

## ABSTRACT

Title of Thesis: OPIOID ABUSE AMONG ADOLESCENTS  
WHO OFFEND: RISK FACTORS AND THE  
ROLE OF GENDER

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In this paper, I explore risk factors for opioid use and abuse among juvenile justice system-involved adolescents convicted of a serious offense; a group known to experience high rates of substance abuse and dependence. Using the Pathways to Desistance dataset, I assess whether risk factors for substance use that includes opioids are distinct from the risk factors for other illicit substance use that does not including opioids (non-opioid substance use). I also explore how, if at all, the motives and patterns of opioid use are distinct for male and female adolescent offenders. I identify older age, white race, and clinically significant mental illness as significant risk factors for substance use including opioids relative to non-opioid substance use. I do not find any distinct risk factors for adolescent females' opioid use relative to their male peers.

OPIOID ABUSE AMONG ADOLESCENTS WHO OFFEND: RISK FACTORS  
AND THE ROLE OF GENDER

by

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## Dedication

For William, whose light is still shining.

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## Chapter 1: Introduction and Literature Review

An alarming uptick in adolescent substance abuse and death, starting in the late 1990s, has been attributed primarily to the growing epidemic of opioid misuse in the United States (Curtin et al., 2017). Drug overdose deaths increased 15 percent for males and 35 percent for females aged 15-19 between 2013 and 2015; more than two-thirds of these deaths were attributable to opioids (Curtin et al., 2017). Opioid-related fatalities have increased fourfold since 1999, and deaths due to synthetic opioids like fentanyl have increased 540 percent in the past three years (Rudd et al., 2015; O'Donnell, 2017). Further, opioid misuse was estimated to cost the U.S. \$504 billion in 2015 (Florence et al., 2016). Accordingly, opioid misuse has been highlighted as an urgent public health and criminal justice problem in the U.S. (Rudd et al., 2015; O'Donnell, 2017; Warner et al., 2016).

The opioid epidemic is driven largely by increases in prescription opioid misuse among young adults, however, opioid use, particularly prescription opioid use, is also a growing problem among adolescents. This matters because when opioid use begins in adolescence, users are significantly more likely to develop drug dependence and less likely to receive substance abuse treatment relative to users who begin later in life (Palamer et al., 2016). Hospital admissions due to opioid exposures for adolescents doubled between 1997 and 2012 (Gaither et al., 2016). While adolescents report higher levels of prescription opioid than heroin use, increases in adolescent deaths are primarily due to heroin, and other drugs laced with the synthetic opioid fentanyl (Ahrensback et al., 2017). Notably, these drastic increases in opioid misuse

have occurred while rates of use for most other drugs have remained stable or declined (Jones et al., 2015; Warner et al., 2016). In 2015, for example, 25 percent of adolescents reported never using alcohol or marijuana compared to only two percent of adolescents in 1975 (Johnston et al., 2016).

Increases in opioid use are facilitated, in part, by a greater variety of available prescription opioids and because physicians have prescribed these medications at an increased rate since the mid-1990s (Kilmer et al., 2014; Muhuri et al., 2013). This is notable because most opioid users, including adolescents, begin with prescription opioids (Ahrensback et al., 2017). Supply of heroin has also increased in parallel to the rising availability of prescription opioids, and prices for heroin have decreased consistently each year since 2001. (Compton et al., 2016; Kilmer et al., 2014). One study found that each \$100 decrease in the cost per gram of heroin was associated with a 2.9 percent increase in heroin overdose related hospitalizations (Unick et al., 2014).

In this paper, I will explore risk factors for opioid use among juvenile justice system-involved adolescents, a group known to experience high rates of substance abuse and dependence. I will also examine whether these risk factors are distinct from the risk factors for non-opioid substance use. This population merits exploration because opioids are more likely to be prescribed to youth who already have risk factors for substance use disorders. For example, adolescents with pre-existing mental health disorders (not including substance use disorders) are more likely to receive opioids and more likely to receive long-term prescriptions for opioids than adolescents without pre-existing mental health disorders (Cicero et al., 2014;

SAMHSA, 2016). This is troublesome for reasons that extend beyond increasing access to prescription opioids among an already high-risk population.

Adolescents who misuse prescription opioids report that they are most likely to get the drugs from friends, so increases in prescription opioids may reach more adolescents than intended (SAMHSA, 2016; Jones et al., 2015; Ahrensback et al., 2017). Further, among heroin users, those who report prior prescription opioid misuse are more likely to meet the criteria for a substance use disorder than those who do not report prior prescription opioid misuse (Jones, 2013). Further, youth who have used prescription opioids are more likely to go on to use heroin (Jones, 2013; Ahrensback et al., 2017). Among high school students who report use of heroin, more than three in four students (over 75 percent) began with prescription opioids (Palamar et al., 2016). Another study found that adults who misuse prescription opioids are 19 times more likely to initiate heroin use than adults who do not misuse prescription opioids (Muhuri et al., 2013). Qualitative studies examining the transition from prescription opioid misuse to heroin use find that users view heroin as more available and more cost-effective than prescription opioids (Cicero et al., 2014; Lankenau et al., 2012; Mars et al., 2014; Pollini et al., 2011). Last, I want to explore sex differences in adolescent opioid use since prior research suggests that young adults are more likely to engage in opioid use than younger teens. Contrary to trends for the overall population, among those aged 12-17, opioid use is more prevalent among adolescent females than males, a phenomenon driven primarily by prescription opioid misuse (Gaither et al., 2016).

### ***The relationship between opioid abuse and other substance abuse among juvenile offenders***

Research consistently finds that justice system-involved youth in the U.S. report higher levels of substance abuse than their uninvolved peers (Chassin, 2008; Office of Applied Studies, 2003). Three-quarters of detained females and nearly two thirds of detained male adolescents meet the criteria for a substance use disorder diagnosis (Teplin et al., 2002; McClelland et al. 2004). Many justice-involved adolescents also report current substance use; up to 65 percent of males and up to 55 percent of females test positive for illegal drug use at the time of arrest (Dembo et al., 1999; Zhang, 2004).

There is limited research on opioid abuse among juvenile offenders, but research finds that adolescents who engage in “hard drug” use are more likely to engage in polydrug use, and have higher exposure to an array of risk factors compared to adolescents who engage in alcohol or marijuana use alone. One longitudinal study of serious juvenile offenders found that seven percent reported opiate use at the baseline reporting year, compared to 80 percent who reported using marijuana and 80 percent who reported using alcohol (Mulvey et al., 2010). These rates were nearly twice that of their same-age peers who are not involved in the juvenile justice system (Ahrensback et al., 2017). While this demonstrates that proportionally fewer juvenile offenders report opioid abuse than abuse of other substances, it does not describe the different characteristics or experiences that lead to drug use for juvenile offenders who abuse opioids. Further, death due to opioid use is more common than deaths for other substance use, thus is important for policy and

prevention. One reason for the lack of information specific to opioid abuse among juvenile offenders is that a substantial portion of research treats alcohol and other drug use (“AOD”) as a monolithic indicator of risk (Kilpatrick et al., 2000; Wiesner & Capaldi, 2005; Trim et al., 2015). This research finds that there are several overlapping risk factors for substance use and juvenile justice system involvement, including: male gender, low self-control, early initiation of substance use, history of mental illness, low levels of parental monitoring, negative peer influence, and exposure to traumatic experiences. (Trim et al., 2015, SAMHSA, 2016; Hawkins, et al., 1992).

Juvenile offenders who desist from substance use are more likely to desist from offending, as well. Youth who desist from substance abuse early are less likely to become persistent offenders into adulthood (Chassin, 2008; Office of Applied Studies, 2003; Mulvey et al., 2010). Juvenile offenders who report high levels of substance use are more likely to recidivate, report antisocial behaviors, engage in property crime, and are less likely to engage in prosocial behaviors (D’Amico et al., 2008; Schubert et al., 2011). It is important, then, to explore patterns of opioid abuse among juvenile offenders to better understand whether existing interventions targeting substance abuse behavior, and risk factors that may lead to substance abuse behaviors, among juvenile offenders are also adequate for addressing opioid abuse.

Females in the juvenile justice system may be at a higher risk for opioid use because relative to males, they are more likely to have a mental health diagnosis or to report substance use (Mendel, 2008). Further, females are more likely than their male

counterparts to come into contact with the juvenile justice system for low level offenses, such as substance use. (Huizinga & Miller, 2013).

I will explore the risk factors for opioid abuse among adolescents, whether these risk factors are different for opioids compared to other illicit substances, and how, if at all, the motives and patterns of opioid use are distinct for male and female adolescent offenders. Specifically, I will explore the following research questions:

- How do risk factors for opioid abuse differ from risk factors for other drug use among system-involved adolescents?
- How do risk factors for opioid abuse differ for system-involved males and females?

Disentangling the unique risk factors, motives, and experiences that facilitate distinct types of illicit drug use may be important for understanding the types of rehabilitative services that juvenile offenders need. This may also help the research, policy, and program communities respond to changing trends in drug use and poly-drug use among juvenile offenders.

## **Review of the Literature**

### **Risk factors for opioid abuse and other substance abuse among juvenile offenders**

Research on adolescent substance use in general suggests that risk factors for adolescent opioid abuse and dependence may be distinct from risk factors for other illicit substances. There is limited research available on opioid use specifically, but one study found that frequency of opioid abuse was predicted by antisocial peers,

anxiety and other mental health symptoms, and delinquent behavior while frequency of marijuana use was only predicted by antisocial peers and delinquent behavior, hallucinogen use was predicted by age and social problems, and binge drinking was predicted by all of these risk factors (Nation & Heflinger, 2006). Below, I review risk factors for substance abuse in general and present theoretical explanations for why these risk factors may be associated with opioid abuse, when appropriate. I am also interested in exploring whether distinct risk factors are related to opioid abuse for female versus male adolescent offenders. Accordingly, I also highlight evidence of gender differences and theoretical explanations for these differences specific to each risk factor.

## **Age**

Though prevalence of most substance use peaks around 17 years, increases in opioid abuse have been observed most prominently among young adults aged 18-25 (Johnston et al., 2013; Jones et al., 2015). Heroin use, for example, increased 109 percent among young adults ages 18-25 between 2011 and 2013 (Jones et al., 2015). While levels of heroin use among high school students remain low, at less than one percent of high school students, the number of high school age adolescents who tried heroin for the first time in the past year continues to increase (Hughes et al., 2016; Johnston et al., 2013). While opioid use peaks around age 18-25, other substance use declines after peaking around age 17. Continued increases in use beyond age 17, then, may be a unique predictor for opioid use. It remains unclear, however, whether age will represent a unique predictor for opioid use among justice system involved adolescents.

## **Race/ethnicity**

Rates of substance abuse among black, white, and non-white Hispanic adolescents are similar (Saloner et al., 2014). White and non-white Hispanic youth report roughly similar levels of alcohol and other illicit substance use and abuse, which is slightly higher than rates of use abuse among black youth (Swendsen et al., 2012). Opioid abuse seems to be equally prevalent among white individuals and in some communities, even more prevalent among white individuals (Cicero et al., 2014; Hedden, 2015; Hughes et al., 2016). In the past 20 years, heroin use has increased across all ethnic groups but has increased most among non-Hispanic whites (Cicero et al., 2014; Heden, 2015; Jones et al., 2015;). Youth of color are overrepresented in the juvenile justice system, so it merits exploration whether race and ethnicity serve as a protective factor against opioid abuse among this population.

## **Self-Control**

Personality traits, including sensation seeking, impulsivity, aggression, and social withdrawal are associated with an increased risk of substance abuse during adolescence (Flexon et al., 2016; Nation & Heflinger, 2006; Wiesner et al., 2005). Many of these personality traits are studied as measures of a broader indicator of self-control. Low self-control is one of the most reliable predictors of antisocial behavior (Flexon et al., 2016; Pratt & Cullen, 2000). In a study of drug treatment among serious adult offenders, impulsivity and sensation seeking personalities were negatively associated with desisting from opioid abuse. These same factors were important characteristics for desisting from other types of drugs, as well (Taylor et al.,



2013). Additionally, high self-control appears to buffer the effects of stressful life events and peer substance use on adolescent substance abuse (Willis et al., 2008).

The General Theory of Crime provides a theoretical explanation for the influence of self-control on adolescent substance abuse. The General Theory of Crime reasons that low self-control, impulsive behavior, and inability to delay gratification in early childhood are strong and consistent risk factors for offending and “analogous” risk behaviors later in life (Gottfredson and Hirschi, 1990). Gottfredson and Hirschi (1990) argue that individuals who exhibit low self-control in early childhood are not able to see the long-term consequences of their actions. These individuals tend to be thrill seeking and lack future orientation. Consistent with this theory, research finds that conduct problems and aggression in early childhood predict substance use in adolescence (Wiesner et al., 2005). Literature also shows initiation of substance use before adolescence is associated with an increased likelihood of engaging in criminal offending in adolescence (Huizinga et al., 1995). Further, low self-control has been found to predict a variety of substance use behaviors, including opiates, marijuana, and cocaine (De Wit, 2009). Self-control is likely an important predictor for opioid use, but evidence does not suggest that self-control is a stronger predictor of opioid use than other drug use.

### **Co-occurring mental health problems**

Mental illnesses, not including substance use disorders, have been linked to greater likelihood as well as higher levels of opioid abuse. In a study examining how risk factors predict adolescent substance use, extreme anxiety predicted opioid use, but not use of any other drugs or alcohol (Nation & Heflinger, 2006). One study

found that 70 percent of individuals with an opioid abuse disorder had a co-occurring mental health diagnosis (Rounsaville et al., 1985).

Adolescent offenders are at an increased risk of having a substance use disorder. When adolescent offenders have a substance use disorder, they are more likely to meet the criteria for another co-occurring mental health diagnosis. Seventy percent of adolescent offenders satisfy the criteria for a mental health disorder and 30 percent satisfy the criteria for post-traumatic stress disorder; these rates are significantly higher than their uninvolved peers (Dierkhising, 2013). Mental illness appears to be an important predictor of all types of substance use, but may be a particularly strong predictor for opioid use.

### **Prior delinquent behavior**

When youth initiate risk behaviors such as substance use and delinquency at an early age, it increases the likelihood of subsequent risk behavior, including continued substance abuse and offending (Lipsey & Derzon, 1998). Research also finds a dose-response effect, with higher engagement in substance use predicting increased likelihood of offending, increased severity of the offenses committed, and a longer period of overall criminal offending (Hoeve, et al. 2015; Lipsey & Derzon, 1998; Wiesner et al., 2005). Prior delinquent behavior predicts many types of substance use, including opioid use. In a study examining how various risk factors predict substance use, delinquent behavior predicted involvement in all types of drug abuse, including opioid abuse, except for use of hallucinogens (Nation & Heflinger, 2006). A meta-analysis on type of drug use and criminal offending finds that opioid use is more highly positively correlated with delinquent behavior than any other drug

use except for crack cocaine (Bennett, et al., 2008). Prior delinquency, then, may be an especially strong predictor of opioid use.

### **Parental monitoring and parental substance abuse**

Low parental monitoring and parental substance abuse are associated with increased risk for adolescent opioid abuse, as well as abuse of other illicit substances (Nation & Heflinger, 2006; Weinberg, 2001). When parental monitoring is high, adolescents are less likely to engage in substance use because there is a greater opportunity of getting caught. Parental monitoring in early childhood is also associated with greater self-control later in life. Indeed, parental monitoring is a strong predictive factor against many types of substance use (Lac & Crano, 2009; Ford, 2009). Adolescents may model parents' substance use behaviors leading to increased likelihood of adolescent substance use (Li et al., 2009). Low parental monitoring may also increase adolescents' access to their parents prescription opioids. Further, when parents have substance use disorders, households typically have lower incomes, lower levels of monitoring, and less engaged parenting practices (Griffin et al., 2000). While parental substance use may influence adolescent opioid use, there is not evidence that this relationship would be any stronger for adolescent opioid use relative to other drug use.

### **Peer relationships**

Peer substance abuse is a robust predictor of adolescents' substance abuse behavior (Monahan et al., 2009; Oxford et al., 2001). Peer substance abuse is a strong predictor of adolescents' age of initiation of opioid abuse and continued engagement in opioid

abuse (Nation & Heflinger, 2006; Weinberg, 2001). Additionally, strong connections to prosocial friends appear to buffer the relationship between low self-control and substance abuse for adolescents (Baker, 2010). One way that peer networks increase the likelihood of opioid abuse is when peers deal to or share drugs with their friends. Most opioid users access drugs through peer networks; this finding has been replicated in studies with adults, young adults, and high school students (Keyes et al., 2014; McCabe et al., 2012). Akers (1985) Social Learning Theory suggests that behavior is learned in intimate social groups, such as peer groups. When peer groups reinforce antisocial behaviors, an adolescent is likely to continue engaging in that behavior. Peers are likely an important influence for many types of substance use, but may be particularly important in opioid use because delinquent peers may increase access to opioids.

### **Trauma and stressful life events**

Stressful life events such as parents' divorce, exposure to violence, victimization, and health problems among family members are associated with initiation of substance abuse and levels of substance abuse over time, including opioid abuse (Nation & Heflinger, 2006). One study found that adolescents who were victimized or witnessed violence were more than two times as likely to engage in substance abuse (Kilpatrick et al., 2000).

Juvenile offenders are disproportionately likely to have experienced stressful life events; 90 percent report exposure to at least one traumatic event (Dierkhising, 2013). One study among juvenile offenders found that childhood sexual abuse, but not childhood physical abuse was related to substance abuse during adolescence

(Smith & Saldana, 2013). Other studies have documented a strong relationship between trauma and substance abuse (Abram et al., 2007; Chassin, 2008).

Strain theories suggest that adolescents' risk behaviors are a response to a stressful life event, or in many cases, multiple exposures to traumatic or stressful events. Agnew's General Strain Theory (1992) proposes that delinquent behavior may result from three categories of strain: the failure to achieve positively valued goals, exposure to noxious stimuli, and the removal of positive stimuli. According to GST, exposure to strain causes a negative emotional response which necessitates a coping mechanism. The coping mechanism is more likely to be associated with antisocial behavior when the strain is severe, unjust, or associated with negative emotions (Agnew, 2001). Trauma is prevalent for the majority of justice system involved youth. While trauma likely plays an important role in adolescent substance use, the evidence is not compelling that trauma has a stronger effect for opioids than for other substances.

### ***Gender differences in risk factors for opioid use***

U.S. data consistently find that gender matters when examining prevalence of substance use and substances of choice (SAMHSA, 2016; Smith, 2014). For example, females are more likely than males to report prescription opiates or heroin as their primary drug and males are more likely than females to report marijuana as their primary drug (Greenfield et al., 2010). Further, male gender is one of the strongest predictors of non-opioid substance abuse for adolescents who offend and those in the general population alike (Chassin, 2008). Since the late 1990s, heroin and non-medical abuse of prescription opioids, however, has increased disproportionately

among females relative to their male counterparts, representing a departure from trends in abuse of other illicit substances (Rudd et al., 2016; Cicero et al., 2014).

Gender alone cannot logically explain these differences in substance use; it is likely that other risk factors moderate the relationship between gender and opioid use. The risk factors and motivations leading to substance abuse may differ by gender, however. For example, females may have greater access to opioids because they are prescribed opioids at a higher rate than their male counterparts (Isacson, et al., 2002; Green et al., 2009). A history of other substance use may also be a stronger correlate of opioid abuse for females than for males. In a study examining treatment seeking adults in the general population, history of overdose and problem drinking were correlates for opioid abuse for females but not for males (Sansone et al., 2009; Leve et al., 2015). These trends from the general population suggest that exploration of the factors that moderate the role of gender on opioid use among adolescents in the juvenile justice system merits attention.

There is evidence that gender differences in substance use vary by age. For example, rates of substance use dependence are similar among males and females ages 15-17. After age 18, however, males are twice as likely as females to report substance use dependence (SAMHSA, 2016; Smith, 2014). Among those aged 18-25 admitted for substance abuse treatment, 18 percent of females reported prescription opiates were their primary drug and just 13 percent of males (Smith, 2014). Understanding how age interacts with gender can provide a more thorough understanding of adolescent opioid use.

Some research has found a moderating effect of impulsivity on gender for alcohol use; impulsivity was an important predictor of alcohol use for males and females, but a greater predictor for females (Stoltenberg et al., 2008). A study of young adults seeking treatment for opioid dependence found that insufficient self-control was the most prevalent risk factor among males and females, but that a greater proportion of the females reported insufficient self-control (Shorey et al., 2012). According to the General Theory of Crime, gender differences in antisocial behaviors, such as opioid and other drug use, are a result of differential levels of self-control between males and females. Accordingly, males engage in more substance abuse because they have lower levels of self-control than females. One study found that after controlling for self-control and opportunity to commit crime, gender differences in adolescent alcohol and marijuana use were eliminated, however, which suggests that self-control mediates the relationship between gender and substance use. This study used parental monitoring as a measure of opportunity, however, and females reported significantly higher levels of monitoring than their male counterparts. (LaGrange & Silverman, 1999). Although evidence is mixed, lower levels of self-control may be an important predictor of substance use for both males and females but may be associated with a greater risk for opioid use among females than for males.

Several studies have found that female opioid abusers are more likely than males to report mental illness (Green et al., 2009; Sansone et al., 2009; Leve et al., 2015). For example, one study of treatment seeking opioid abusers found that the risk of psychiatric illness among female patients was more than three times as high as for

male patients (Darke et al., 1992). Female adolescent offenders are more likely to have a substance abuse disorder and a diagnosis of substance use dependence than their male counterparts, which also increases the risk of a co-occurring mental health diagnosis (LaGrange & Silverman, 1999; Teplin et al., 2002). Research examining whether mental illness moderates the relationship between gender and substance use among adolescents, however, provides mixed results (Schwinn et al., 2010). For example, some studies have found that depression and anxiety have been associated with higher rates of substance use among adolescent females but not among males. Other research has found no association between depression and differential levels of substance use among male and female adolescents (Acierno et al., 2010; Patton et al., 2002; Galambos et al., 2004).

There is mixed evidence that peer influence moderates the relationship between gender and opioid use. The role of peers appears on adolescent substance abuse has been found to be greater for males than females. Males and females with similar levels of delinquent peer influence, however, report differential levels of substance use (McCabe et al., 2007; Dara et al., 2003). Other research finds that these gender differences can be explained by differential levels of parental monitoring for males and females. The protective effects of parental monitoring can buffer negative peer influence (Svennson, 2003). Research on opioids also suggests that peers are an important predictor of opioid use. A study of opioid abuse among high school students found that females were more likely than males to share their prescription opioids with friends for recreational use (McCabe et al., 2012).



Trauma is an important predictor of substance use for females. A breadth of research finds that justice-involved adolescent females are up to twice as likely as males to experience physical and sexual child abuse, exposure to other traumatic life events, and early substance abuse (Kerig & Ford, 2014; Smith & Saldana, 2013). This study found that for justice-involved female adolescents, sexual abuse was significantly related to stimulant, opioid, and depressant use but not to abuse of hallucinogens, inhalants, or prescription “club” drugs (Smith & Saldana, 2013). Girls who end up in the juvenile justice system are disproportionately likely to have experienced childhood abuse, including physical and sexual abuse. Victimization, thus, is an important part of girls’ (and women’s) pathway to delinquency. The coping mechanisms that girls are likely to employ in response to trauma are the same behaviors that are likely to result in their incarceration, including running away, truancy, and substance use. Research examining the link between childhood abuse, running away, and arrest yield mixed results. The literature agrees that experiencing abuse or neglect in childhood increases the risk of juvenile arrest later in life, for both genders. One study found that abuse and running away increased the likelihood of arrest but abuse alone did not directly predict likelihood of arrest. Running away, regardless of abuse history, was found to increase risk of arrest (Kauffman & Widom, 1999).

Research finds that among individuals who experience high levels of strain, females are more likely to abuse substances as a coping mechanism or a form of self-medication than are males (Kerig & Ford, 2014). Females are more likely to respond to strain with internalizing behavior such as depression or substance use than anger

(Broidy and Agnew, 1997). Males, on the other hand, are more likely to externalize their emotional response to strain. Thus, GST may offer a better explanation for female's substance use (Agnew, 1997; Broidy, 2001). While it is important to account for females' prior exposure to traumatic life events, the literature provides some evidence for both a moderating and mediating role of strain on gender and opioid use.

### **Implications for the current study**

Risk factors describe characteristics or experiences that increase an individual's likelihood of engaging in substance abuse, but presence of risk factors does not imply a causal relationship. One reason that it is difficult to establish a causal relationship between risk factors and risk behaviors among juvenile offenders is that there is substantial overlap in risk factors for substance abuse and risk factors for offending. Some studies find that substance abuse and offending are interrelated and participation in one behavior may increase the severity of participation in the other. For example, one study conducted with juvenile offenders in Los Angeles found that opioid abuse, as well as abuse of other illicit substances, and delinquency had reciprocal effects: participation in one increased likelihood of participation in the other (D'Amico et al., 2008). Another complicating factor in understanding the role of risk factors is that the effects of many risk factors are mediated by other factors (Baker, 2010; Forgays, 1998).

Each of the factors reviewed above, low self-control, mental illness, , deviant peer relationships, prior delinquent behavior, and strain, may contribute to opioid abuse and other substance use among juvenile offenders. In accordance with the

review of the literature, it appears that some of these risk factors may be particularly strong predictors of opioid use relative to other substance use. Additionally, in line with research on substance abuse in general, gender appears to play an important role in the pathway to initiation and persistence of opioid abuse for juvenile offenders, though for many risk factors evidence is mixed. Specifically, factors that have some evidence of moderating the relationship between gender and opioid abuse include: age, self-control, mental illness, peer relationships, and strain.

This thesis will explore the following hypotheses:

- H1: Among adolescents who offend, the constellation of risk factors for opioid abuse are different than risk factors for other drug use. Specifically:
  - H1a: Female gender will be more strongly related to opioid use and abuse than other drug use and abuse.
  - H1b: Older age will be more strongly related to opioid use and abuse relative to other drug use and abuse.
  - H1c: Being white relative to another race will be more strongly related to opioid use and abuse relative to other drug use and abuse.
  - H1d: Mental illness will be more strongly related to opioid use and abuse relative to other drug use and abuse.
  - H1e: Greater prior offending will be more strongly related to opioid use and abuse relative to other drug use and abuse.
  - H1f: Delinquent peers will be more strongly related to opioid use and abuse relative to other drug use and abuse.
- H2: Among adolescents who offend, female opioid users will have a constellation of risk factors that is different than their male counterparts. Specifically:
  - H2a: Being older and female will be associated with greater risk of opioid use and abuse than being older and male.
  - H2b: Being female with low levels of impulse control will be associated with a greater risk of opioid use and abuse relative to having low impulse control and being male.
  - H2c: Females with a mental illness will have a greater risk of opioid use and abuse than males with mental illness.
  - H2d: Females who report more delinquent peer behavior will have a greater risk of opioid use and abuse than males who report more delinquent peer behavior.

- H2e: Females with higher exposure to strain will have an increased risk of opioid use and abuse relative to males who have higher exposure to strain.

## Chapter 2: Methods

The purpose of this study is to test the hypotheses that 1) risk factors for opioid use are distinct from risk factors for other substance use for justice system involved youth, and 2) that there are differences in these risk factors for females relative to males. Accordingly, I used multinomial logistic regression to analyze how well, if at all, the risk factors identified in the literature review above predict ordinal measures of opioid use after baseline. In the multinomial logistic regression, for a one unit increase in the independent variable, the relative risk ratio represents the change in the risk ratio for the dependent variable in one group relative to the dependent variable in the reference group. I compare the risk ratios in these models for substance use including opioid use relative to non-opioid substance use and relative to no substance use among a sample of juveniles convicted of a felony offense. I tested for a moderating relationship of female gender on my hypothesized predictors of opioid use using interactions of female gender with each of the risk factors in the model. To assess the relationship between age and opioid use and gender I conducted a longitudinal logit model, looking at age and opioid use each year to determine whether, as hypothesized, age of opioid use for a high-risk group is lower than typical opioid use in the general population and whether the age when opioid use is most prevalent differs for males and females. I repeated this process with opioid use as the dependent variable to examine whether risk factors varied for heavier users.

### ***Description of the data***

I will use the publicly available Pathways to Desistance dataset, a longitudinal survey of 1,354 serious juvenile offenders. The Pathways to Desistance study enrolled serious juvenile offenders ages 14 to 20 at the time of their committing offense between November 2000 and January 2003 in Maricopa County, Arizona or Philadelphia, Pennsylvania. Youth were recruited between 2000 and 2003 and followed for seven years, leaving the study between 2007 and 2010. During this time, opioid use sharply increased, particularly prescription opioid use, and opioid use among white individuals (Alexander et al., 2017). After 2010, opioid use continued to increase, and is projected to continue increasing for the next two decade. After 2010, however, opioid use shifted from prescription opioids to synthetic opioids like fentanyl and heroin. Thus, during the study period, increases in opioid use are largely attributable to prescription opioids. Youths' qualifying offenses were primarily felonies, but in some cases misdemeanor property offenses, sexual assaults, and weapon offenses were included. The study team capped the proportion of males found guilty of a drug charge at 15 percent to avoid over representation of drug offenders. Twenty percent of youth that were asked to participate in the study declined to participate.

The study team recruited 1,354 adjudicated adolescents aged 14-20 when they committed the offense that made them eligible for the study. About 41 percent of youth were placed on probation, 21 percent were placed in a non-incarceration out-of-home setting, 21 percent were incarcerated, and 15 percent were awaiting a placement decision.

Pathways data are primarily based on adolescent self-report. Adolescents completed eleven surveys. The baseline interview was conducted in 2000 within 75 days of the adjudication hearing for youth in the juvenile system. For youth in the adult system, the baseline interview was conducted within 90 days of the decertification hearing for Pennsylvania youth and within 90 days of the adult arraignment hearing for Arizona youth. The difference for youth in the adult system is due to Arizona having no provision for waiving youth back to the juvenile system.

In addition to the baseline interview, follow-up interviews were conducted at six, 12, 18, 24, 30, 36, 48, 60, 72 and 84 months post-baseline. The study team maintained 90 percent of the sample throughout the entire follow-up period. The interviews cover six domains: 1) background characteristics, 2) indicators of individual functioning, 3) psychosocial development and attitudes, 4) family context, 5) personal relationships, and 6) community context.

Adolescents used computer assisted survey interview software and trained interviewers read the questions aloud. Interviews took place in-home, in public locations, or in facilities. To maximize privacy, respondents could choose to enter their responses on a keypad instead of responding verbally to the interviewer. Self-report information was validated through interviews with collateral reporters, a family member or friend, and official records such as FBI records of arrest and juvenile and adult records from the appropriate jurisdiction (Schubert et al., 2004).

## **Study Sample**

I measured my independent variables at baseline and my key dependent variable post-baseline, thus I restricted my sample to adolescents who completed the

baseline survey and at least one follow-up survey to ensure measurement is available for every individual on the key variables. This exclusion removed 18 cases from the study sample. Characteristics of the overall sample and the study sample are comparable as shown in Table 1. The exclusion of these 18 cases did not appear to disproportionately affect demographic characteristics or estimates of opioid abuse for those in the study sample compared to the original sample.

The mean age at baseline in the study is about 16 years. Roughly 21% of adolescents included in the study are white, 41% are black, and 34% are Hispanic. Most of the adolescents in the study did not report opioid use at baseline. Table 1 shows that males and females in the sample have roughly similar baseline characteristics. However, a greater proportion of females (26.9%) are white compared to the male subpopulation (20%).

**Table 1. Baseline characteristics of study sample**

Characteristic	Sample N=1,354	Study N=1,336	Males N=1,154	Females N=182
Mean age in years (SE)	16.04 (1.14)	16.04 (1.14)	16.04 (1.16)	15.99 (1.04)
Race/Ethnicity (%)				
White	20.23%	20.51%	19.50%	26.92%
Black	41.43%	40.94%	41.59%	36.81%
Hispanic	33.53%	33.83%	34.40%	30.22%

Table 2 shows substance use at baseline. Opioid use in the past six months is slightly higher for females at baseline (4.4%) than males (3.6%). All other substance use except for binge drinking is also higher among females than males at baseline.



**Table 2. Percent substance use at baseline (SE)**

Variable	Study N=1,333	Males N=1,151	Females N=182	Min	Max
Opioids	3.75% (19.01)	3.65% (18.76)	4.40% (20.56)	0	1
Binge Drinking	18.00% (38.44)	18.5% (38.85)	14.84% (35.64)	0	1
Marijuana	57.24% (49.49)	56.47% (49.60)	62.09% (48.65)	0	1
Cocaine	12.53% (33.12)	11.99% (32.50)	15.93% (36.70)	0	1
Ecstasy	8.25% (27.53)	8.08% (27.26)	9.34% (29.18)	0	1
Hallucinogens	11.70% (32.16)	11.12% (31.45)	15.38% (36.18)	0	1

***Measures*****Dependent Variables**

In this paper, I focus on opioid use, the use of opioids for non-medically indicated purposes, and abuse, the repeated use of opioids for a non-medically indicated purpose. Opioids are a class of drugs that include heroin, fentanyl, and prescription pain relievers like oxycodone, hydrocodone, codeine, morphine, and others. This opioid use variable captures anyone who reported using opioids one or more time during the recall period. This measure captures “recreational users” as well as heavier users. Opioid abuse captures repeat users of opioids; or those who report using opioids three or more times at any recall period.

As shown in Table 3, I found substantial overlap between opioid use and other substance use at each follow up. For example, at baseline every person who reported opioid use also reported marijuana use. Accordingly, it is unrealistic to assess risk factors for opioid use without considering polysubstance use. Taking this into consideration, I constructed two ordinal measures for my dependent variables: polysubstance use including opioid use and polysubstance abuse including opioid abuse. I refer to these as measures of opioid use and opioid abuse.

	Baseline N=50	FU1 N=25	FU2 N=22	FU3 N=24	FU4 N=22	FU5 N=26	FU6 N=25	FU7 N=37	FU8 N=41	FU9 N=44	FU10 N=51
Binge drink	56.00%	32.00%	50.00%	41.67%	40.91%	46.15%	40.00%	45.95%	34.15%	54.55%	49.02%
Marijuana	100.00%	84.00%	90.91%	91.67%	90.91%	92.31%	84.00%	94.59%	87.80%	81.82%	82.35%
Cocaine	48.00%	64.00%	63.64%	54.17%	45.45%	61.54%	56.00%	50.54%	36.59%	34.09%	25.49%
Ecstasy	46.00%	44.00%	36.36%	33.33%	40.91%	38.46%	16.00%	32.43%	34.15%	18.18%	25.49%
Hallucinogen	72.00%	56.00%	63.64%	58.33%	45.45%	46.15%	40.00%	27.03%	29.27%	25.00%	27.45%

To measure opioid use, I constructed a variable with three mutually exclusive categories: “0” represents no substance use at all; “1” represents substance users that do not report opioid use; and “2” represents opioid users and other substance users. To construct this variable, I drew from several substance use measures. Specifically, I used measures asking about frequency of opiate, alcohol, marijuana, cocaine, ecstasy, and hallucinogen use in the recall period.<sup>1</sup> Each of these is an ordinal measure asking how many times youth used the respective substance in the recall period on a scale from “never” to “every day.” Most youth at each follow up period reported that they “never” used each of the substances. The ordinal measure, therefore, did not provide a

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<sup>1</sup> The recall period is the time since the last interview, unless specified otherwise. For most interviews there were six months in the recall period, but for the last three interviews there are 12 months in the recall period.

lot of variation. I dichotomized the measures of substance use to indicate youth who reported any opiate, marijuana, cocaine, ecstasy or hallucinogen use, respectively. For alcohol use, I wanted to capture binge drinking rather than any alcohol use. The National Institute of Drug Abuse states the binge drinking occurs when an individual is drunk five or more days in a month. Accordingly, I coded binge drinking as “1” if respondents reported being drunk once a week or more. For each substance, (opioids, binge drinking, marijuana, cocaine, ecstasy, and hallucinogens) I then aggregated the dichotomous measure of substance use across follow up periods two through eleven by coding substance use as “1” if the youth reported using the substance at any follow-up period between two and eleven. I then constructed the ordinal measure of polysubstance use including opioid use: If a respondent reported never engaging in any substance use, they are coded as “0”; If a respondent reported any binge drinking, marijuana, cocaine, ecstasy, or hallucinogen use but no opioid use, they were coded as a “1”; if a respondent reported any opioid use, regardless of whether they reported any other substance use, they were coded as “2”. For substance use, 16.32 percent of respondents reported no use, 68.94 percent reported substance use but no opioid use, and 14.75 percent reported substance use including opioid use.

I operationalize opioid abuse in a parallel way. I constructed a variable where “0” represents no substance abuse at all, “1” represents substance abusers who do not report opioid abuse, and “2” represents opioid abusers and other substance abusers. I dichotomized opioid, marijuana, cocaine, ecstasy and hallucinogen abuse as reporting the respective substance use “three or more times” at any follow up period. I dichotomized alcohol abuse as “1” if the respondent reported being drunk 4-5 times

per week or more at any follow-up period. This is in accordance with guidelines from the National Institute of Drug Abuse. For substance abuse, 25.52 percent of respondents reported no abuse of any substances, 62.65 percent reported substance abuse not including opioid abuse, and about 11.83 percent reported substance abuse including opioid abuse. As shown in Table 4, the average response for opioid abuse, 0.86, is somewhat lower than the average response for opioid use, 0.98. The average response is comparable for males and females in the study sample.

Table 4. Descriptive statistics for opioid use and abuse						
	Study, N=1,336		Males, N=1,154		Females, N=182	
	Mean	SD	Mean	SD	Mean	SD
Opioid use (and other substance use)	0.98	0.56	0.99	0.56	0.97	0.57
Opioid abuse (and other substance use)	0.86	0.60	0.86	0.6	0.85	0.60

## Independent Variables

The independent variables for hypothesis one include: age, white race, female gender, mental illness, prior delinquent behavior, and delinquent peer influence. I also control for baseline substance use. The independent variables for hypothesis two include: age, female gender, impulse control, delinquent peer influence, and exposure to violence. As in hypothesis one, I also control for baseline substance use.

## Race/Ethnicity

I created three dichotomous variables from a nominal measure of youth's self-reported race/ethnicity at baseline. These three dichotomous variables identify whether the adolescent is Hispanic, Black, or White. As shown in Table 1, about 20 percent of the sample is white, 41 percent is black, and 34 percent is Hispanic. Five percent of the sample identified as another race; these individuals were coded in the

reference category (“0”) for each variable. I use white race as an independent variable in hypothesis one and two.

### **Age**

To assess the relationship between age, opioid use and abuse, and gender I used a continuous measure of age at each follow-up period to examine hypothesis 1b and hypothesis 2a. I also used a continuous measure of youth’s age at baseline as a control variable in the multivariate models for the remaining hypotheses. As shown in Table 5, the mean age at baseline was about 16 years. Most of the sample (96 percent) was 15-18 at the baseline interview. Forty-three individuals (3.4 percent) were age 14, eleven individuals (about one percent) were 19, and one was 20 (<one percent).

### *Gender*

I included a variable identifying whether adolescents are female based on their reported gender at baseline. As shown in Table 5, about 14 percent of the sample is female.

### **Self-Control**

I used a measure of impulse control which represents the mean of eight questions on impulsivity from the Weinberger Adjustment Inventory (Weinberger & Schwartz, 1990). Each question was answered on a scale from False to True (False, Somewhat False, Not Sure, Somewhat True, True). Higher mean scores indicate greater impulse control. Previous research with the pathways dataset has found that this subscale is reliable (Cronbach alpha=.76) (Mulvey et al., 2010). As shown in Table 5, the mean for the impulse control variable is 3.36 out of 5 indicating that on average participants ranked items asking about impulse control between not sure and somewhat true.

## **Mental Illness**

Youth responded to the 53-item Brief Symptom Inventory (Derogatis & Melisaratos, 1983) based on the extent to which they experienced psychiatric symptoms in the past week. I used a variable that includes the number of subscales which reach clinical significance. There are nine subscales: somatization, obsessive-compulsive, interpersonal sensitivity, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. Range for the variable is 0-9, where 0 is no subscales reaching clinical significance and 9 is clinical significance on all subscales. I dichotomized the variable to indicate presence of at least one clinically significant mental illness at baseline. As shown in Table 5, about 22 percent of the sample reported at least one clinically significant mental illness.

## **Prior Delinquent Behavior**

Youth may only be included in this sample if they have a history of prior delinquent behavior. I used a continuous measure of offending variety indicating the number of types of criminal acts in the past year over the total number of offending questions to which youth responded. Research finds that prior offending variety is often a better predictor of future behavior than frequency of prior offending (Hindelang et al., 1981; Monahan & Piquero, 2009). A study with the Pathways dataset found concordance between prior offending variety and frequency of prior offending measures (Monahan & Piquero, 2009). Proportions closer to 1 indicate more offending variety. For example, if youth provided non-missing responses to five delinquent acts and reported participation in four acts, their offending variety would be  $4/5$  or .8. As shown in Table 5, the mean proportion of prior offending variety is .15.

### **Peer relationships**

Youth responded to the Peer Delinquent Behavior items indicating how many of their friends encourage them to engage in seven items from the same Peer Delinquent Behavior Items scale. Responses were measured on the scale from “none of them” to “all of them.” Youth must have responded to at least five of the seven items in order for the mean to be computed. As shown in Table 5, on average youth reported that very few of their friends (scale value=2.13) encouraged them to engage in delinquent behaviors.

### **Trauma and stressful life events**

To measure strain, I used a measure constructed from a modified version of the Exposure to Violence Inventory (Selner-O'Hagan, Kindlon, Buka, Raudenbush, & Earls, 1998). This measure includes frequency of violent events that the adolescent witnessed as well as experienced. Scores range from 0 events to 13 events. Higher scores indicate exposure to more violent events. As shown in Table 5, youth were exposed to an average of 5.35 violent events.

### **Baseline substance use and abuse**

To control for substance use and abuse at baseline, I constructed two variety scales of substance use and abuse. I first dichotomized baseline opioid, marijuana, cocaine, ecstasy, and hallucinogen use as well as binge drinking following the same guidelines used to construct the dependent variable for opioid use. At baseline, respondents were asked about substance use in the past six months. Thus, if respondents reported using a substance at least once in the past six months, I coded them as “1”. I then created a variety scale indicating how many substances the individual reported using. The scale

ranges from “0”, indicating no substance use at baseline, to “6” indicating they used each of the substances. I followed a parallel procedure for the baseline substance abuse variety scale. As shown in Table 5, the average baseline substance use variety scale score was 1.11 and the average baseline substance abuse variety scale score was 0.80; these numbers are similar for males and females in the study sample. Further, this table shows that there are somewhat large differences in presence of a clinically significant mental health disorder between males and females (19.05% and 36.42%, respectively).

Table 5. Descriptive statistics for independent and control variables							
	Study		Males		Females		
Variable	N	Mean (SE)	N	Mean (SE)	N	Mean (SE)	Range
Age in years	1,336	16.04 (1.14)	1,154	16.04 (1.16)	182	15.99 (1.04)	14-19
Female	1,336	13.62% (34.32)	1,154	0	182	1	0-1
White	1,336	20.51% (40.39)	1,154	19.50% (39.64)	182	26.92% (44.48)	0-1
Clinically Significant Mental Illness	1,224	21.46% (41.07)	1,071	19.05% (39.29)	173	36.42% (48.26)	0-1
Prior offending Variety	1,333	14.97% (15.33)	1,151	15.62% (15.71)	182	10.83% (11.92)	0-1
Peer delinquent influence	1,321	2.13 (.96)	1,140	2.16 (.97)	181	1.98 (.84)	1-5
Baseline substance use variety	1,336	1.11 (1.27)	1,154	1.10 (1.26)	182	1.22 (1.35)	0-6
Baseline substance abuse variety	1,336	0.80 (1.05)	1,154	0.80 (1.05)	182	0.86 (1.05)	0-6

### ***Analysis***

I began by descriptively examining the relationship between substance use and abuse and each of the independent variables. To examine *Hypothesis 1b: Age will be more strongly related to opioid use and abuse relative to other drug use and abuse* I examined this relationship at each follow up period. Unlike my other independent



variables, which are measured at baseline, I examined age as a time-varying covariate to see how, if at all, age and substance use covary at each follow up period. After looking at patterns of age and opioid use and abuse over time, I conducted bivariate multinomial logistic regression models to determine whether age was a significant predictor of opioid use or abuse relative to non-opioid substance use/abuse and relative no substance use/abuse. For these bivariate models, I clustered at the individual level to account for the same individual providing up to eleven responses each (one per survey).

I then collapsed opioid use and abuse across all follow up time points and conducted multinomial logistic regression models with baseline predictors to assess which risk factors are associated with adolescent substance use and abuse including opioids relative to non-opioid substance use and to no substance use. More specifically, I compared the risk of individuals coded as “2,” use/abuse substances including opioids relative to “1” individuals who use use/abuse substances not including opioids, and to “0” individuals who do not use/abuse any substances. I report findings from the comparison of substance use that includes opioids (the “2s”) relative to non-opioid substance use (the “1s”) and do not report findings for substance use including opioids relative to no substance use or non-opioid substance use relative to no substance use. For these aggregated analyses, I started by conducting bivariate analyses with opioid use and abuse and each of the key independent variables. I then ran the full model with all independent and control variables (age and baseline substance use/abuse). To assess model fit, I used the model chi square fit statistic. I also conducted Wald tests to assess joint significance of any variables that were not

significant in the model. After arriving at the final model, I calculated relative risk ratios for each covariate.

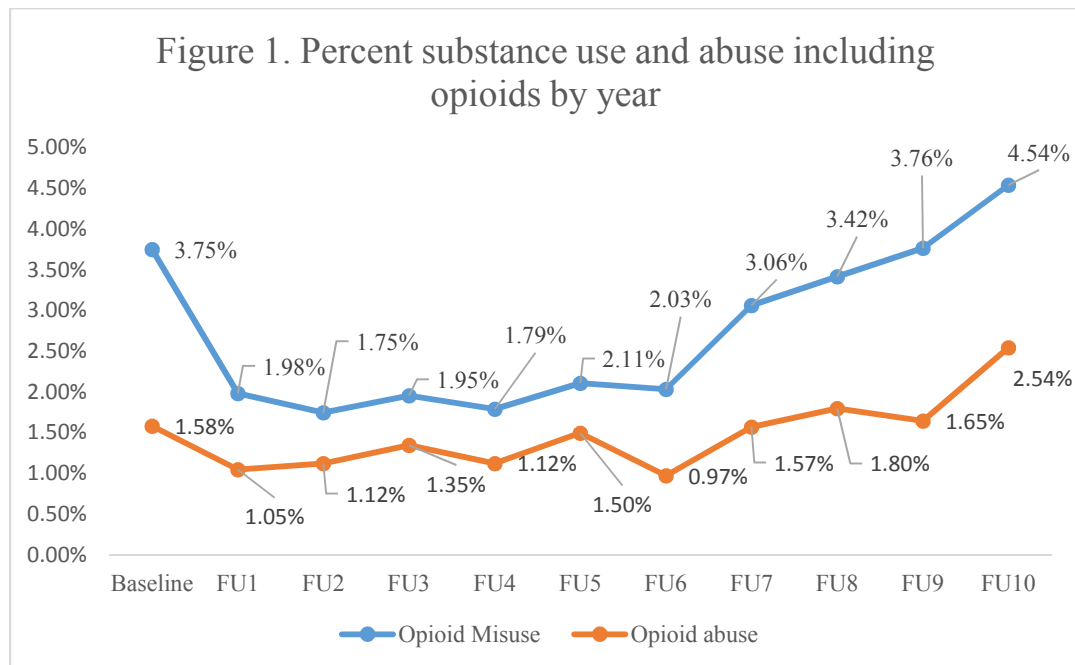
To assess whether the risk factors for substance use that includes opioids are distinct from non-opioid substance use I compared the risk ratio for substance use that includes opioids relative to non-opioid substance use. To assess gender differences, I first examined the relationship between opioid use and abuse and age by gender at each follow-up period. I then ran bivariate logistic regression models by gender for opioid use and age to determine whether age was a significant predictor of opioid use or abuse. In each model, I clustered at the individual level to adjust standard errors for non-independence of error terms. Then, I once again collapsed opioid use and abuse across all follow periods and created interactions between gender and each of the independent variables. In this model I considered age and baseline substance use/abuse control variables, so I do not create interactions with these items. To assess whether risk factors for opioid use and abuse are distinct for females, I interpreted the interaction terms.

Finally, because clinically significant mental illness has significant missing data (n=1,224), I ran the multivariate models for hypothesis one and hypothesis two without it and assessed any differences between the restricted (without mental illness) and unrestricted models.

## Chapter 3: Results

### *Hypothesis 1*

I begin by descriptively examining patterns of substance use and abuse and the time-varying covariate, age at each follow-up. Figure 1 shows substance use including opioid use and substance abuse including opioids for participants at each wave. Rates of opioid use and abuse are elevated at baseline and then start to increase again around the eighth follow-up period (five years after baseline). Prior to arrest, individuals may have been engaged in overall higher levels of risk behaviors, including substance use. Increases after the seventh follow-up period may correlate with increases in age for the study population, described below and shown in Table 6. Depending on when youth joined the study, the eighth follow up period was between 2005 and 2008. Sharp increases in opioid use in the U.S. overall began in the early 2000s (Alexander et al., 2017).



I hypothesized that age would be a more important risk factor for opioid use relative to other substance use. Specifically, I expected more significant increases in opioid use with age relative to other substance use. As shown in Table 6, the data appear to support this hypothesis; opioid use and abuse increase with age. Like individuals in the general population, in this sample opioid use is more prevalent among adolescents, those between the ages of 20 and 24.

Table 6. Substance use and abuse including opioids by age		
Age	Opioid use	Opioid abuse
14	1.95%	0.98%
15	1.50%	0.75%
16	2.55%	1.67%
17	2.23%	1.38%
18	2.33%	1.48%
19	1.97%	1.44%
20	2.56%	1.15%
21	4.61%	2.93%
22	3.98%	2.43%
23	4.30%	2.65%
24	3.31%	1.89%

To assess whether age is a more robust predictor of opioid use and abuse relative to non-opioid substance use, I ran bivariate multinomial logistic regressions with non-opioid substance use as the reference category and clustered on the individual. I do not report findings for substance use that includes opioids relative to no substance use. As shown in Table 7, the risk of substance use including opioids relative to non-opioid substance use is higher for older adolescents. The relative risk for a one-year increase in age is 1.10 for substance use including opioids use relative non-opioid substance use and this is significant at  $p<.01$ .

Table 7. Bivariate multinomial logit opioid use, abuse and age	
Relative risk of substance <u>use</u> including opioids vs. non-opioid substance use	
RRR	SE
<b>1.10*</b>	0.03
Relative risk of substance <u>abuse</u> including opioids vs. non-opioid substance abuse	
RRR	SE
<b>1.10*</b>	0.03
<b>*indicates significance at <math>p&lt;.01</math>, two-tailed</b>	

Similarly, the risk of substance abuse including opioid abuse relative to non-opioid substance abuse is higher for older adolescents. The relative risk for a one-year increase in age is 1.10 relative to non-opioid substance abuse; this is significant at  $p<.01$ . Findings from these bivariate models support *Hypothesis 1b: Age will be more strongly related to opioid use and abuse relative to other drug use and abuse.*

To assess whether the constellation of risk factors for substance use including opioid use and abuse are distinct from risk factors for non-opioid substance use and abuse, I collapsed measures of opioid use and abuse across follow up periods. I first ran bivariate models with opioid use and abuse and the key independent variables: female gender, white race, mental illness, prior offending variety, and delinquent peer influence. Relative risk ratios and standard errors from the bivariate multinomial logistic regression models for opioid use are shown in Table 8, and results for the substance abuse models are shown in Table 9.

Table 8. Bivariate multinomial logit results, opioid use			
	Relative risk of substance use including opioids vs. non-opioid substance use		
	RRR	SE	N
Female	0.98	0.23	1,336
White	<b>3.41*</b>	0.57	1,336
Mental illness	<b>1.88*</b>	0.34	1,244
Prior offending	<b>5.86*</b>	2.58	1,333

Peer influence	<b>1.26*</b>	0.10	1,321
<b>* Indicates significance at <math>p&lt;.01</math>, two-tailed</b>			

The risk of substance use including opioids relative to non-opioid substance use is higher for white youth, those with mental illness, those with a higher prior offending and those who score higher in the negative peer influence scale. Female gender is not significant, but the relative risk ratio suggests that being female is associated with a slightly decreased risk of substance use that includes opioids relative to non-opioid substance use (RRR 0.98). Youth who are white are at an increased risk of substance use that includes opioids relative to substance use that does not include opioids (RRR 3.41,  $p<.01$ ). Youth who have a clinically significant mental illness are also at an increased risk of substance use that includes opioids relative to substance use that does not include opioids (RRR 1.88,  $p<.01$ ). An increase in prior offending variety is also associated with an increased risk of substance use that includes opioids relative to non-opioid substance use (RRR 5.86,  $p<.01$ ). Scoring one unit higher on the scale of negative peer influence is associated with an increased risk of substance use that includes opioids relative to substance use that does not include opioids (RRR 1.26,  $p<.01$ ).

Table 9. Bivariate multinomial logit results, opioid abuse			
	Relative risk of substance abuse including opioids vs. non-opioid substance abuse		
	RRR	SE	N
Female	0.98	0.25	1,336
White	<b>2.19*</b>	0.41	1,336
Mental illness	1.48 <sup>b</sup>	0.30	1,244
Prior offending	2.38	1.14	1,333
Peer influence	0.97	0.09	1,321
<b>*Indicates significance at <math>p&lt;.01</math>, two-tailed</b>			
<sup>b</sup> Indicates significance at $p<.10$ , two tailed			

Fewer risk factors reach significance in the bivariate models for substance abuse including opioids: only white race and having a clinically significant mental illness. As in the model of substance use, female gender is not significant, but the relative risk ratio suggests that being female is associated with a slightly decreased risk of substance abuse that includes opioids relative to non-opioid substance abuse (RRR 0.98). Also parallel to the substance use model, being white is associated with an increased risk of substance abuse including opioids relative to non-opioid substance abuse (RRR 2.19,  $p < .01$ ). Having a clinically significant mental illness is associated with an increased risk of substance abuse including opioids relative to non-opioid substance abuse (RRR 1.48,  $p < .10$ ). Prior offending variety is not significant, but the relative risk ratio suggests that having a greater prior offending variety is associated with an increased risk of substance abuse including opioids relative to non-opioid substance abuse (RRR 2.38). Negative peer influence is also not significant, but contrary to the hypothesized relationship, the relative risk ratio suggests that increased negative peer influence is associated with a decreased risk of substance abuse including opioids relative to non-opioid substance abuse (RRR 0.97).

### ***Multivariate models of substance use***

I then ran the full multivariate models of substance use and abuse with all independent variables (female, white race, clinically significant mental illness, prior offending variety, and delinquent peer influence). I also included relevant control variables, age, and the baseline substance use variety scale. Results from multivariate

models of substance use are shown in Table 10, and Table 11 displays results for the multivariate models of substance abuse.<sup>2</sup>

Table 10. Multivariate multinomial logit results, opioid use		
	Relative risk of substance use including opioids vs. non-opioid substance use, N=1,229	
	<b>RRR</b>	<b>SE</b>
Female	0.75	0.19
White	<b>3.07*</b>	0.56
Mental illness	<b>1.76*</b>	0.35
Prior offending	1.44	0.87
Peer influence	1.08	0.11
Age	0.93	0.07
Baseline substance use	<b>1.29*</b>	0.09
<b>*Indicates significance at <math>p &lt; .01</math>, two-tailed</b>		

Table 11. Multivariate multinomial logit results, opioid abuse		
	Relative risk of substance abuse including opioids vs. non-opioid substance abuse, N=1,229	
	<b>RRR</b>	<b>SE</b>
Female	0.83	0.23
White	<b>2.10*</b>	0.42
Mental illness	1.55 <sup>a</sup>	0.33
Prior offending	1.86	1.22
Peer influence	0.85	0.10
Age	0.96	0.08
Baseline substance use	1.15 <sup>b</sup>	0.10
<b>*Indicates significance at <math>p &lt; .01</math>, two-tailed</b>		
<sup>a</sup> Indicates significance at $p < .05$ , two-tailed		
<sup>b</sup> Indicates significance at $p < .10$ , two tailed		

*H1a: Female gender will be more strongly related to opioid use and abuse than other drug use and abuse.*

As shown in Table 10, female gender is not a significant predictor of opioid use

relative to non-opioid use, but the relative risk ratio suggests that females are at less

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<sup>2</sup> I also ran the models without clinically significant mental illness and found no differences compared to the unrestricted models.



risk of opioid use than males (RRR 0.75). Similarly, as shown in Table 10, female gender is not a significant predictor of substance abuse including opioids relative to non-opioid substance abuse, but the direction of the risk ratio suggests females are at a decreased risk of opioid abuse (RRR 0.83). Neither the use nor abuse results support my hypothesis.

*H1c: Being white relative to another race will be more strongly related to opioid use and abuse relative to other drug use and abuse.*

Being white relative to another race is associated with an increased risk of substance use including opioids relative to non-opioid related substance use (RRR 3.07,  $p < .01$ ). Similarly, being white relative to another race is associated with an increased risk of substance abuse including opioids relative to non-opioid substance abuse (RRR 2.18,  $p < .01$ ). Findings from both the use and abuse models support my hypothesis.

*H1d: Mental illness will be more strongly related to opioid use and abuse relative to other drug use and abuse.*

Having a clinically significant mental illness is associated with an increased risk of substance use that includes opioids relative to non-opioid substance use (RRR 1.76,  $p < .01$ ). Having a clinically significant mental illness is also associated with an increased risk of substance abuse that includes opioids relative to non-opioid substance abuse (RRR 1.55,  $p < .05$ ). Findings from both the use and abuse models support my hypothesis.

*H1e: Greater offending variety will be more strongly related to opioid use and abuse relative to other drug use and abuse.*

A one unit increase in prior offending variety suggests an increased risk of 1.44 for substance use that includes opioids relative to non-opioid substance use, but the relative risk ratio is not significant. A higher prior offending is also associated with an increased risk of substance abuse that includes opioids relative to non-opioid

substance abuse, but the relative risk ratio is not significant (RRR 1.86). Results from the use and abuse models do not support my hypothesis.

*H1f: Delinquent peers will be more strongly related to opioid use and abuse relative to other drug use and abuse.*

A one unit increase on the scale of delinquent peer influence suggests an increased risk of substance use including opioids relative to non-opioid substance use, but the relative risk ratio is not significant (RRR 1.08). In contrast, a unit increase on the scale of delinquent peer influence suggests a decreased risk of substance abuse including opioids relative to non-opioid substance abuse, but this relative risk ratio is also not significant (RRR 0.85). Results from the use and abuse models do not support my hypothesis.

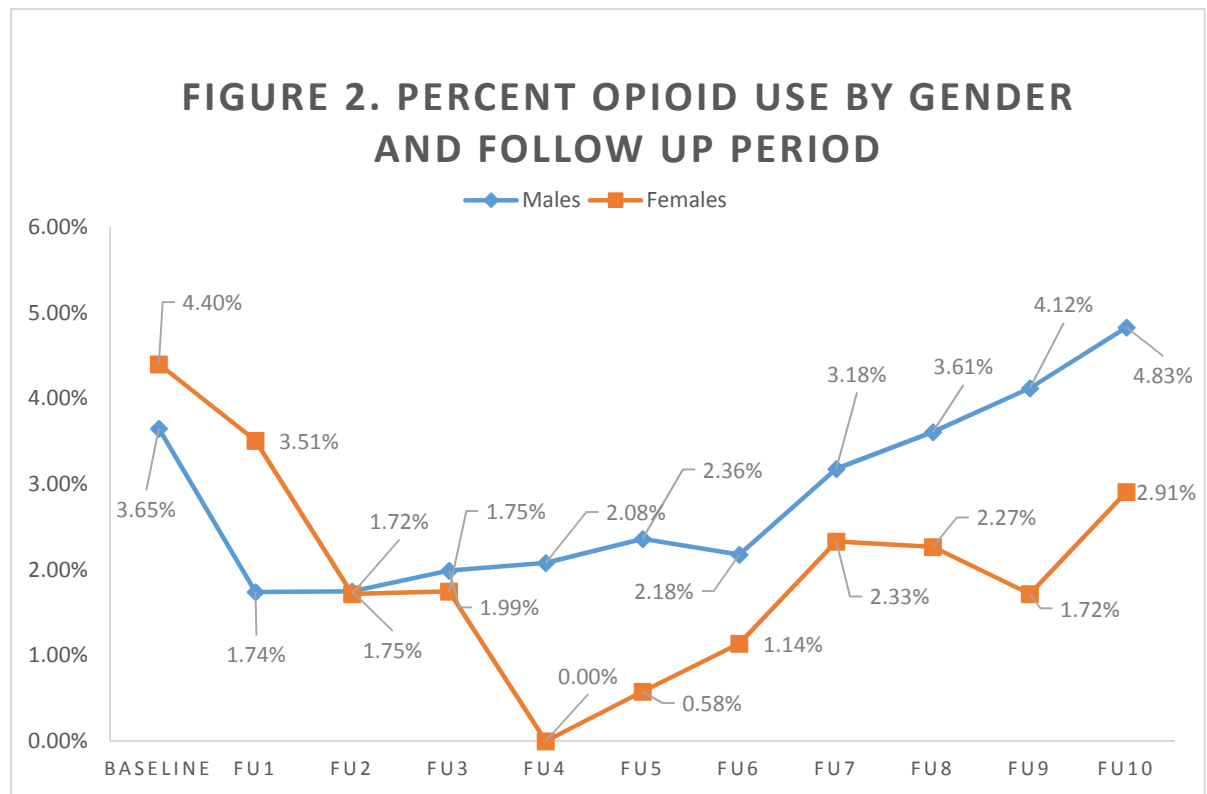
As shown in Table 12, the models presented above provided support for my hypotheses pertaining to age, white race, and clinically significant mental illness as significant risk factors for substance use including opioid use and abuse. I did not find support for my hypotheses pertaining to gender, prior delinquency, or delinquent peers. Results from the use and abuse models coincided for every risk factor.

Table 12. Summary of findings: Hypothesis 1		
	Opioid use	Opioid abuse
H1a: Female gender will be more strongly related to opioid use and abuse than other drug use and abuse.	X	X
H1b: Age will be a more strongly related to opioid use and abuse relative to other drug use and abuse.	✓	✓
H1c: Being white relative to another race will be more strongly related to opioid use and abuse relative to other drug use and abuse.	✓	✓
H1d: Mental illness will be more strongly related to opioid use and abuse relative to other drug use and abuse.	✓	✓

H1e: Greater offending variety will be more strongly related to opioid use and abuse relative to other drug use and abuse.	X	X
H1f: Delinquent peers will be more strongly related to opioid use and abuse relative to other drug use and abuse.	X	X

### *Hypothesis 2*

I began by looking at patterns of opioid use and abuse by gender. As shown in Figure 2, females report greater levels of opioid use at baseline and first follow-up but fall below their male peers at the second follow up (12 months).



To assess significant gender differences in opioid use by age, I ran a bivariate multinomial logistic regression clustering on the individual. Results from bivariate models for use and abuse are shown in Table 13.

Table 13. Bivariate Multinomial Logit Results, opioid use and abuse and age by gender			
	Relative risk of substance <u>use</u> including opioids vs. non-opioid substance use		
	RRR	SE	N
Female	1.04	0.07	1,911
Male	<b>1.10*</b>	0.03	11,567
	Relative risk of substance <u>abuse</u> including opioids vs. non-opioid substance abuse		
Female	1.12	0.12	1,911
Male	<b>1.10*</b>	0.03	11,567
<b>*Indicates significance at <math>p &lt; .01</math>, two-tailed</b>			

For females, the relative risk ratios suggest that an increase year of age is associated with an increased risk of 1.04 for substance use including opioids relative to non-opioid substance use, but the relative risk ratio is not significant. The results from the opioid abuse model are similar: an increased year in age for females is associated with an increased risk of 1.12 for substance use including opioids relative to non-opioid substance use, but this relative risk ratio does not reach significance.

For males, an increased year of age is associated with an increased risk of non-opioid substance use relative to non-opioid substance use (RRR 1.10,  $p < .01$ ). The results from the opioid abuse model are similar: an increased year of age for males is associated with an increased risk of substance use including opioids relative to non-opioid substance use (RRR 1.10,  $p < .01$ ).

The risk ratios for opioid use relative to non-opioid substance use are similar for males and females, however, the standard errors are greater for females leading to null findings. The high standard errors for females may be due in part to the relatively smaller sample size of females. These results do not provide support for *H2a: Being*

*older and female will be associated with greater risk of opioid use and abuse than being older and male.*

To examine whether female opioid users have a constellation of risk factors distinct from their male peers, I began by running regressions with each independent variable, female gender, and an interaction term for female gender and the independent variable. Results from these models are shown in Table 14.

Table 14. Multivariate multinomial logit results, opioid use with gender interaction by construct		
	Relative risk of substance use including opioids vs. non-opioid substance use	
	RRR	SE
Impulse control, N=1,333		
Female	0.75	0.60
Impulse control	<b>0.65*</b>	0.06
Impulse Control*Female	1.09	0.27
Clinically significant mental illness, N=1,244		
Female	1.05	0.32
Mental illness	2.11	0.41
Mental illness*Female	0.57	0.28
Peer influence, N=1,321		
Female	0.60	0.38
Peer influence	1.23	0.10
Peer influence*Female	1.27	0.33
Exposure to violence, N=1,333		
Female	1.79	0.80
Exposure to violence	1.07 <sup>a</sup>	0.03
Exposure*Female	0.89	0.07
<b>*Indicates significance at <math>p &lt; .01</math>, two-tailed</b>		
<sup>a</sup> Indicates significance at $p < .05$ , two-tailed		

As shown in Table 14, being female relative to male was not associated with increased risk of substance use including opioids relative to non-opioid substance for any of the models. Similarly, the interaction terms were not significant in any of the

models. The same is true for the models of substance abuse including opioids relative to non-opioid substance abuse (see Table 15).

Table 15. Multivariate multinomial logit results, opioid abuse with gender interaction by construct		
	Relative risk of substance abuse including opioids vs. non-opioid substance abuse	
	RRR	SE
Impulse control, N=1,333		
Female	0.92	0.83
Impulse control	0.84 <sup>b</sup>	0.08
Impulse Control*Female	1.02	0.27
Clinically significant mental illness, N=1,244		
Female	0.90	0.31
Mental illness	1.50 <sup>b</sup>	0.33
Mental illness*Female	0.98	0.53
Peer influence, N=1,321		
Female	1.13	0.77
Peer influence	0.97	0.09
Peer influence*Female	0.93	0.28
Exposure to violence, N=1,333		
Female	1.15	0.57
Exposure to violence	1.02	0.03
Exposure*Female	0.97	0.09
<sup>b</sup> Indicates significance at $p < .10$ , two-tailed		

These initial models with gender interactions suggest there is no support for Hypothesis 2.

## Chapter 4: Limitations and Discussion

### *Limitations*

There are a few limitations to this study. A primary limitation of the study is that, due to the significant overlap in different types of substance use, I was unable to isolate individuals who exclusively used opioids. The prevalence of polysubstance use among opioid users limits my ability to identify unique risk factors for opioid use. Additionally, I was not able to control for number of days in detention during each follow up period. Participants in secure detention may have less access to opioids than those who are not in secure detention. Just over half (51.2%) of respondents were in secure detention at baseline which suggests that detention may have played an important role in access to opioids for a substantial proportion of the sample. Participants in secure detention may also have been more likely to receive wraparound services like counseling for substance abuse disorders or other substance abuse treatment which may also lead to decreased likelihood of engaging in substance use. For the majority of my analyses I aggregated substance use after baseline, so not controlling for substance abuse treatment was likely not a major limitation of the study. Detention status may explain the unexpected trend in opioid use with time; opioid use was more prevalent among youth at age 16, less prevalence between ages 17-19, and increased again at age 20. It is possible that the decline in opioid use during the later teen years is attributable, in part, to placement in secure detention where there is limited access to illicit substances. Another limitation is that the length of time between follow up periods changed after the fourth year of data collection

from six months to one year. This longer exposure window may have allowed for more time for opioid use to occur, accounting for increases in opioid use in the later years.

Another limitation is that data were collected during the rise of the opioid epidemic in the US, between 2000 and 2010. I did not measure or control for increased availability and use of opioids overall, which may have influenced these findings. Additionally, the key independent and dependent variables in the study relied on adolescent self-report. Some research has found that adolescents are reliable reporters of their own risk behaviors, but it would be optimal to include corroborative reporting. Finally, the generalizability of these results is limited as the data are not a random sample of all juvenile justice system involved youth; data are collected only from adolescents who committed a serious crime in Phoenix, Arizona or Maricopa County, Pennsylvania.

## ***Discussion***

Increases in opioid use and deaths attributable to opioid use since the late 1990s have garnered significant attention of the research and policy communities. Increased public attention may also be due, in part, to the fact that the opioid epidemic affects populations that are not expected to be at risk of engaging in substance use such as white, middle and upper class young adults. From 2000-2010, deaths attributable to opioids occurred predominantly among white individuals and were largely caused by misuse of prescription opioids. Individuals in the general population who misused opioids did not typically misuse a variety of other substances. Based on these patterns from the general population, I aimed to better understand risk factors for opioid use



among a population known to be at high risk for engaging in substance use, juvenile justice system involved youth. I examined whether risk factors were distinct for substance use that includes opioids relative to non-opioid substance use.

I found that, overall, opioid use among juvenile justice system involved youth is best understood in the context of polysubstance use more broadly. At baseline, all opioid users in the sample also used marijuana, and many used other substances as well. I found a few risk factors were associated with increased risk for substance use that includes opioids relative to non-opioid substance use: older age, white race, and presence of a clinically significant mental illness. These risk factors parallel risk factors for opioid use among individuals in the general population. In the general population, opioid use is more common among young adults than adolescents, and this appears to be the case among this in-risk sample as well. Being white is also significantly associated with substance use including opioids relative to substance use that does not include opioids, a finding that also parallels trends from the general population.

That youth with a clinically significant mental illness are more likely to use opioids also parallels findings from studies with youth in the general population. Some studies have found, for example, that individuals with mental illnesses are more likely to be prescribed opioids for pain than individuals who do not have mental illnesses.

I also found that female gender, prior offending variety, and delinquent peer influence are not associated with an increased risk of opioid use or abuse relative to non-opioid substance use and abuse. Prior offending variety was associated with increased risk of substance use including opioids relative to non-opioid substance use in the bivariate

models (RRR 5.86,  $p < .01$ ), as was delinquent peer influence (RRR 1.26,  $p < .01$ ). The absence of any significant relationship between prior offending variety or delinquent peer influence and opioid use in the multivariate model may be due to their high correlation with prior substance use because after controlling for prior substance use, these factors are no longer significant in the model. Another potential explanatory variable may be age. Prior offending variety and delinquent peer influence are robust predictors of adolescent risk behaviors such as substance use and future delinquency but may not do as well at explaining risk behaviors among young adults.

A primary aim of this study was to examine how, if at all, gender predicts opioid use and abuse relative to non-opioid substance use and abuse. A substantial body of literature suggests that among adolescents overall, females are more likely to identify opioids as their primary drug of choice than are males. Additionally, there were larger increases in opioid use among females than males between 2000 and 2010. This is notable because male gender is one of the most robust predictors for all non-opioid substance use. Given these trends in the overall population, I wished to examine how similar the relationship between female gender and opioid use would be among juvenile justice system involved adolescents relative to patterns among adolescents overall. I expected to find unique predictors for females' opioid use and abuse. More specifically, I expected female gender to moderate the relationships between age, self-control, mental illness, strain and opioid use. Contrary to my hypotheses, gender was not a significant predictor or moderator of substance use or abuse including opioids relative to non-opioid substance use or abuse in any of the models.

There are a few possible explanations as to why predictors of opioid use among female adolescents convicted of a serious offense are no different than those of their male counterparts. I found no support that female gender was a significant predictor of substance use including opioids relative to non-opioid substance use. Research conducted among adolescents and young adults in the general population suggests that females are more likely to use opioids, but this typically involves prescription opioids. Further, most adolescents get access to prescription opioids through their friends and family members. Juvenile justice system involved females may simply have more limited access to prescription opioids than females in the general population, leading to a preference for more readily accessible alternatives. On the other hand, it is possible that females who exhibit more high-risk behavior, such as the females who might end up in this sample, are subject to higher levels of monitoring possible from caregivers or through involvement with the juvenile justice system, which could limit access to prescription opioids. Also, because I was unable to control for detention status, females may have been subject to more monitoring through disproportionate stays in detention facilities, which would decrease their access to opioids and reduce their overall risk for opioid use.

I also found no effect for any of the interaction terms with gender and each risk factor I examined. This suggests that female gender does not moderate the relationship between risk factors and substance use. It is possible the processes that lead adolescents to be involved in the juvenile justice system, and further, to be convicted of a felony or similarly “serious” offense, differ for males and females. For example, relative to their male counterparts, system involved female adolescents are

less likely to have committed nearly all crime types than their male counterparts except for running away and prostitution. I did not have measures for adolescents' specific offense histories, thus did not explore crime severity as a predictor. Females are less likely than males to be arrested, but once they enter the juvenile court system they are more likely to be sentenced to detention for lower level crimes than their male counterparts. Male adolescents who are involved in the juvenile justice system are more likely than their female counterparts to be charged with a violent crime or a drug-related crime (Hogdon, 2013). It is possible, then, that females who enter the juvenile justice system represent a lower risk group than males who enter the juvenile justice system. If males' propensity for risk behavior in the sample is elevated above that of the females', and more so than would be expected among adolescents overall, this could explain why I did not find any predictors of opioid use that were more robust for female adolescents.

Further, these data are also only representative of adolescents who were convicted of a serious crime, thus the results do not reflect patterns among juvenile justice system-involved adolescents more broadly. Females are disproportionately likely to be arrested for low level offenses, and are more likely to receive secure detention for a lower level offense relative to their male counterparts. Often, adolescent females are convicted of crimes that correspond to coping mechanism for strain including substance abuse, running away, and status offenses. Differences in how and why adolescents are sentenced contribute to differences in risk factors and outcomes for males versus females in the juvenile justice system overall. Among this sample of serious juvenile offenders, it is possible that there are fewer baseline

differences between males and females, or that females in a sample of serious juvenile offenders are more similar to their male counterparts than females and males in the juvenile justice system in general. Adding to this selection issue, the proportion of male respondents enrolled in the study who were convicted of a drug offense was capped at 15% while there was no cap for females convicted of a drug offense. The group of females may be more representative than the male group, but females may also have been more likely to be assigned to substance abuse treatment than males.

Finally, prior literature has found mixed evidence for the moderating role of some of the variables I examined in this study. For example, previous literature has found support for both moderating and mediating roles of self-control, mental illness, and delinquent peers on gender and substance use. It is possible, then, that some of these risk factors mediated rather than moderated the relationship between female gender and substance use. This does not seem to be the case for self-control, which, based on the main effect variable, appears to reduce the risk associated with substance use including opioids relative to non-opioid substance use (RRR .84,  $p < .10$ ). Additionally, the main effect for peer influence is not significant and close to one, suggesting this may not be a mediator (RRR 0.97). Mental illness, however, is associated with an increased likelihood of substance use involving opioids relative to non-opioid substance use (RRR 1.5,  $p < .10$ ). This may indicate that after controlling for mental health status, gender differences in opioid use are eliminated. It is impossible to say whether mental illness acts as a mediating variable without more appropriate statistical testing, such as structural equation modeling, however.

### ***Implications for research and policy***

A primary takeaway from this study is that opioid use among juvenile justice system involved youth almost never occurs in the absence of other drug use. Researchers must approach studies of opioid use in the context of polysubstance use. Further, policies aimed at prevention, screening, and intervention, may benefit from targeting efforts toward other substance users.

Developmental theories of offending suggest that most individuals tend to desist from delinquent behavior, including substance, use by young adulthood. If engaging in opioid use is associated with persistence of delinquency, then these individuals may need targeted attention not only with substance abuse treatment, but also with tasks related to transitioning to adulthood. Thus, substance abuse treatment programs may be more beneficial if they incorporate components such as job training, healthy relationships programming, and other adult skills.

In line with trends for other substance use, and in line with trends for adolescents overall, system involved adolescents who are white are more likely to engage in substance use that includes opioids relative to non-opioid substance use. This may point to greater access or availability of these substances for white youth. It may also suggest that white youth perceive less risk associated with engaging in opioid use. Future research could examine whether risk perceptions vary by race.

I also found that youth with a clinically significant mental illness are more likely to engage in substance use that includes opioids relative to non-opioid substance use. Youth with mental illness are more likely to be prescribed opioids for pain management relative to youth without a mental illness. This is alarming because

prescription opioid users are more likely to go on to use heroin. Further, heroin abuse often co-occurs with mental illnesses. Thus, adolescents with a mental illness may be at increased risk for longer term, and more dangerous patterns of opioid use. All adolescents prescribed opioids should be closely monitored and informed of the risks associated with their medicine, but youth with mental illness may benefit from additional check ins with practitioners.

Future research should aim to better unpack the relationship between gender and opioid use. Given the variety of selection processes at play when studying system-involved adolescents, it may be hard to answer this question through secondary data alone. For example, research should examine the relationship between gender, mental illness, and opioid use. In this study, females had a higher prevalence of mental illness than males, but mental illness was not a more significant predictor of opioid use for females relative to males.

Focus groups or interviews may provide more illuminating and nuanced information about the reasons system-involved females and males do or not prefer opioids, and to tap into the presence of other risk factors. Additional research using secondary data may provide additional insight by including measures of caregiver monitoring and detention stays that may have influenced females' access to opioids. This may be particularly important given prior literature that finds females are subject to higher levels of monitoring than their male counterparts.

Finally, future research should examine risk factors for opioids among other high-risk populations, such as youth involved in the child welfare system and youth in the behavioral health care systems. Youth involved in any of these systems are an

increased risk for substance use. Although there is some overlap between these populations and the juvenile justice population, the selection processes vary from that of the juvenile justice system. Accordingly, there may be more significant findings by gender in these other at-risk populations.

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