



Social Ecological Determinants of Substance Use Treatment Entry Among Serious Juvenile Offenders From Adolescence Through Emerging Adulthood



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ABSTRACT

Purpose: To examine the social–ecological determinants of substance use treatment entry among serious juvenile offenders over a 7 year period. Using the social–ecological framework, relevant predictors of substance use from the literature were used to assess risk (and protective) factors at the individual, parental, peer and neighborhood level.

Method: Serious juvenile offenders ($N = 1354$, $M_{age\ baseline} = 16.0$ years, $SD = 1.14$) were prospectively followed over 7 years ($M_{age\ Conclusion} = 23.0$ years, $SD = 1.15$). Cox regression with time invariant and time varying predictors was used to predict time to first substance use treatment entry.

Results: Results for each dimension, separately, varied slightly from the full model. In the full model peer delinquency, peer arrests, post-traumatic stress disorder (PTSD), impulse control, temperament, and emotional regulation remained salient risk (and protective) factors for treatment entry.

Conclusion: Associating with more deviant peers and having more of your peers arrested over the 7 year study period was associated with substantial increase in time to treatment entry. Furthermore, one of the strongest risk factors for treatment entry was a PTSD diagnosis. Treatment implications are discussed regarding peer affiliation and PTSD symptomology as well as potential neurological and biological contributors to increased risk for treatment entry.

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1. Introduction

Drug and alcohol use is most abundant during the developmental periods of adolescence (ages 12–17) and emerging adulthood (age 18–25). Specifically, 8.8% of adolescents and 21.5% of emerging adults reported using illicit drugs and nearly 12% of adolescents and 83% of emerging adults reported using alcohol in the past year (SAMHSA, 2013). Of greater concern are subsets of youth and emerging adults involved in the criminal justice system (Abrantes, Hoffmann, & Anton, 2005). These individuals have approximately five times higher rates of substance use and three times higher rate of substance use disorders (Aarons, Brown, Hough, Garland, & Wood, 2001; Grisso & Underwood, 2004) than those not involved in the criminal justice system. They also are more likely to enter substance use disorder (SUD) treatment, primarily through court order.

Though some studies have investigated which factors are most salient in predicting subsequent use among justice system involved youth, no study has considered the social–ecological risk (and protective) factors that predict entry into substance use disorder treatment. A social–ecological framework provides an excellent basis for exploring the influences of specific domains on SUD treatment entry among youth. A better understanding of these domains will enhance our ability to serve justice system involved youth.

1.1. Social ecological risk (and protective) factors

Utilizing the social–ecological approach (Bronfenbrenner, 1977) allows researchers to better depict, understand, and predict individual behaviors that are embedded in, and strongly affected by, social contexts. While a substantial literature has developed examining risk (and protective) factors for substance use, the current study is the first to examine risk (and protective) factors vis-à-vis SUD treatment entry among juvenile offenders. In this study we focused on four ecological dimensions most frequently identified by theorists and researchers (Bronfenbrenner, 1977): individual behaviors/traits, parental factors, peer factors, and neighborhood context.

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1.1.1. Individual factors

Some of the most robust predictors of substance use among youth and emerging adults are personality and temperament factors (Stevens et al., 2014; Wills & Dishion, 2004). Other facets of intraindividual processes that serve as protective factors include increased commitment or attachment to work (Henkel, 2011) and increased emotional regulation (Tarter et al., 2014). Additionally, studies have identified mental health factors (e.g. depression, post-traumatic stress disorder, and anxiety; Busuttill, 2011; Rao, 2006) as particularly impactful on substance use and substance use problems among young people. Remarkably, studies have found that individuals with a history of trauma or abuse and serious mental health problems are more likely to drop out of SUD treatment (Claus & Kindleberger, 2002). Considering that individuals involved with the justice system demonstrate extremely high rates of trauma and PTSD (Carrion & Steiner, 2000; Steiner, Garcia, & Matthews, 1997), it is important to examine how trauma may influence SUD treatment participation and response. More proximal factors that predict substance use include early age of onset (Grant, Stinson, & Harford, 2001), exposure to violence (Graziano & Wagner, 2011), and prefrontal pathology (Day, Celio, Lisman, Johansen, & Spear, 2013; Tahaney, Kantner, & Palfai, 2014).

1.1.2. Parental factors

Parental factors that contribute to substance use among youth include parental use (Biederman, Faraone, Monuteaux, & Feighner, 2000) and low levels of parental warmth (and high levels of parental hostility; Barnow, Schuckit, Lucht, John, & Freyberger, 2002; Van Ryzin, Fosco, & Dishion, 2012). For example, Van Ryzin et al. (2012) reported that family relationship quality predicted continued substance use from adolescence into emerging adulthood. Barnow et al. (2002) found that adolescents with alcohol problems, compared to those without, had a higher perception of parental rejection and lower warmth – thus leading to more alcohol use.

1.1.3. Peer factors

Peer influence is a major risk factor for substance use; adolescents who associate with anti-social (delinquent) peers are at substantially elevated risk of problem behaviors (e.g., SUD, delinquency) (Tarantino et al., 2014). For several decades, researchers have known that socializing with deviant peer groups is strongly and positively associated with risk for delinquency and drug use (Elliott & Menard, 1996; Elliott, Ageton, & Huizinga, 1982) and that one of the most common factors leading to any form of substance use is affiliating with substance-using peers (Chassin, Presson, Sherman, Montello, & McGrew, 1986; Dishion & Owen, 2002; Duncan, Duncan, & Hops, 1994; Elliott et al., 1982; Hawkins, Catalano, & Miller, 1992; Maxwell, 2002; Van Ryzin et al., 2012). Studies also have found that resistance to peer influence and the quality of peer relationships can mitigate the risk of substance use and delinquency among adolescents and young adults (Engels & ter Bogt, 2001; Giordano, Cernkovich, & Pugh, 1986; Giordano, Cernkovich, & Holland, 2003; Monahan, Steinberg, & Cauffman, 2009; Piehler, Véronneau, & Dishion, 2012; Steinberg & Monahan, 2007; Urberg, Goldstein, & Toro, 2005; Van Ryzin et al., 2012).

1.1.4. Neighborhood factors

As adolescents mature they begin to spend less time at home (under supervision of parents) and spend more time interacting with a variety of diverse settings (Cook, Herman, Phillips, & Settersten, 2002) and people. This can include spending more time with their friends, which could, in turn, lead to increased time spent in settings that may cause increased problems. For example, as adolescents report spending time in more disorganized neighborhoods they also report increased alcohol and drug use (Cicchetti & Rogosch, 2002; Leventhal & Brooks-Gunn, 2003; Winstanley et al., 2008). However, participation in more prosocial activities should mitigate the risk of substance use

and, in particular, risk for treatment entry. Moreover, previous research has found individuals with higher social capital (see Coleman & Coleman, 1994) are less likely to drink heavily or engage in health-damaging behaviors (Putnam, 2001; Wodak, Rana, & Vlahov, 2000), and report higher self-assessed health (Bolin, Lindgren, Lindström, & Nystedt, 2003).

1.1.5. Risk (and protective) factors for treatment entry

Prior studies investigating treatment entry among youth primarily have relied on cross-sectional data and have generated inconclusive results (Tsogia, Copello, & Orford, 2001). Tsogia et al. (2001) have called for more rigorous methodologies that use longitudinal data due to inconclusive results across studies. Among studies that have investigated predictors of treatment entry, the most common predictors include psychological wellbeing or psychological distress (Finney & Moos, 1995; Hser, Maglione, Polinsky, & Anglin, 1998; Storbjörk & Room, 2008), social distress such as family and peer conflict, (Cunningham, Sobell, Sobell, Agrawal, & Toneatto, 1993) and negative life events such as traumatic life experiences (or positive life events as a buffer for treatment entry; Cunningham, Sobell, Sobell, & Gaskin, 1994; Finney & Moos, 1995). It is noteworthy that much of the literature regarding treatment entry focuses on the motivation of the client or social pressures to enter treatment (DiClemente, Schlundt, & Gemmell, 2004; Hser et al., 1998; Simpson & Joe, 1993). While motivation is certainly an important factor to consider, it is likely that motivation for treatment is driven by a variety of individual and contextual factors that are not included in previous studies. For example, early studies have found that intrinsic motivation for treatment is more important than drug or alcohol use severity and other demographic variables (e.g. socio economic status, age of first use; Simpson & Broome, 1998). The processes described here may have been due to, not only motivational and social factors, but also intraindividual processes (e.g. emotional regulation), mental health problems, and the larger contexts with which the individual resides, such as community level risk factors.

Unfortunately, many of these studies have only focused on one dimension (e.g., microsystem) and have not considered a more encompassing approach that includes multiple domains (individual, parent, peer, and neighborhood) in tandem (e.g., mesosystem). Furthermore, many studies also only use static (time-invariant) predictors while examining the process of treatment entry, thus missing an opportunity to understand how predictors change within an individual over time. There is a need to use more dynamic approaches to understand complex processes such as treatment entry (especially for at risk samples such as juvenile delinquents) that include rigorous longitudinal designs and use both time varying and time invariant predictors. The current study moves the literature forward in its longitudinal, comprehensive, and multi-domain approach to understand predictors of treatment entry among youth.

1.1.6. Summary and hypotheses

By applying a social-ecological framework (Bronfenbrenner, 1977), this study aims to fill a gap in the literature by investigating factors in various domains (individual, familial, peer, and neighborhood) separately and simultaneously to determine risk and protective factors for treatment entry among serious juvenile offenders over the course of 7 years. We expected that individual factors related to personality and trauma would emerge as important risk factors for treatment entry, and more proximal factors (e.g., parental factors, and peer factors) would emerge as salient predictors of treatment entry over the 7 year period. Since neighborhood factors are more distal, we hypothesized that these factors would remain significant predictors of treatment entry, however at a smaller magnitude.

2. Method

2.1. Participants

Data were obtained from the *Pathways to Desistance Study*, a longitudinal study of serious juvenile offenders ($N = 1354$). To be considered for enrollment in this study participants had to be an adjudicated delinquent or found guilty of a serious offense. Data were collected over a period of 7 years with bi-annual assessments during the first three years and annual assessments (due to funding constraints) during the last four years of the study. At baseline participants were between the ages of 14 and 17 and 21 to 25 at study completion. Overall the study was able to achieve an average of 89.5% retention. Additional details on the study design and methods can be found in (Mulvey et al., 2004; Schubert et al., 2004).

2.2. Measures

A table with more detailed information on all measures including example items, number of items, and detailed descriptions can be found in Supplementary Table 1.

2.2.1. Dependent variable

The dependent variable was time to first entry into substance use disorder treatment. This was assessed by asking each participant if they had been admitted to any type of substance use disorder (alcohol or drug) treatment during the recall period.

2.2.2. Individual dimension

Gender (female reference group), racial minority (non-White reference group) and early age of onset (before 11 years old reference group) were dichotomous indicators. Neurological pathology was a dichotomous indicator for pre-frontal cortex impairment with the Stroop color-word test and the trail making task (Golden & Freshwater, 1978; Reitan, 1958). Socio economic status (Hollingshead, 1957) was measured using The Parental Index of Social Position (scores 11–17 = upper; 18–31 = upper-middle; 32–47 = middle; 48–63 = lower-middle; and 64–67 = lower) with lower scores indicating a higher social position.

Past year post traumatic stress disorder and major depressive disorder were assessed using a dichotomous indicator for the presence of PTSD in the past year with the Composite International Diagnostic Interview (Wittchen, Robins, Semler, Cottler, & World Health Organization, 1993; World Health Organization, 1994). Anxiety (time varying; α range .70–.95) was assessed using The Revised Children's Manifest Anxiety Scale (Reynolds & Richmond, 1985). Participants answered "yes" or "no" to 37-items regarding the level and nature of anxiety. Total score was used. Higher scores indicate more endorsed anxiety symptoms. The Exposure to Violence Inventory (time varying; α range .67–.78; Selner-O'Hagan, Kindlon, Buka, Raudenbush, & Earls, 1998) was used to assess the frequency of exposure to violence, with higher scores indicating greater exposure to violence.

Work orientation (time varying; α range .73–.97) was a subscale from the 30 item Psychosocial Maturity Inventory (Greenberger, 1984; Greenberger & Bond, 1976; Greenberger, Josselson, Knerr, & Knerr, 1975; Greenberger & Sørensen, 1974). Participants responded on a 4 point Likert scale ranging from "strongly agree" to "strongly disagree" to 10 items regarding pride in the successful completion of tasks. Impulse control (time varying; α range .78–.81) was measured using the Weinberg Adjustment Inventory (Farrell, Danish, & Howard, 1992; Weinberger & Schwartz, 1990). Participants respond on a 4-point Likert scale ranging from "strongly disagree" to "strongly agree." Higher scores indicate more impulse control. Temperament was measured using the Emotionality, Activity, Sociability, and Impulsivity Inventory (EASI, $\alpha = .67$; (Buss & Plomin, 1975). Participants respond on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree." Higher scores

indicate greater emotionality. Emotional regulation (time varying; α range .81–.88) was assessed using the Children's Emotion Regulation Scale, (Walden, Lemerise, & Gentile, 1992). Participants responded on a 4-point Likert scale ranging from "not at all like me" to "really like me." Higher scores indicate better ability to regulate emotions.

2.2.3. Parental dimension

Parental substance use and parental arrests were dichotomous indicators assessing mother and father past or current substance use and if one or both parents had been arrested in the past 6 months. Parental warmth and hostility (time varying; α range .78–.96) were measured using The Quality of Parental Relationships Inventory (Conger, Ge, Elder, Lorenz, & Simons, 1994).

2.2.4. Peer dimension

Peer delinquency (time varying; α range .89–.94) was measured using the mean values of both anti-social peer behaviors and anti-social peer influences from the Peer Delinquent Behavior measure (Browning, Thornberry, & Porter, 1999). Participants responded on a 5 point Likert scale ranging from "none of them" to "all of them." Higher scores indicate associating with more delinquent peers. Friend arrests (time varying) was the proportion of the participant's 5 closest friends who have been arrested. Resistance to peer influence (time varying; α range .73–.78) was measured using a scale developed by the original project investigators for the Pathways to Desistance. Participants were asked to rate how accurate statements about their friends were for them (i.e. "really true"). The mean across all ten dimensions is used to create one score where higher scores indicate less peer influence. The Quality of Relationships Inventory (Pierce, Sarason, Sarason, Solky-Butzel, & Nagle, 1997) was adjusted to reference peers to assess quality of friendships (time varying; α range .74–.82). The scale contains 10 items that vary in the level of support offered by friends in which participant's rate on a 4 point Likert scale ("not at all" to "very much"). Higher scores indicate higher supportive friendships.

2.2.5. Neighborhood dimension

Neighborhood disorganization (time varying; α range .94–.96) was measured using the Neighborhood Conditions Measure (Sampson, Morenoff, & Gannon-Rowley, 2002) that assessed physical and social disorder. A total score was used to assess neighborhood disorder. Participants responded on a 4 point Likert scale ("never" to "often") which higher scores indicate more neighborhood disorder. Social capital (time varying; α range .67–.76) was measured using the Social Capital Inventory (Nagin & Paternoster, 1994) which assesses intergenerational closure, social integration, and perceived opportunity for work. The mean of the three dimensions was used, with higher scores indicating more social capital. **Community activities** (time varying; e.g., sports, volunteer work) was assessed using the Community Involvement Scale, (Elliot, 1990) with higher scores indicating involvement in more structured activities. More information on measures can be found at Pathways to Desistance website (www.pathwaysstudy.pitt.edu).

2.2.6. Statistical analyses

Cox proportional hazards regression with time-varying co-variables, which is a class of survival models, (Singer & Willett, 2003) was the primary analytical approach. The follow up period, defined in number of months, was used as the survival time. The event was defined as the time of first admittance to SUD treatment. The amount of time to death, loss to follow up, or the end of the study period was treated as the censored time observation. The association between the predictors and the outcome (e.g. time to treatment entry) was quantified using hazard ratios and 95% confidence intervals. Our analyses consisted of 5 models. In our unadjusted analyses, each of the predictors from each of the dimensions (e.g. individual, parental, peer, and neighborhood) were entered separately. In our adjusted analyses, all predictors from all dimensions were entered into the model simultaneously. In each

model (both unadjusted and adjusted) race, gender, alcohol, drug use, and exposure time (e.g. time spent in the community) were controlled allowing us to determine risk and protective factors for substance use treatment entry above and beyond participants' actual substance use and time spent in a controlled environment. Furthermore, our models utilized time-varying and time-invariant predictors over the 7 year study period, allowing us to capture both static and shifting risk factors. Missing data (< 10%) were handled using multiple imputation ($k = 50$; Allison, 2002; Graham, Olchowski, & Gilreath, 2007) and all analyses were conducted using SAS version 9.4. (SAS Institute Inc., 2011. Version 9.4, 2011).

3. Results

3.1. Participant characteristics

On average, participants were 16 ($SD = 1.14$) years old and primarily male (86%; $n = 1170$; Table 1). Overall, the race/ethnicity of participants was diverse with 41% ($n = 561$) identifying as African American, 33% ($n = 454$) Hispanic, and 20% ($n = 274$) White. At baseline, participants reported alcohol use/frequency on 15 ($SD = 31$) days in the past 6 months and 21% reported using cannabis daily.

3.2. Social ecological determinants by dimension

Table 2 displays hazard ratios and 95% confidence intervals for each dimension (model 1 – model 4) and the final model (model 5).

Table 1
Baseline characteristics.

	Total sample ($N = 1354$) M (SD) or n (%)
Demographics	
Age, in years	16.04 (1.14)
Male n (%)	1170 (86.4)
White n (%)	274 (20.2)
Black n (%)	561 (41.4)
Hispanic n (%)	454 (33.5)
Other n (%)	65 (4.80)
Neighborhood	
Neighborhood disorganization	2.35 (.752)
Social capital	3.00 (.481)
Community activities	.259 (.575)
Family/School	
Enrolled in school n (%)	972 (71.9)
Unemployment n (%)	1000 (73.9)
Father drug problem n (%)	487 (45.9)
Mother drug problem n (%)	364 (28.16)
Psychiatric disorders	
Clinically significant depression ^a n (%)	97 (7.69)
Clinically significant anxiety ^b	10.1 (6.11)
Post-traumatic stress disorder ^a n (%)	76 (6.24)
Substance use diagnoses	
Alcohol use (past 6 months)	15.4 (31.4)
Early onset substance use n (%)	51 (4.11)
Lifetime alcohol dependence n (%)	132 (10.1)
Lifetime drug dependency n (%)	204 (15.67)
Social and peer	
Peer delinquency ^c	2.03 (.826)
Friend arrests ^d	.617 (.426)

Ranges: Neighborhood disorganization (1.0–4.0); social capital (1.1–4.4); community activities (0.0–4.0); depression, post-traumatic stress disorder (0.0–1.0); anxiety (0.0–28.0); peer delinquency (1.0–5.0); friend arrests (0.0–1.0).

^a Diagnoses were derived from the Composite International Diagnostic Interview.

^b Anxiety scores were derived from the Revised Children's Manifest Anxiety Scale.

^c Delinquency scores were derived from the Peer Delinquent Behavior measure.

^d Friend arrests is the proportion of the participants 5 closest friends who have been arrested.

3.2.1. Individual dimension

Individual level factors (Table 2; model 1) revealed that diagnosed prefrontal pathology (i.e. Stroop task), socio-economic status, major depressive disorder, anxiety disorder, and emotional regulation were not significantly associated with SUD treatment entry. White participants, compared to non-White participants, had a 38.4% decrease in the hazard rate of treatment entry and, compared to males, females had a 33.9% increase in the hazard. Youth who started using alcohol or drugs before the age of 11 had a 55.3% increase in the hazard rate for substance use treatment entry. Youth who were diagnosed with post-traumatic stress disorder (PTSD) had a 56.6% increase in the hazard rate for treatment entry. Those who were exposed to violence had a 7.5% increase and youth with higher work orientation had a 24.8% decrease in the hazard rate. In terms of personality characteristics, individuals who had higher impulse control had a 14.4% decrease and those with higher temperament (e.g., emotional reactivity) scores had a 20.9% decrease in the hazard rate for treatment entry.

3.2.2. Parental dimension

Among factors measured for participants' parents, both mothers' substance use and parental warmth were not significantly associated with treatment entry. Having a father with a current or past drug problem was associated with a 32.5% increase in the risk of treatment entry compared to individuals who did not have a father with a substance use problem. Furthermore, if youth reported high parental hostility, they had a 46.9% increase in the hazard of entering treatment and individuals who reported having a family member arrested or jailed had an 8.4% increase in the hazard. See model 2.

3.2.3. Peer dimension

Both resistance to peer influence and friendship quality were not significantly associated with SUD treatment entry. However, individuals who reported associating with delinquent peers had a 43.5% increase in the likelihood of treatment entry (model 3). Furthermore, youth who had a higher proportion of friends who had been arrested had a 34.5% increase in likelihood of entering treatment.

3.2.4. Neighborhood dimension

Neighborhood disorganization (model 4) and social capital were not significantly associated with substance use treatment entry. Interestingly, involvement in organized community activities was associated with a 25% increase in the hazard for treatment entry.

3.2.5. Social ecological determinants combined

Model 5 displays hazard ratios and confidence intervals for each dimension entered simultaneously. Individuals who were diagnosed with PTSD had a 66.8% increase in the hazard rate. In terms of personality, youth with higher impulsive control and higher internal emotionality had a 14% and 32.6% decrease in the chances of SUD treatment entry, respectively. Furthermore, individuals with higher work orientation had a 22.2% decrease in the likelihood of SUD treatment entry. Just shy of significance ($p = .05$), individuals with increased emotional regulation had a 15.2% decrease in the chances of treatment entry.

Interestingly, in the full model, none of the parental factors significantly predicted time to treatment entry. However, involvement with delinquent friends and having a larger proportion of friends arrested during the study period increased the hazard rate by 31% and 40%, respectively. From the most distal dimension (e.g. neighborhood), we can see that youth involved in organized community activities have a 24.3% increase in the hazard rate. Both neighborhood disorganization and social capital were not associated with treatment entry over the 7-year period.

Table 2
Cox regression hazard ratio models (HR, 95%CI).

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
	Individual dimension	Parental dimension	Peer dimension	Neighborhood dimension	Full model
Non-White	.616 [.494, .769]				.614 [.470, .871]
Female	1.34 [1.01, 1.77]				1.59 [1.15, 2.20]
Early onset	1.55 [1.07, 2.26]				1.09 [.694, 1.71]
Socio-economic status	.998 [.990, 1.01]				.953 [.839, 1.08]
Prefrontal pathology	.901 [.477, 1.70]				.985 [.479, 2.03]
MDD	1.16 [.795, 1.68]				1.07 [.712, 1.61]
PTSD	1.57 [1.04, 2.36]				1.67 [1.07, 2.61]
Anxiety	1.02 [.997, 1.04]				1.02 [.991, 1.04]
Work orientation	.752 [.616, .919]				.778 [.609, .993]
Exposure to violence	1.08 [1.03, 1.12]				1.05 [.993, 1.10]
Impulsive control	.856 [.764, .958]				.860 [.750, .986]
Temperament	.719 [.565, .916]				.674 [.511, .891]
Emotional regulation	.877 [.760, 1.01]				.848 [.712, 1.01]
Mothers substance use		1.01 [.823, 1.24]			1.02 [.804, 1.29]
Fathers substance use		1.33 [1.07, 1.64]			1.20 [.939, 1.54]
Parental warmth		.908 [.778, 1.06]			.904 [.748, 1.09]
Parental hostility		1.47 [1.12, 1.93]			1.19 [.860, 1.64]
Family arrests		1.08 [1.02, 1.06]			1.04 [.972, 1.12]
Peer delinquency			1.44 [1.28, 1.61]		1.31 [1.12, 1.54]
Friend arrests			1.35 [1.06, 1.73]		1.40 [1.04, 1.88]
Friendship quality			.865 [.715, 1.05]		.954 [.753, 1.21]
Resistant to peer influence			.860 [.733, 1.00] ^a		.911 [.747, 1.11]
Neighborhood disorganization				1.02 [.903, 1.15]	.989 [.847, 1.56]
Social capital				.849 [.706, 1.02]	1.06 [.838, 1.14]
Community involvement				1.25 [1.43, 1.55]	1.24 [1.03, 1.50]
Street time exposure	.762 [.602, .965]				.890 [.669, 1.18]
Alcohol use	1.00 [.999, 1.00]	1.00 [1.00, 1.00]	1.00 [1.00, 1.01]	1.00 [1.00, 1.01]	1.00 [.998, 1.00]
Drug use	1.40 [1.34, 1.48]	1.45 [1.39, 1.51]	1.44 [1.38, 1.50]	1.49 [1.43, 1.55]	1.34 [1.26, 1.42]

HR = hazard ratio; 95% CI = 95% confidence interval; MDD = major depressive disorder; PTSD = post traumatic stress disorder.

Bold indicates the confidence interval does not include 0.

^a $p = .05$.

4. Discussion

The primary purpose of this study was to examine the impact of social-ecological determinants of substance use disorder (SUD) treatment entry among serious juvenile offenders over a 7 year period. Better understanding what factors heighten the likelihood of SUD treatment entry will improve the fields' ability to provide the best possible services for these youth. This is important as this study begs the question – is substance use disorder treatment a good or bad thing? Our study aids in determining which social-ecological dimensions are most salient in predicting treatment entry, thus potentially identifying individuals who would benefit from early intervention. We did find that more proximal dimensions (e.g. individual, peer) were the most salient predictors of treatment entry. However, no parental factors emerged as important predictors in treatment entry among this sample of juvenile delinquents.

4.1. Distal predictors of treatment entry

Perhaps not surprisingly, peers appeared to be the most influential domain influencing treatment entry among juvenile offenders. Specifically, we found that associating with more deviant peers and having more of your peers arrested over the 7 year study period was associated with substantial increases in the likelihood of SUD treatment entry.

Prior studies have demonstrated that, while affiliation with like-minded peers is partly due to a tendency for individuals to select peers with pre-existing similarities, it is also due to peer socialization, with peers influencing each other and becoming more alike in their attitudes and behaviors over time (Brown, 2004). It may be that witnessing peers become increasingly involved in delinquency (e.g. being arrested, increase substance use) could serve as a “wake up call” for some individuals who may begin to see their behavior as less normative and more problematic. Furthermore, experimental work has found

that adolescents, when in the presence of peers, tend to engage in more risk taking behavior (Gardner & Steinberg, 2005). Individuals associating with primarily deviant peers may be simply increasing the amount of time spent with these peers during community activities. Given that most developmental theory (Moffitt, 1993) has supported the notion that resisting influence of peers should mitigate deviant behaviors (Monahan et al., 2009), we were surprised to find that resistance to peer influence was not associated with a significant decrease in the likelihood of treatment entry among the current sample.

Though none of the parenting dimensions were significantly associated with treatment entry, it may be that adolescents with parents who display hostility and have multiple parents or family members involved with the criminal justice system may be more apt to gain emotional and psychological support from their peers. Previous meta-analyses have found that the strongest effects for the association between parenting and delinquency were support aspects such as neglect and hostility (effect size range 0.26–0.33; Hoeve et al., 2009). This may indicate that increased peer selection and friendship during early adolescence may be associated with developing emotional and behavioral autonomy from parents, and this dependence may be replaced by dependence on peers (Steinberg, 1990). These findings have clinical implications regarding how treatment is provided for serious juvenile offenders. Perhaps treatment should focus on how to reduce deviant peer affiliation, in part through decreasing parental hostility. Previous research has found promising effects for multi-systemic therapy which has been found to improve family relations (e.g. functioning, monitoring, & cohesion) and, subsequently, reduce affiliations with delinquent peers among serious juvenile offenders (Huey, Henggeler, Brondino, & Pickrel, 2000).

4.2. Individual predictors of treatment entry

A second important finding in this study was the strong association between PTSD and treatment entry. Specifically, we found that a

diagnosis of PTSD at baseline was associated with >50% increase in the likelihood of treatment entry. This is in line with decades of epidemiological studies showing that high prevalence of PTSD symptoms is associated with increased substance use (Chilcoat & Menard, 2003; Hien et al., 2009). Previous studies have found that individuals involved in the criminal justice system experience PTSD symptoms at higher rates (upwards of 30%) than community samples (Carrion & Steiner, 2000; Steiner et al., 1997). For youth whose brains are still developing, traumatic experiences may be particularly detrimental (De Bellis, 2001) and may permanently alter the stress response system (e.g., sympathetic nervous system, hypothalamic–pituitary–adrenal axis; De Bellis, 2001; Heim, Meinlschmidt, & Nemeroff, 2003); and such alterations have been shown to be associated with increased risk of substance use problems (Gollan, Lee, & Coccaro, 2005; Shonkoff, Boyce, & McEwen, 2009; Shonkoff & Garner, 2012). These factors could contribute to increased delinquency and, more importantly, increased substance use and need for treatment. Consistent with the foregoing, our results indicated that individuals with greater impulse control, increased emotionality, and better emotional regulation were less likely to enter SUD treatment (range 15–32%).

4.3. Treatment considerations

From our results, it appears that the majority of juvenile delinquents entering SUD treatment can be expected to have experienced some form of serious emotional or physical trauma. When considering the developmental periods of our sample (adolescence and emerging adulthood) attention should be paid to three important factors: 1) literature exploring treatment receipt for those that need it, 2) delinquency in the context of persistence (e.g. adolescent limited vs. life-course persistent; (Moffitt, 1993) and how this impacts treatment, and 3) co-morbidity in the context of tailored or managed-care models.

Among our sample, one of the more important factors to consider is – are those individuals in need of treatment receiving it? We found that, among those with a drug or alcohol abuse or dependence diagnosis at the 6th year follow up (participants between the ages of 20 and 26), approximately half received some form of treatment. This proportion should be interpreted in the context of the larger treatment system, that is, in 2013 of the 23 million individuals who needed treatment only 2.5 million (10%) actually received treatment (Center for Behavioral Health Statistics and Quality, 2015). While treatment admission may be due to larger factors such as court ordered treatment, identifying factors that predict increased time to treatment entry may aid in pre-emptively intervening in a more appropriate way by addressing areas such as delinquent peers and PTSD symptomology.

Much of the literature surrounding juvenile delinquency and development has focused on classes of individuals. Specifically, Moffitt (1993) identified two classes of delinquency: adolescent limited and life-course persistent. Briefly, adolescent limited individuals develop normative delinquency during adolescence and eventually phase out. However, life-course persistent individuals display antisocial behaviors early in life and continue to experience consequences of delinquency throughout adulthood including arrests, drug use, and various social problems. Typical mental health treatments may not be enough for life-course persistent individuals who have a history of trauma or substance use. While great strides have been made in the utilization and development of substance use disorder treatments, refinements are still needed to tailor treatments for different adolescent profiles.

One treatment that has focused on treating trauma among juvenile delinquents is Trauma Affect Regulation: Guide for Education and Therapy (TARGET; Ford & Russo, 2006) which focuses on interrupting automatic, or reactive, processes (e.g. “auto pilot”). Recent studies have found significant reductions in PTSD symptoms and substance use for those assigned to TARGET compared to trauma-sensitive usual care (Ford & Russo, 2006; Frisman, Ford, Lin, Mallon, & Chang, 2008). However, a traditional approach to treating individuals who have a

multitude of risk factors (e.g. delinquency, PTSD, emotional regulation problems, and a substance use disorder) may simply not be appropriate for these individuals. This is shown best among studies that have found that improvement in PTSD symptoms is associated with improvement in substance use outcomes, with minimal evidence for changes in substance use improving PTSD symptomology (Back, Brady, Sonne, & Verduin, 2006; Hien et al., 2009). It may be useful to engage juvenile delinquents with a history of trauma or a diagnosis of PTSD into treatments specifically focused on PTSD symptom reduction which may, in turn, reduce alcohol and drug use. Furthermore, when considering the treatment of adolescents and emerging adults some individuals may experience re-traumatization during in the treatment process thus calling for more specific and tailored time frames of treatment.

Though the idea of managed care processes (sometimes called chronic care models; Von Korff, Gruman, Schaefer, Curry, & Wagner, 1997; Wagner, Austin, & Von Korff, 1996) – or the systematic use of guidelines supported by continued input of clinical information – are not new to the field of health care, only recently have researchers in SUD treatment begun to visit this as a possible treatment model. Treatment management strategies can include the following strategies: patient self-management support, delivery system redesign, use of clinical information systems, provider decision support, linkage to community resources, and health care organization support (Bodenheimer, Wagner, & Grumbach, 2002). In the context of our study and integrating our findings with treatment strategies that mimic these chronic care models, individuals with co-occurring disorders (e.g. PTSD diagnosis and substance use disorder) may have more complex clinical and organizational needs.

One example taken from our findings could include individuals with a persistent delinquent profile (e.g. continued delinquency into young adulthood), a history of trauma or PTSD, and a substance use disorder. These individuals may benefit from a care model that re-evaluates treatment needs at frequent intervals. Clinicians may consider re-evaluating a treatment plan after a pre-determined amount (e.g. 1 month) of time to tailor specific treatment needs. For example, clinicians may decide to include more trauma based therapy for individuals with prior histories or a diagnosis of PTSD. Other examples may include more technology based strategies for individuals who are unresponsive to face-to-face therapy (e.g. MAPIT; Walters et al., 2014), reminder systems for medication compliance, referral to peer support groups, exercise programs, home care programs, and even interventions in which decision making is a shared process (Woltmann et al., 2012). Utilizing this managed care approach has sometimes been criticized for the cost-effectiveness compared to traditional treatment strategies (van Steenberg-Weijnenburg et al., 2010), however in a more recent meta-analysis there were no differences in the use of chronic care models compared to other treatment strategies when treating a variety of mental health problems (Woltmann et al., 2012). Though there are an undue number of management care options – it is clear that adolescents involved in the justice system represent a population that may benefit from more tailored treatment parameters than typical medical based care can provide.

5. Limitations and conclusions

Our study has several limitations. First, only a small proportion (12%) of individuals in our sample enter substance use disorder treatment through the 7 year study period, which may have restricted the variability in outcomes. However, our findings are robust such that we controlled for days and frequency of drug and alcohol use as well as time spent in the community. Second, the sample was comprised entirely of juvenile delinquents and was primarily male (86%); thus, findings may not extend to the general population or to female juvenile delinquents. Finally, future research should investigate these pathways with methodologies that investigate both within- and between-person variance (e.g. auto-regressive cross-lagged models with structured

residuals; Bollen & Curran, 2006; Curran, Howard, Bainter, Lane, & McGinley, 2014).

The present study is the first, to our knowledge, to longitudinally investigate the social ecological determinants of substance use treatment entry among serious juvenile offenders. These data afforded us the opportunity to investigate these predictors over two developmental periods: adolescence and emerging adulthood. Our results offer two social ecological perspectives: first, we offer support for treatment entry risk (and protective) factors among more proximal dimensions and second, with each dimension combined. Results indicated peer factors, PTSD symptomology, and internal emotion regulation as salient predictors. However, future research should investigate if individuals in need of treatment are actually receiving it. Future research should also investigate factors more closely as they relate to relapse rates or increased delinquent behaviors over the span of adolescence and emerging adulthood.

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