, 2006). As well, rates of mental health disorders are higher for early-onset youth than later-onset youth (Hoeve et al., 2015). For the current study, mental health is dichotomized, with youth having a history of mental health problems coded 1 (else = 0). Mental health problems involved such diagnoses as schizophrenia, bi-polar, mood, thought, personality, and adjustment disorders, and excluded conduct disorder, oppositional defiant disorder, substance abuse, and ADD/ADHD. Mental health problems were those based on a formal diagnosis provided by an individual legally authorized to provide such diagnoses in the State of Florida, and not simply the opinion of the juvenile probation officer.

Familial Risk Factors

Parenting

Based on the importance of parenting practices in Moffitt's taxonomy and DeLisi and Vaughn's temperament-based theory, we included an additive scale item of consistency/appropriateness of rewards for pro-social behavior, and consistency/appropriateness of punishment of inappropriate behavior ($\alpha = .853$). Both original items were coded 1-3 with higher scores indicating greater degrees of inconsistency, inappropriateness, and more punitive.

Parental authority and control

This item measures the extent to which the youth follows parental rules and obeys his/her parents. Hoeve et al. (2008) argued for the need to include multiple dimensions of family functioning. Parental authority/control is coded 1-3 representing youth who usually obey and follow parental rules, sometimes obey or obey some rules, and those who consistently disobey or are hostile towards parental rules.

Parental Supervision

Parental supervision measures the extent to which the youth's parents know whom the youth is with, times the youth will return, where the youth is going, and what the youth intends to do when leaving the home. This item is similar to those used in prior work (Hoeve et al., 2008) and in keeping with Moffitt's notion that parents of difficult youth over time provide less instruction and oversight. The item is coded for consistent good supervision, sporadic supervision, and inadequate supervision (coded 1-3, respectively).

Respect for authority

This item measures the extent to which the youth respects authority figures and ranges from respecting most authority figures to defying/hostility towards most authority figures (coded 1-4). While not *exclusively* related to the youth's parents, we nevertheless included this item under the familial risk factor domain as it does involve the youth's level of respect for his/her parents. Prior research has documented the lack of legitimacy of authority for those immersed in street culture, and the corresponding predominance of retaliatory aggression and violence (Anderson, 1999; Stewart & Simons, 2010). More recent research has revealed early-onset youth tend to have more negative views of the legitimacy of the justice system and its actors (Gann, Sullivan, & Ilchi, 2015; see also Fagan & Tyler, 2005).

Personal History Domain

School behavior

Early-onset offenders should evidence more conduct problems in school based on the notion that their antisocial behavior crosses many areas of their lives (Moffitt, 1993). School problems were included in the current study as a standardized scale of two measures. Age at first suspension or expulsion ranged from 0-4 with higher values indicating a *younger* age at first suspension/expulsion. Number of suspensions/expulsions ranged from 1-6 with higher values indicating more suspensions/expulsions. These two items were standardized to create the school behavior scale ($\alpha = .787$).

History of residential placement

This measure is dichotomous for whether the youth in the current study had a history of residential commitment placement with the FDJJ (coded 1, else= 0). Forty percent of youth meet this criteria. In Florida, a youth is committed to a residential program only by a judge, and for an indeterminate length of time and must complete an individualized treatment plan.

History of Running Away

This item measures the number of times a youth ran away or was kicked out of the house where the youth did not voluntarily return within 24 hours. The measure includes instances reported as well as not reported to law enforcement. The item ranges from no instances, 1, 2 to 3, 4 to 5, and over 5 instances (coded 1-5, respectively). The grouping of instances is based on that captured by the C-PACT.

Analytic Strategy

Our analytic strategy is three-fold. First, we created aggregate official offending curves for the full sample (n = 64,329) by coding a dichotomous yes/no for whether each youth was arrested at each age from 7-17. Additionally, the age-crime curves are disaggregated by those with high ACE scores (>5) and those with lower ACE scores (ACE scores of 5 or fewer). Youth were included in each year for prevalence rates, with the exception of any youth who was in a residential commitment program for at least nine months of a given year in order to control for street time. The next year for which an excluded youth was back in the community for at least three months, the youth was placed back into the sample to compose prevalence (hence the aggregate curves control for "street time"; see Piquero et al., 2001).

Next, we used Semi-Parametric Group-Based Method (SPGM) to identify different latent groups of official offending trajectories based on individual variation over time (Nagin & Land, 1993). SPGM was used to model arrest (yes/no) on an annual basis using the STATA procedure "traj". The number of trajectory groups being modeled and their form was specified prior to analysis, with the process repeated to determine the parameters that produced the best fit for the data. The model with the optimum number of trajectories was selected on the basis that it had a high Bayesian Information Criterion (BIC; indicating improved model fit) and an average probability of group assignment that was as close to 1 as possible. Each youth was assigned to the

trajectory group for which his/her posterior probability of membership was the highest.

Finally, we examined how measures differed between individuals on different offending trajectories. Following much of the prior work in this area, multinomial logistic regression was used to examine which measures distinguished between trajectory groups (see Jennings & Reingle, 2012; Piquero, 2008).

Results

Aggregate Offending Curves

The actual aggregate official offending crime curves of the full sample, high ACE, and low ACE curves are displayed in Fig. 1. It is immediately apparent that a larger proportion of youth who have endured a high number of ACEs were arrested earlier on in life, and that a larger proportion of youth with higher ACE scores were arrested at every age. This is consistent with the anticipated impact of trauma on subsequent offending. Two questions remain, however: (1) Does this aggregate curve accurately characterize all groups of youth within the sample?; and (2) Does the apparent impact of ACEs hold up after accounting for all of the risk factors identified in previous literature? The remainder of our analyses seek to provide insight into each of these questions.

Official Juvenile Offending Trajectories

Next, we estimated the number of distinct offending trajectories that can be identified in the Florida juvenile offender cohort. Models with three to seven trajectories were created, and the BIC and average group membership probabilities for each were examined. The optimum model included five or six groups, with the sixth group having a slightly lower BIC (BIC closer to 0). The form of the trajectories was examined and indicated that the six-group model produced a small erratic-behaving group that distracted from ease of interpretation. Consequently, the five-group model was selected for ease of interpretation.[6] The five official offending trajectories are presented in Fig. 2.

Overall, it can be seen that the five trajectories are visibly distinct from one another and represent very different patterns in offending throughout adolescence. For ease of interpretation, the trajectory groups were labeled (1) mid-to-early onset who later desist, (2) late starters, (3) mid-to-late starters who begin to desist, (4) early starters, and (5) mid-to-early starters.[7] The two mid-to-early onset groups (groups 1 and 5), whom represent a combined 47.4% of the sample (13.7% + 33.7% = 47.4%) consist of youth who began offending between ages 11 and 13, but follow very different trajectories from that point. Group 1, comprising about 31.8% of all youth, is characterized by 31.8% mid-to-early onset and limited continued involvement in the juvenile justice system. A subsequent look at the total number of offenses committed by each youth reveals that Group 1, on average, has the lowest number of career offenses across the five groups considered. The majority of these youth began offending between ages 11 and 13 but desist shortly thereafter. Group 5, on the other hand, is also characterized by mid-to-early onset, but includes youth who continued to offend into late adolescence. The late onset group (Group 2), about 19% of the sample, committed very few offenses up until around age 15, but then the proportion of active offenders rapidly increases by age 18. The 19 mid-to-late and desisting group (Group 3), represents 12.6% percent of the sample and starts offending between ages 14 and 15 but by age 18 they begin to desist. The early onset group (Group 4), which represents the group of particular interest to the current study, consists of around 7% of the total sample and began offending much earlier in life and is characterized by persistent offending throughout the adolescent period. [8] The five groups differ in the total number of arrests from ages 7-17 ($F = 8484.3$, $p < .001$), with post hoc analyses indicating all differences significant except between mid-to-early onset who later desist youth (Group 1) and late starters (Group 2). Early starters (Group 4) evidenced an average of 17.8 arrests, followed by mid-to-early starters (Group 5; 12.1 arrests), mid-to-late starters who begin to desist (Group 3; 5.8 arrests), and finally mid-to-early onset who later desist (Group 1) and late starters (Group 2) with 4.7 arrests each.

Table 1 contains the descriptive statistics, including the ACE score and all relevant covariates for the youth assigned to each group. Generally, these descriptive statistics support the hypothesized associations between each of these five groups, which have been labeled according to their trajectory displayed in Fig. 2. Most striking are the differences across the groups of youth in the sum of ACE scores as well as the proportion of each youth with a large number (>5) of ACEs. Specifically, as onset occurs earlier in life, the average ACE score, as well as the proportion of youth with high ACE scores, increases accordingly. For example, within the early onset group (Group 4), 30 percent of the youth have experienced more than five ACEs with an average of 3.34, compared to Group 2 (late onset) where only ten percent of youth have undergone a large number of traumatic experiences (mean = 2.46). Results for the other risk domains are also consistent with past research. Specifically, higher degrees of risk appear to consistently predict earlier onset of criminal activity. A few exceptions to the monotonically increasing values of the different risk factors across the four groups

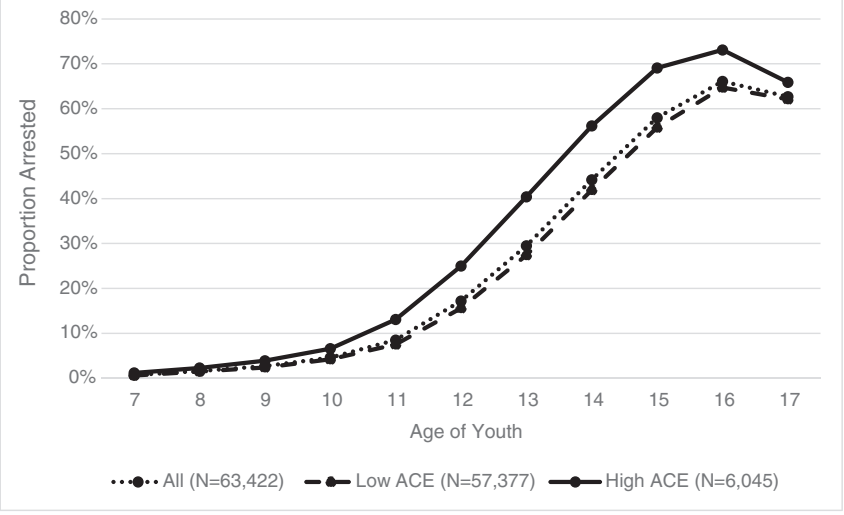

Fig. 1. Aggregate Proportion Offending at Each Age.

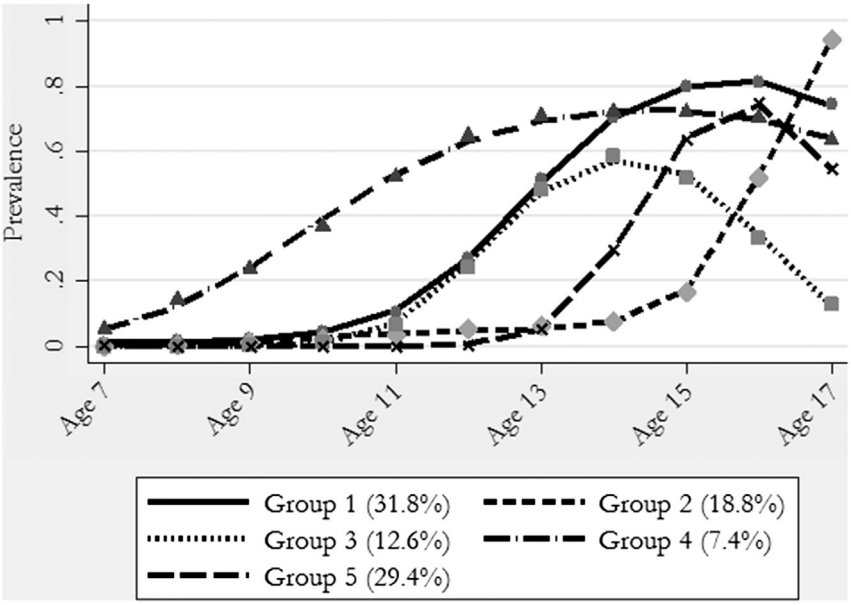

Fig. 2. 5 Group Trajectory Model.

emerge, such as the large proportion of youth who report substance abuse problems—which is highest in the late-onset group (Group 2). Also, the number of reported instances of running away is highest among these mid-to-early onset and persistent offenders (Group 5).

Distinguishing Trajectory Group Membership

The primary research question addressed in this study is whether the number of adverse childhood experiences a youth has endured is associated with earlier (and more persistent) involvement in the juvenile justice system, net of other factors known to contribute to offending. In the next stage of the analysis, we estimated a series of multinomial logistic regression models in which the five offending trajectory groups were distinguished between each other. These models are used to examine the effect of adverse childhood experiences as well as other risk domain variables on offending trajectory group membership. The results presented in Table 2 assess this relationship in a series of models which contain the sum of ACEs for each youth in addition to

Table 1
Group Means for Analysis of Adverse Childhood Experience and Offending Trajectory Groups

	Group 1: Mid-to-Early, Declining		Group 2: Late Starters		Group 3: Mid-to-Late Starters		Group 4: Early Starters		Group 5: Mid-to-Early, Persistent	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
ACE Scores										
Sum of ACEs	2.72	1.93	2.46	1.78	2.63	1.84	3.34	1.94	3.03	1.87
High ACE (>5)	.15	.36	.10	.30	.13	.34	.30	.46	.22	.41
Demographics										
Gender	.71	.45	.79	.41	.76	.43	.88	.33	.81	.39
Black	.40	.49	.38	.49	.39	.49	.65	.48	.54	.50
Hispanic	.16	.37	.18	.38	.18	.38	.07	.26	.13	.34
Individual Risk Factors										
Antisocial peers	.09	.29	.09	.28	.10	.30	.16	.36	.14	.35
Impulsivity	.06	.24	.05	.21	.06	.23	.12	.33	.08	.27
Anger-irritability	3.55	1.36	3.34	1.32	3.51	1.34	3.92	1.34	3.73	1.35
Aggression	.97	.68	.86	.68	.94	.68	1.17	.64	1.07	.67
Situational perception	.94	.73	.85	.71	.90	.71	1.13	.73	1.04	.71
Consequential thinking	.11	.31	.09	.29	.10	.30	.14	.35	.12	.32
Special education	.36	.48	.25	.43	.30	.46	.66	.47	.46	.50
Substance abuse	.57	.71	.93	.72	.86	.74	.73	.74	.88	.74
ADHD	.20	.40	.16	.36	.16	.37	.35	.48	.22	.41
Mental health problems	.13	.34	.11	.31	.12	.32	.16	.37	.13	.34
Familial Risk Factors										
Parenting	.60	.85	.63	.86	.67	.87	.99	.94	.87	.92
Parental authority	1.66	.67	1.69	.67	1.74	.67	1.85	.67	1.84	.67
Parental supervision	1.47	.66	1.52	.67	1.54	.68	1.79	.75	1.70	.72
Youth's respect for authority	1.34	.68	1.31	.64	1.36	.69	1.59	.84	1.49	.77
Personal History Risk Factors										
School behavior	5.19	2.76	4.57	2.77	4.98	2.73	6.57	2.39	6.00	2.49
Residential placement history	.26	.44	.22	.42	.30	.46	.71	.45	.55	.50
History of running away	1.52	1.07	1.61	1.12	1.64	1.15	1.67	1.18	1.75	1.23
	n = 7,531		**n = 12,476**		**n = 17,102**		**n = 3,665**		**n = 22,648**	

Table 2
Logistic odds-ratios, likelihood of group membership in given trajectory vs group 1, sum of ACE score

	Group 2: Late Starters				Group 3: Mid-to-Late Starters				Group 4: Early Starters				Group 5: Mid-to-Early Starters			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
ACE Scores																
Sum of ACEs	.941**	.938**	.914**	.917**	.989	.965**	.941**	.937**	1.287**	1.133**	1.075**	1.053**	1.147**	1.056**	1.006	.982
Demographics																
Gender	1.465**	1.423**	1.418**	1.606**	1.299**	1.266**	1.265**	1.323**	3.830**	3.143**	3.052**	2.377**	1.990**	1.753**	1.730**	1.537**
Black	.915**	1.234**	1.209**	1.334**	.981	1.204**	1.182**	1.230**	2.908**	3.410**	3.241**	2.860**	1.858**	2.232**	2.147**	1.997**
Hispanic	1.014	1.118*	1.102*	1.114*	1.107*	1.172**	1.156**	1.178**	.793**	.895	.869	.952	1.141**	1.213**	1.180**	1.251**
Individual Risk Factors																
Antisocial peers	--	.859**	.795**	.802**	--	.958	.884*	.870**	--	1.200**	1.066	.973	--	1.144**	1.009	.941
Impulsivity	--	.953	.926	.960	--	.983	.946	.953	--	1.244**	1.158	1.091	--	.926	.862*	.830**
Anger-irritability	--	.948**	.933**	.944**	--	1.006	.985	.992	--	1.010	.988	.981	--	1.016	.987	.983
Aggression	--	.891**	.877**	.896**	--	.980	.963	.973	--	1.206**	1.166**	1.167**	--	1.103**	1.071**	1.070**
Situational perception	--	.928**	.898**	.906**	--	.956*	.926**	.927**	--	1.011	.945	.926*	--	1.053*	.991	.977
Consequential thinking	--	1.029	1.016	.992	--	.986	.971	.960	--	.969	.936	.968	--	.956	.929	.947
Special education	--	.639**	.633**	.699**	--	.821**	.814**	.833**	--	2.430**	2.388**	1.892**	--	1.357**	1.336**	1.160**
Substance abuse	--	2.284**	2.213**	2.297**	--	1.917**	1.858**	1.853**	--	1.444**	1.366**	1.207**	--	1.973**	1.875**	1.701**
ADHD	--	.926	.945	.987	--	.811**	.824**	.838**	--	1.283**	1.363**	1.305**	--	.875**	.910*	.886**
Mental health problems	--	.945	.950	.929	--	.914*	.915*	.890*	--	1.167*	1.213**	1.160*	--	.964	.982	.926
Familial Risk Factors																
Parenting	--	--	1.015	1.030	--	--	1.031	1.037	--	--	1.175**	1.149**	--	--	1.110**	1.099**
Parental authority	--	--	1.148**	1.147**	--	--	1.188**	1.169**	--	--	.962	.888**	--	--	1.149**	1.068**
Parental supervision	--	--	1.164**	1.181**	--	--	1.085**	1.082**	--	--	1.345**	1.263**	--	--	1.239**	1.190**
Youth's respect for authority	--	--	.989	1.007	--	--	1.012	1.012	--	--	1.083*	1.026	--	--	1.049*	1.007
Personal History Risk Factors																
School behavior	--	--	--	.908**	--	--	--	.951**	--	--	--	1.083**	--	--	--	1.037**
Residential placement history	--	--	--	.745**	--	--	--	1.109**	--	--	--	4.300**	--	--	--	2.568**
History of running away	--	--	--	1.123**	--	--	--	1.087**	--	--	--	1.004	--	--	--	1.080**

Note: N = 63,422; *p < .05, **p < .01; In all models, Group 1 (mid-to-early and declining) serves as the reference group.

the risk factors included in each of the domains discussed above (demographics, as well as individual, familial, and personal history risk factors). Four models are presented for each group, comparing the odds that youth with these given traits belong to the focal group in comparison to the omitted group (Group 1). Model 4 for each group is the most comprehensive, and includes all of the measures included in the current study.

As shown in Table 2, there are several factors which distinguish youth belonging to each offending group (Group 1, mid-to-early, declining, serves as the reference group). Perhaps of most importance with respect to Moffitt's taxonomy are the results predicting membership in Group 2 (late starters) and group 4 (early starters). Specifically, with respect to demographic characteristics, Blacks are more likely to have begun offending at an early age, and less likely to belong to the late starting group. In subsequent models which account for many of the individual risk factors considered, the Odds Ratios for Blacks become greater than one, however, the probability that Blacks belong to the early (Group 4) or mid-to-early (Group 5) trajectory groups is much greater than those groups which start offending later (Groups 2 and 3). In terms of salient individual-level risk factors, those youth with antisocial peers, higher levels of impulsivity, angry-irritableness, and aggression are less likely to be late starters and more likely to belong to the group which began offending earlier in adolescence (Group 4). Similarly, those youth who have had mental health problems, or have been diagnosed with ADHD or special education needs are more likely to have started offending early. The results for school behavior are also consistent with expectations, as a history of school suspensions/expulsions at a younger age was associated with earlier involvement with the juvenile justice system.

Table 2 also examines the effect of the number of adverse childhood experiences youth have endured on group membership. Consistent with expectations, those youth who have experienced a greater number of trauma types were significantly more likely to begin offending at an earlier age (as demonstrated by odds ratios of >1), as well as less likely to begin offending later in adolescence. These effects were consistent across each of the four models estimated for each group, suggesting that the effect of a larger number of adverse childhood experiences persists, net of the other individual, familiar and personal history risk factors considered.

Next, we consider the sensitivity of the results reported above, with a modification to the ACE measure, which in the next set of analyses relies on the dichotomous measure indicating those youth with or without a large number (>5) of ACEs. As can be seen in Table 3, those youth who suffered more than five types of traumatic life experiences were significantly more likely to begin offending earlier in life. Substantively, for youth with greater than five ACEs the odds of belonging to the early onset group were 345% greater than the odds for those youth with less than 5 ACEs. Similarly, the odds of being in the late onset group were reduced by just over 30% among those youth who had experience a large number of traumatic events. The results were consistent, yet less striking with respect to group membership in Groups 3 and 5, the middle onset groups. Overall, these results point towards the robust and salient effect of adverse childhood experiences for distinguishing each delinquent trajectory group from one another, with the prevalence of adverse childhood experiences being associated with earlier onset and continued criminal justice system involvement throughout adolescence.

Table 3
Logistic odds-ratios, likelihood of group membership in given trajectory vs group 1, high-ACE youth

	Group 2: Late Starters				Group 3: Mid-to-Late Starters				Group 4: Early Starters				Group 5: Mid-to-Early Starters			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
ACE Scores																
High ACE Score (>5)	.685**	.726**	.691**	.683**	.894**	.878**	.836**	.806**	3.446**	2.298**	2.038**	1.799**	1.992**	1.611**	1.448**	1.288**
Demographics																
Gender	1.466**	1.432**	1.438**	1.620**	1.290**	1.276**	1.284**	1.337**	3.845**	3.297**	3.261**	2.515**	1.984**	1.812**	1.818**	1.604**
Black	.913**	1.231**	1.213**	1.340**	.977	1.205**	1.189**	1.238**	2.898**	3.496**	3.350**	2.949**	1.854**	2.271**	2.200**	2.046**
Hispanic	1.021	1.129**	1.121**	1.132**	1.104*	1.181**	1.173**	1.196**	.776**	.912	.900	.983	1.121**	1.229**	1.213**	1.285**
Individual Risk Factors																
Antisocial peers	--	.847**	.793**	.800**	--	.950	.882*	.869**	--	1.216**	1.072	.981	--	1.147**	1.010	.943
Impulsivity	--	.945	.924	.960	--	.976	.942	.949	--	1.239**	1.138	1.075	--	.919	.851**	.819**
Anger-irritability	--	.937**	.922**	.935**	--	.999	.977	.984	--	1.022	.988	.980	--	1.019	.982	.976
Aggression	--	.881**	.867**	.886**	--	.973	.955*	.965	--	1.220**	1.169**	1.168**	--	1.107**	1.067**	1.065**
Situational perception	--	.921**	.895**	.903**	--	.951*	.923**	.924**	--	1.015	.944	.925*	--	1.054*	.990	.975
Consequential thinking	--	1.025	1.015	.990	--	.983	.970	.959	--	.974	.940	.969	--	.958	.931	.949
Special education	--	.638**	.633**	.700**	--	.819**	.811**	.832**	--	2.371**	2.319**	1.843**	--	1.334**	1.308**	1.142**
Substance abuse	--	2.252**	2.182**	2.272**	--	1.900**	1.838**	1.838**	--	1.467**	1.372**	1.215**	--	1.980**	1.867**	1.697**
ADHD	--	.920	.933	.978	--	.808**	.815**	.830**	--	1.280**	1.349**	1.293**	--	.873**	.900**	.876**
Mental health problems	--	.935	.930	.915	--	.904*	.895*	.874**	--	1.134*	1.151*	1.114		.938	.935	.889**
Familial Risk Factors																
Parenting	--	--	.997	1.015	--	--	1.018	1.024	--	--	1.173**	1.145**	--	--	1.098**	1.084**
Parental authority	--	--	1.124**	1.127**	--	--	1.168**	1.153**	--	--	.954	.883**	--	--	1.133**	1.056*
Parental supervision	--	--	1.148**	1.168**	--	--	1.073**	1.071*	--	--	1.328**	1.248**	--	--	1.221**	1.172**
Youth's respect for authority	--	--	.977	.998	--	--	1.003	1.004	--	--	1.084*	1.028	--	--	1.044	1.002
Personal History Risk Factors																
School behavior	--	--	--	.905**	--	--	--	.949**	--	--	--	1.084**	--	--	--	1.036**
Residential placement history	--	--	--	.748**	--	--	--	1.112**	--	--	--	4.200**	--	--	--	2.538**
History of running away	--	--	--	1.116**	--	--	--	1.079**	--	--	--	.985	--	--	--	1.061**

Note: N = 63,422; *p < .05, **p < .01; In all models, Group 1 (mid-to-early and declining) serves as the reference group.

Discussion

The purpose of this study was to examine the relationship between adverse childhood experiences for distinguishing offending patterns through late adolescence in a large sample of adjudicated juvenile offenders from the State of Florida. Such an investigation not only advanced prior research in exploring this relationship in an offender-based sample, but also considered the extent to which the experience of early life traumatic events successfully distinguished between offenders. Five key findings emerged from our analysis.

First, in the full sample, a higher number of ACEs was associated with an earlier age at first arrest and further that higher ACE scores were associated with a greater likelihood of arrest from childhood through late adolescence. Second, our trajectory analysis yielded five distinct groups of offenders who displayed significant heterogeneity in their offending patterns through age 17. One of these groups in particular, the early onset group, was comprised of about seven percent of the full sample and their offending patterns showed an early onset and a persistent level of offending through late adolescence. This group averaged about eighteen arrests through late adolescence. Finally, thirty percent of the youth in the early onset group experienced more than five ACEs at the initial assessment, a much higher degree of adverse experiences compared to the other four trajectories, and the risk factors considered in the Florida data tended to show that the early onset group exhibited the most risk. Third, when we used the ACE and relevant risk factors to distinguish between the offending trajectories we found a dose-response relationship in that a higher number of ACEs was indeed a significant predictor of more chronic styles of offending, a pattern that held across groups as well as with controls for many risk factors—most of which operated as expected. When we performed a supplemental analysis where we dichotomized the ACE measure to consider those with six or more adverse childhood experiences, we found that this high proportion of experiences was especially predictive of membership in the early starter trajectory, a result that is consistent with both Moffitt's taxonomy and DeLisi and Vaughn's temperament-based theory, as well as other theories and frameworks that consider the role of early childhood trauma for antisocial behavior (see Agnew, 1992; Widom & Maxfield, 2001). Fourth, and contrary to previous research (Hoeve et al., 2014), inclusion of mental health and substance use risks did not eliminate the significant adverse childhood experience effect. Although further exploration of this finding is warranted, it may be due to the nature of the Florida adjudicated youth population and/or perhaps to the concept of interrelatedness of ACEs, which is why ACE researchers caution against attempts to separate exposure types. Lastly, the analyses revealed that antisocial peers was an important distinguishing feature of the desistance and escalation trajectories (Wiesner & Capaldi, 2003), but importantly antisocial peers was not very important in predicting membership in the early start trajectory, a result consistent with Moffitt's taxonomy that early onset/LCP offenders do not need antisocial peers to encourage their offending. Of note, prevalence of substance abuse problems was highest in the late starter group. Though beyond the scope of the current study, substance abuse has been theorized to be a potential "snare" delaying desistance, and has been argued pivotal in why low risk boys later engage in serious and chronic offending during and after the transition to adulthood (Sivertsson & Carlsson, 2014).

Before we highlight the policy implications of our findings, it is important to consider our results in light of some limitations. First, as the ACE measure only considers the experience of ten specific events, it

does not measure the severity or frequency of abuse. Future research should consider expanding the ACE measure in this (and other) regard(s). Second, the Florida data do not contain any information related to youth genetic coding/genotype. Although some readers may be skeptical of this point, ample research has identified certain genetic susceptibilities where childhood maltreatment exacerbates antisocial and deleterious health outcomes in individuals based on levels of MAOA expression (Caspi & Moffitt, 2006; Caspi et al., 2002, 2003; Kim-Cohen et al., 2006). Additional theoretical work and empirical exploration is pertinent on this front. Third, as the data are based only on information from the State of Florida, we do not have any information on youth who moved out of the state nor information about their out-of-state arrests. Future research should consider a more expansive data collection, recognizing the great difficulty in accessing juvenile offending records across jurisdictions. Furthermore, as all youth in the sample were juvenile offenders, we lack comparison with a non-offending group, as well as an adult onset group. Andersson and Levander (2013) stress the importance of examining adult-onset females, and their similarity to high level chronic offenders. Additional work should examine whether the ACE exposures differ from early-onset to adult-onset groups, and whether threshold effects of ACE exposure exist. We would be remiss to not mention caution has been advised regarding the continuity of offending into adulthood when using samples of active offenders (Lussier & Blokland, 2014).

Additionally, self-reported delinquency measures would be informative. Prior work has indicated official measures show shorter offending careers, later age of onset, and, surprisingly, later age of desistance (Farrington, Ttofi, Crago, & Coid, 2014). However, the probability of a self-reported offense leading to conviction was highest at ages 15-18, and the probability of a convicted offense being self-reported decreases with age from a 10 to 14 year old group to 42-47 year olds (Farrington et al., 2014). Based on these findings, the current study and its use of official measure is arguably comparable to other studies based on self-reports.

Lastly, space limitations precluded an in-depth investigation of demographic differences in the relationship between ACEs and longitudinal offending patterns. Future studies should expand their foci to include such analyses. As noted by others, little is known about racial and ethnic differences in long-term criminal careers into late adulthood (Doherty & Ensminger, 2014). Prior race/ethnicity examination of juvenile justice-involved youth has indicated a greater proportion of Black youth and a lower proportion of Hispanic youth, were exposed to 3 or more ACEs in comparison to White youth (Baglivio & Epps, 2015). However, more work needs to focus on how chronic stressors influence patterns of offending across race/ethnicity, both in terms of age of onset, as well as desistance, and how juvenile justice system involvement may serve to differentially "ensnare" some late-onset youth based on demographic differences (cf. Monahan, Stienberg, & Piquero, 2015).

While current data establish appropriate time order between risk factors and ACEs for distinguishing subsequent offending trajectories, we restricted our analysis from direct testing of Moffitt's taxonomy or DeLisi and Vaughn's temperament-based theory. To do so would require temporal order and/or repeated measures of neurological deficits, effortful control, and negative emotionality with constructs such as parenting practices, peer associations, and social skills. Both theories argue a reciprocal relationship between the difficulty of the child and harsh, withdrawn, or inadequate parenting practices, and later peer associations/rejection and educational (non)attainment, yet both posit deficits of the child may be causal "where the characteristics of an individual generate responses from others that produce environments which in turn further moderate underlying propensities" (DeLisi & Vaughn, 2014, pp.15). Specifically, with respect to ACEs and the current study, both acknowledge vulnerable children are more likely born into dysfunctional environments.

As a collective, our findings indicate that youth referred for delinquency (arrested) who have experienced adverse environments and traumatic experiences—especially those who have experienced a high proportion of them—have a greater likelihood of exhibiting early onset, persistent, and chronic styles of offending. The finding of increased ACE exposure for early-onset youth adds a new metric to a growing body of empirical work regarding dysfunction across family, temperament, and self-regulatory deficits of the most early-onset, persistent offenders found in prior work (DeLisi et al., 2013; DeLisi & Vaughn, 2014; Moffitt, 1993). Past longitudinal work has been successful at accurately predicting approximately 30% of high rate chronic offenders using cumulative risk indices (Farrington, Piquero, & Jennings, 2013; Sivertsson & Carlsson, 2014), though many within the highest risk groups do not become high-rate chronic offenders throughout adulthood, demonstrating the problems of prospective offender identification in criminal career research. Future work should examine whether the cumulative ACE score adds to the predictive ability, or whether human agency and social context limit ACE predictions as well.

Although the juvenile justice system is not necessarily equipped to lower the risk of such experiences (which tend to occur in the youth's home or neighborhood), it may provide services to youth while they are being detained and/or treated in the system. Providing services to these youth with respect to coping mechanisms and/or associated cognitive and emotional therapies would be useful. Prior work has called for the reduction of "toxic stress", such as multiple ACE exposures, at the earliest age possible to thwart long-term repercussions due to increased risk of offending and violence (Welsh & Loeber, 2013). Study findings also showed that offending behavior through late adolescence was also influenced by a range of risk in the individual, familial, and personal history domains, including especially anger-irritability, aggression, substance abuse, parental supervision, and school misbehavior. A wide range of evidence-based prevention and intervention strategies exists for lessening the influence of these risk factors including early-family/child training programs (Piquero, Farrington, Welsh, Tremblay, & Jennings, 2009), self-modification (Evans-Chase, 2014; Evans-Chase, Kim, & Zhou, 2013) and self-control modification (Piquero, Jennings, & Farrington, 2010) programs, as well as substance abuse treatment strategies (Vaughn & Howard, 2004). All of these programs should be made available to youth presenting such risk upon entry into the juvenile justice system.

Notes

[1] Of course, there are several other theoretical frameworks that consider ACE, including Agnew's (1992) General Strain Theory. We selected Moffitt's developmental taxonomy and DeLisi and Vaughn's temperamental-based theory for purposes of this paper because of their early life-course focus and the nature of the sample being studied.

[2] Though not the focus of the current study, offenders on the AL pathway begin their curtailed antisocial activities in the middle teens primarily because of a maturity gap, or the frustration that adolescents themselves feel like they are adults but they are not legally afforded adult status and the roles and activities that are permitted. When these individuals encounter peers who are similarly strained, they tend to become involved in acts that symbolize adulthood, including drinking and drug use and become involved in minor thefts that may provide them resources. Because they do not suffer from the injurious childhoods that LCPs face, as adulthood ensues most AL's cease their offending except for a select few who encounter a snare, or negative consequence of their offending involvement such as a drug addiction or incarceration stint (see Hussong et al., 2004; Craig, Morris, Piquero, & Farrington, 2015).

[3] We thank an anonymous reviewer for this important observation.

[4] A limitation of this measure is its reliance on prevalence and not frequency of offending, the latter which may show even more heterogeneity in offending patterns particularly among the most high-rate offenders (see Caudill, Morris, El Sayed, Yun, & DeLisi, 2013).

[5] This decision does result in a lower prevalence rate across each ACE and the overall ACE score from previous published accounts of this sample.

[6] The form of the five trajectories is best fit by a combination of quadratic and cubic functions (specifically, 3, 3, 2, 2, 3). BIC = -273433.23, AIC = -273333.44, L = -273311.44.

[7] These group labels are meant to serve in a heuristic capacity only and should not be considered indicative that these said groups exist in the population.

[8] Group 4 has the earliest onset and tends to be the more severe of the offending groups. Being comprised of a small percentage of the overall sample, they tend to resemble the severe-5% group that both Moffitt and Vaughn et al. have previously anticipated (see Vaughn et al., 2011, 2013). In particular, the severe-5% group highlighted by Vaughn and his colleagues emerged from a careful analysis of a nationally representative sample that was assessed on sociodemographic, psychiatric, and behavioral characteristics. Their

findings showed that the severe-5% group was involved in a wide range of varied and intensive antisocial and psychiatric behaviors.

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