Smoking and Pregnant: Criminological Factors Associated with

Maternal Cigarette Smoking and Marijuana Use during Pregnancy

by

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ABSTRACT

Maternal cigarette smoking and marijuana use during pregnancy are risk factors that can adversely affect offspring. Although a large body of empirical literature has examined the adverse health effects of maternal cigarette smoking and marijuana use during pregnancy, few studies have looked at criminological factors associated with prenatal cigarette smoking and marijuana use. This thesis uses strain theory and social learning theory to explain a number of underlying mechanisms behind why some pregnant women decide to smoke tobacco and marijuana cigarettes during pregnancy. Previous drug involvement before pregnancy is also used to determine if it is a predictor of maternal cigarette smoking during pregnancy. Logistic regression was used to analyze data collected from the 1988 National Pregnancy and Infant Health Survey. This data set consists of information gathered from three different national samples of maternal and infant data occurring in 1988, which included 13,417 live births, 4,772 fetal deaths, and 8,166 infant deaths. The mothers in the sample were mailed questionnaires. Results showed that pregnant women who have unexpected pregnancies and experience financial hardship during pregnancy are more likely to smoke cigarettes and use marijuana during pregnancy, which is consistent with the general strain theory. Results also indicate that pregnant women who live in households with other people who smoke are more likely to smoke cigarettes during pregnancy, which may be explained by social learning, and that women who use illegal drugs are less likely to smoke cigarettes during pregnancy, even after controlling for strain and social learning. The practical and theoretical implications for this research are discussed.

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INTRODUCTION

Maternal cigarette smoking during pregnancy has been a controversial issue in America. There are labels on every box of cigarettes warning mothers of what can happen to their fetus if they choose to smoke during pregnancy. According to Gillies & Wakefield (1993), pregnant women of low socioeconomic status tend to smoke more than women who are from middle class and affluent backgrounds, in part, because of additional stressors due to financial hardship and limited social support. Pregnant smokers tend to be young, disadvantaged, unmarried women with low levels of education. They also tend to have a partner who smokes and little work experience or financial support (McCormick, Brooks-Gunn, Shorter, Holmes, Wallace, & Heagarty, 1989; Phung, Bauman, Nguyen, Young, Tran, & Hillman, 2003).

Research from several different disciplines indicates that maternal cigarette smoking (MCS) during pregnancy has a detrimental impact on offspring, including health and behavioral effects (DiFranza, Aligne, Weitzman, 2004; Hofhuis, de Jongste, & Merkus, 2003; Walsh, 1994). MCS during pregnancy has also been associated with various forms of crime and delinquency through decreased self control in offspring, as well as other developmental deficits (McGloin, Pratt, & Piquero, 2006; Pratt, McGloin, & Fearn, 2006). Evidence has shown decreases in cognitive and language attainment, slower social development, increased irritability, and lower reasoning ability among children who were exposed to MCS during pregnancy (Curet & Hsi, 2002; Fogelman & Manor, 1988; Fried, Watkinson, & Gray, 1998; Rantakallio, 1983; Weitzman, Gortmaker, & Sobol, 1992). Research has also found a significant, but inconsistent connection between maternal cigarette smoking during pregnancy and antisocial behavior

in adolescents who were exposed to cigarette smoke as fetuses (Pratt et al, 2006).

Criminologists have taken particular interest in behavioral problems, such as conduct disorder and general externalizing behaviors (Fergusson, Woodward, & Horwood, 1998; Hill, Lowers, Locke-Wellman, & Shen, 2000; McGloin et al, 2006; Pratt et al, 2006; Weitzman et al., 1992). These findings are noteworthy because they suggest that abstaining from MCS during pregnancy could potentially mitigate or reduce crime and delinquency in at-risk populations.

Research has shown that maternal cigarette smoking during pregnancy is prevalent both internationally and nationally. Ananth, Savitz, & Luther (1996) found that 32.7 percent of the pregnant mothers in their sample from Nova Scotia smoked cigarettes. Similarly, Gillies & Wakefield (1993) found that 1 in 3 women in the United Kingdom smoked during pregnancy. Chung, Kowalski, Kim, & Buchman (2000) found that 13.6% of pregnant mothers smoked cigarettes during pregnancy in the United States. These figures are concerning from a public health and child developmental perspective.

Smoking marijuana is a related health problem among pregnant women in the United States. Marijuana is reported to be one of the most commonly used illicit drugs among women of child bearing age (Fried & Smith, 2001; Huizink & Mulder, 2006). According to a maternal health study conducted in Florida by Chasnoff, Landress, & Barrett (1990), 14.4 percent of white pregnant women smoked cannabis during pregnancy, compared to 6 percent of black women. In contrast, Huizink & Mulder (2006) examined data from the 1996 National Pregnancy and Health Survey, and found that 2.9 percent of pregnant women gave self-reports that they used marijuana during their

pregnancies. Marijuana has been considered a "gateway drug" by some scholars and has been linked to a number of health problems (Shieh & Kravitz, 2006).

Illicit drug use increases the odds of cigarette smoking (Richter, Ahluwalia, Mosier, Nazir & Ahluwalia, 2002). Research has shown that cocaine users often use other substances concurrently, such as marijuana, heroine, cigarettes, or alcohol (Bendersky, Alessandri, Gilbert, & Lewis, 1996; Jacobson, Jacobson, Sokol, Martier, Ager &Shankaran, 1994; Zuckerman, 1991). As a result, it is often hard to separate the effects of cocaine from other drugs (Lyons & Rittner, 1998). Environmental factors are also important when studying the effects of drug use on infants and early childhood development.

There are a number of environmental factors surrounding the infant and mother that can potentially lead to developmental problems (Lyons & Rittner, 1998). Poverty, inadequate nutrition, and poor prenatal care are risk factors that may impede fetal development (Alexander & Korenbrot, 1995). Research on prenatal drug use has also found that social interaction and parenting styles play an important role in predicting negative health outcomes among infants and children raised in drug abusing households (Lyons & Rittner, 1998). Thus, the consequences of drug exposure are not necessarily immediate, but add up over time due to environmental, social, and familial influences.

Smoking tobacco and marijuana cigarettes during pregnancy continues to occur, even as the public has become increasingly aware of the detrimental effects of maternal cigarette smoking (MCS) and illegal marijuana use on offspring. Little research has focused on the question of why some mothers choose to smoke cigarettes or use marijuana during their pregnancy, and the subsequent link to behavioral outcomes.

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The focus of this thesis is to examine the influence of criminological factors on a mother's decision to smoke cigarettes and use marijuana during pregnancy. This study draws on two theoretical perspectives: general strain theory and social learning theory. Measures of economic hardship and deviant peer influence during pregnancy are independent variables that are the focus of analysis. Specifically, drawing from a social learning perspective, does living in the same household with a cigarette smoker increase a mother's likelihood of smoking cigarettes during pregnancy? How does personal strain affect marijuana use and cigarette smoking during pregnancy after controlling for peer influence? To what extent are tobacco and marijuana use linked during pregnancy?

REVIEW OF RELEVANT LITERATURE

Detrimental Health Effects of Maternal Cigarette Smoking (MCS) during Pregnancy

Smoking cigarettes during pregnancy can increase the possibility of health risks for both a mother and her fetus (Floyd, Jack, Cefalo, Atrash, Mahoney, Herron, Husten, & Sokol, 2008). Maternal smoking reduces the amount of oxygen flowing to the fetus, and puts the fetus at risk for slower intrauterine growth, prematurity, low birth weight, and SIDS (Curet & Hsi, 2002; Floyd et al, 2008; Zuckerman, 1991). Cognitive, language, and academic achievement have been found to decline in children who were exposed to cigarette smoke during pregnancy (Floyd et al, 2008).

Adolescents who were exposed to maternal smoking experience a higher rate of childhood cancer (Curet & Hsi, 2002; Floyd et al, 2008), as well as decreased height, slower social development, increased irritability, and decreased reasoning ability (Curet & Hsi, 2002; Fogelman & Manor, 1988; Fried et al, 1992; McGloin et al, 2006; Rantakallio, 1983; Weitzman et al, 1992). These effects have been attributed to the reduction of infant birth weight, and may be directly influenced by "toxic tobacco constituents in organ tissue of the fetus itself" (Orlebeke, Knol, & Verhulst, 1997, p. 317). Children who are born with a low birth weight generally experience more problems relating to physical and mental health (Orlebeke et al, 1997).

Effects from MCS during pregnancy are dose related. Several studies suggest that mothers who smoke one pack of cigarettes a day will increase the likelihood of seeing adverse effects in their offspring (Fergusson, Woodward, & Horwood, 1998; Maughan, Taylor, & Taylor, 2001; Weissman, Warner, Wickramaratne, & Kandel, 1999). Externalizing behavior is more prevalent in offspring exposed to MCS during pregnancy

compared to offspring that were not exposed (Fergusson et al, 1998; Orlebeke et al, 1997). A number of studies have indicated that children who were exposed to MCS during pregnancy experience an increased risk of attention deficit, oppositional defiant behavior, and conduct disorder (Brennan, Grekin & Mednik, 1999; Fergusson et al, 1998; Fergusson, Horwood, & Lynskey, 1993; Millberger, Biederman, Faraone, Chen, & Jones, 1997; Rantakallio, Laara, Isohanni, & Moilanen, 1992; Streissguth, Martin, Barr, Sandman, Kirchner, & Darby, 1984; Wakschlag, Lahey, Loeber, Green, Gordon, & Leventhal, 1997; Weitzman, Gortmaker, & Sobol, 1992). Research suggests that MCS may directly affect the fetus's central nervous system, leading to increased aggression in offspring (Orlebeke et al, 1997). Childhood developmental studies provide evidence that the negative effects of MCS during pregnancy can persist into adolescence and even to adulthood (Fergusson et al, 1998; Wakschlag et al, 1997; Weismann et al, 1999).

Criminogenic Effects and Antisocial Behavior in Offspring Exposed to Maternal Cigarette Smoking

Researchers have also found a significant, but somewhat inconsistent connection between maternal cigarette smoking during pregnancy and antisocial behavior in adolescents who were exposed to maternal cigarette smoking (MCS) as fetuses (Pratt et al, 2006). These studies suggest that there is a link between MCS and increased antisocial behavior and externalizing behavior (Fergusson et al, 1998; Orlebeke et al, 1997). Orlebeke et al (1997) revealed direct connections between MCS and externalizing and antisocial behavior; however, they failed to find statistically significant effects of maternal smoking on internalizing behavior. Other studies have found MCS to be linked to "violent offending, persistent offending, and the early onset of offending" (Pratt et al,

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2006, p. 673) (see also Brennan et al,1999; Fergusson, Horwood, & Lynsky, 1993; Gibson, Piquero, & Tibbetts, 2000; McGloin, et al, 2006; Rantakallio et al, 1992; Rasanen, Hakko, Isohanni, Hodgins, Jarvelin, & Tiihonen, 1999; Weissman et al, 1999).

Pratt et al (2006) conducted a meta-analysis of peer reviewed studies that tested whether or not MCS was a risk factor for criminal and deviant behavior among children. The authors found that MCS was a "moderately important risk factor for criminal and deviant behavior in offspring" (Pratt et al, 2006, p. 682) and that "self-control, delinquent peer associations, and antisocial attitudes" (Pratt et al, 2006, p. 683) played a larger, more significant role in whether or not a child participated in deviant behavior. In other words, there are multiple risk factors that may lead to delinquency, including MCS during pregnancy and more traditional criminological factors.

Another meta-analysis by McGloin et al (2006) looked at the means by which "MCS produced criminogenic risk for life course persistent offending" (LCP offending) (p. 415). The authors found a "significant relationship between MCS and LCP offending that operates independent of neuropsychological dysfunction" (McGloin et al, 2006, p. 420). In other words, other factors affect the relationship between MCS and LCP, not just the indirect pathway of neuropsychological dysfunction (McGloin et al, 2006).

McGloin et al (2006) point out that several factors can affect the delinquent outcomes of a child. The authors suggest that a primary factor, parenting, may play a role in the relationship between MCS and offending. Mothers who smoke during pregnancy usually exhibit poor parenting styles and practices (McGloin et al, 2006). The second mediating factor that may affect the relationship between MCS and offending is that MCS "consistently predicts attention-deficit hyperactivity disorder (ADHD)" (McGloin

et al, 2006; and Sadowski & Parish, 2005). ADHD predicts delinquency (Pratt et al, 2002) mainly because of a lack of self-control (Unnever, Cullen, and Pratt, 2003). The last factor that can affect the relationship between MCS and offending is that ADHD is highly heritable. This finding has been used in an attempt to explain why some mothers who smoke during pregnancy lack self-control and "may have ADHD and engage in excessive smoking as self-medication" (McGloin et al, 2006, p. 422).

Detrimental Health and Behavioral Effects of Maternal Marijuana Use during Pregnancy

Prenatal studies have also found that marijuana is the most frequently used illegal substance among young adults and women who are of reproductive age (Fried & Smith, 2001; Hanna, Faden, & Dufour, 1994; Preston, 2006; Linn, Schoenbaum, Monsom, Rosner, Stubblefield, & Ryan, 1983). Marijuana use among pregnant women is estimated at approximately 12 percent in non-disadvantaged urban areas (Fried & Watkinson, 1988). Marijuana increases the amount of carbon monoxide in the bloodstream, decreasing the amount of oxygen flowing through the human body. When a mother smokes marijuana, the amount of oxygen going to the fetus is reduced (Zuckerman, 1991). Surprisingly, studies on the effects of marijuana on fetuses and infants, have failed to "identify major birth defects or a consistent effect on neurobehavioral function" (Zuckerman, 1991, p. 33).

Fried & Smith (2001) examined a number of different health effects of marijuana use by pregnant mothers. They found that infants in a sample of families residing in Ottowa, who were exposed to marijuana, were more likely to experience tremors and long-drawn-out startles occurring spontaneously or with mild stimulation. Their research

drew upon previous studies which also found that marijuana exposed infants were more likely to have high-pitched cries and exhibit visual impairments (Fried & Watkinson, 1988). Research also suggests that maternal marijuana use causes disturbances in sleep patterns and motility in offspring (Astley & Little, 1989; Scher, Richardson, Coble, Day, & Stoffer, 1988). It should be noted that the frequency and intensity of all symptoms experienced by prenatally exposed infants were dependent on the amount of marijuana use by mothers during pregnancy (Faden & Graubard, 2000). With sufficient dosage, maternal marijuana use during pregnancy has been linked to higher rates of fearfulness and poorer motor development in offspring (Faden & Graubard, 2000). Even when these effects occur, however, Cannabis, such as marijuana, have very low toxicity (Zuckerman, 1991).

Numerous studies have concluded that there are inconsistent findings with regard to the health effects of smoking marijuana and other Cannabis while pregnant (Curet & Hsi, 2002; Zuckerman, 1991). For instance, Fried and Smith (2000) suggest that marijuana use during pregnancy can negatively affect a toddler's motor development, as well as cognitive development. Fried, Watkinson, and Gray (1998) found that children who were exposed to marijuana in utero were more likely to have poor visual reasoning skills than their peers who were not exposed to marijuana. Yet other research has found that there were no such effects on children who were exposed to marijuana in utero. Fried & Watkinson (1988) suggest that marijuana use during pregnancy had fewer effects on infant health than both cigarette and alcohol usage. According to Faden & Graubard (2000), exposure to marijuana in utero was not linked to "mental, motor or language outcomes at ages one and two" (p.331).

Cornelius, Goldschmidt, Day, & Larkby (2002) studied a large sample of pregnant teenagers, who were predominantly African American from a low socioeconomic background. Cigarette smoking was prevalent among pregnant mothers in the sample. Marijuana smoking was also more frequent than the population average, but the rates decreased as the pregnancies progressed. Maternal cigarette smoking was associated with increased skin fold thickness at age 6. Marijuana use during pregnancy was associated with decreased height at age 6, but length deficiency was not noticeable at infancy. Cornelius et al. (2002) noted that although these marijuana effects were small, they were significant and persistent, suggesting that effects on growth could foreshadow "neurobehavioral and cognitive deficits as the child matures" (p.709). This long term effect is more likely for children who are raised in less emotionally and mentally stimulating social environments.

Fried et al. (1998) drew similar conclusions in their research, noting that tests measuring particular aspects of intelligence such as the Block Design subtest and the Picture Completion subtest rather than general IQ tests do a better job at detecting cognitive deficiencies. The Block Design subtest looks at a child's ability to recreate a picture that they were shown. The Picture Completion subtest requires the child to determine what part of a picture is missing. Fried et al. (1998) also found that toddlers who were exposed to marijuana in utero had poorer abstract and visual reasoning skills.

Factors Explaining MCS and Marijuana Use during Pregnancy

Public health campaigns have heightened public awareness about the harmful effects of maternal smoking, alcohol, and substance use during pregnancy (Hill, Lowers, Locke-Wellman, & Shen, 2000). According to research carried out by Gillies &

Wakefield (1993) in the United Kingdom, pregnant women of low socioeconomic status tend to smoke more than women from middle-class and affluent backgrounds, because of additional strains due to financial hardships and limited social support. Infants with adolescent mothers have a higher risk for "prematurity, morbidity, and growth retardation" before socio-demographic factors and substance use are even taken into consideration (Cornelius et al., 2002, p.703). Many studies have noted that pregnant smokers tend to be young, disadvantaged, unmarried women with low levels of education and little financial or social support (Fried et al., 1998; Gillies & Wakefield, 1993; McCormick, Brooks-Gunn, Shorter, Holmes, Wallace, & Heagarty, 1990).

However, Arnold, Davis, Berkel, Jackson, Nandy, & London (2001) found that education level was not associated with knowledge of the detrimental health effects of smoking while pregnant. Further, education levels were not related to beliefs about and attitudes towards smoking. Despite the fact that pregnant mothers who graduated from high school showed more concern about smoking while pregnant, they had similar smoking rates to those mothers who did not graduate from high school (Arnold et al, 2001). Their research also revealed that women who live with smokers were more likely to smoke during pregnancy.

Impoverished women who are addicted to tobacco may not receive proper medical care, "live in hostile or non-supportive environments, experience financial deprivation, reside in inadequate housing, suffer from depression, be involved with a chemically dependent male partner, have histories of physical and sexual abuse, and be victims of domestic violence" (Brennan, Breitenbach, Dieterich, Salisbury & Van Voorhis, 2012; Gustavsson, 1991; Gillies & Wakefield, 1993; Hanna, Faden, & Dufour,

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1994). According to Deren (1986), "Most mothers [who smoke during pregnancy] are unemployed, and manifest low self-esteem, anxiety, and depression, and have histories of family problems, including parental alcoholism, family mental disturbances and physical abuse" (p. 83). Women who suffer from depression or do not look favorably upon their pregnancy are more likely to use tobacco products both before and after they find out they are pregnant (Hanna et al, 1994).

Pregnant women are more likely to smoke cigarettes or marijuana if they had negative attitudes toward their pregnancy or are suffering from depression. Most women make changes to their smoking behavior when they find out they are pregnant; however, the extent of these changes depends on how depressed they are, "both independently and in interaction with the sociodemographic variables that influence smoking", such as race, age, occupation, and marital status (Hanna et al., 1994, p.163). Being older, wealthier, or married produces lower depression scores and more positive views of pregnancy (Hanna et al, 1994). Overall, the results from the Hanna et al (1994) study support prior research suggesting that "depression or stress during pregnancy may in some way be linked to a mother's prenatal care and developmental, psychological, or sociological problems in the mother-child relationship" (p. 165). These risk factors relating to emotional instability or detachment have been linked to the transmission of crime (Giordano, 2010).

THEORETICAL FRAMEWORK

Social Learning Theory

       The early roots of social learning theory were developed in 1966 when Burgess and Akers drew from differential association theory and behavioral reinforcement theory to better understand the various mechanisms involved in the transmission of delinquent values (Akers & Cochran, 1985; Akers, 2009; Pratt, Cullen, Sellers, Winfree, Madensen, Daigle, Fearn & Gau, 2010). Social learning theory states that individuals learn deviant behavior and values through frequent associations and communication with others who have embraced a criminal lifestyle.   Behavioral influences are dynamic processes that shift and change over time and in different circumstances (Akers & Lee, 1996). Important social learning processes include differential association with significant others, modeling behavior after those with whom the individual identifies, differential reinforcement of behavior based on the net impact of reinforcement and punishment, and definitions favorable to lawbreaking gained through symbolic interactions (Lee, Akers & Borg, 2004).

       Differential association can take place through direct experience or indirectly (i.e., vicariously) by observing the actions of other people (Bandura, 1971). A person's exposure to common behavioral patterns varies based on their interactions with others. These observations and interactions can shape a person's attitudes about acceptable or unacceptable behavior (Pratt et al, 2010). Modeling involves imitation of a behavior that one observes, typically, when the beneficial consequences resulting from another person's actions are apparent (Pratt et al, 2010).   Differential reinforcement involves weighing the anticipated rewards and punishments based on past experience when

making decisions. People learn from significant groups, mentors, role models, and intimate others in their lives, who define what normative behavior is and whether specific behaviors are interpreted as favorable or undesirable (Akers, La Greca, Cochran, & Sellers, 1989; Akers & Lee, 1996; Akers & Lee, 1999; Pratt et al, 2010). Actions are in large part controlled by anticipated consequences (Bandura, 1971).

People may learn behaviors either through their own experiences or by observing the actions of others (Bandura, 1971; Gachter & Thoni, 2005). For instance, Weissman et al (1999) found that if a female child grew up in a household of smokers with a mother who smoked during pregnancy, the child would have an increased risk of adolescent-onset drug abuse and dependence. Responses to behaviors are often reinforced by immediate consequences observed after an action takes place. Positive consequences indicate behaviors that will more likely lead to success, whereas negative consequences would more likely lead to failure (Bandura, 1971). As a result, positive consequences often lead to reinforced behaviors, while negative consequences often lead to rejected behaviors (Lee et al, 2004; Powell, Tauras, & Ross, 2005).

According to Piquero, Gover, MacDonald, & Piquero (2005), social interaction with delinquent peers is a strong predictor of deviant behavior and juvenile delinquency. For example, Lundborg (2006) found that adolescents were more likely to smoke, binge drink, or use illicit drugs if they associated with peers who smoked, drank, or used illicit drugs. Likewise, Powell et al (2005) suggest that increased social interactions with smoking peers increases the likelihood that non-smoking adolescents will smoke cigarettes.

Recent research has also stressed the importance of social network structure and its influence on deviance and crime (Piquero et al, 2005). For instance, Haynie & Osgood (2005) found that "peer socialization has a meaningful causal influence on delinquency, contrary to claims that this association is entirely attributable to respondents choosing friends who are similar to themselves" (p.1120). Their results also suggest that adolescents are influenced by friendship networks, regardless of friendship strength.

Haynie (2001) suggests that people do not always have freedom to choose friendship networks. In some cases, available peer networks may be limited by demographic factors, such as age, gender, culture and socioeconomic status. This is problematic because disadvantaged families with fewer social networks may be less able to provide their children with good role models or social assets (Lee et al, 2004).

Strain Theory

General strain theory contends that destructive relationships lead to negative emotions such as anger, frustration, and depression, and that these emotions—especially anger—may lead to delinquency (Agnew, 1992; Agnew & White, 1992; Patchin & Hinduja, 2011; Piquero & Sealock, 2004). Agnew built upon the social structural strain theory noting that on the micro level "strain can occur when others remove or threaten to remove positively valued stimuli that an individual possesses, and when an individual is confronted with negative or unpleasant circumstances" (Ostrowsky & Messner, 2005, p.464; Paternoster & Mazerolle, 1994). Originally developed as a macro-level theory, social structural strain explains the relationship between social class and the ability to obtain culturally defined goals. Social structural strain contends that every society has a central set of values and goals, as well as acceptable ways of accomplishing them.

Central values and goals differ among societies. Merton focused on American values, which tend to emphasize success through individual achievement, such as attainment of material goods and social status. Inability to achieve highly valued societal goals is sometimes regarded as a personal failure instead of a social shortcoming. Groups of individuals who do not have the social means of reaching socially valued goals may respond through rebellion, retreatism, and innovation (California State University Sacramento, 2014).

Unlike Merton's social structural strain theory, which takes a macrolevel approach to personal strain, Agnew's work takes an individual level focus. Positively valued stimuli include personally valued achievements, goals and hopes for the future. Negative or noxious stimuli include aversive experiences such as the loss of a significant other, the death or illness of a family member, an unstable or rapidly changing work or school situation, and parental divorce (Ostrowsky & Messner, 2005).

Agnew identifies three different conditions that may lead to strain, which include (1) failure to accomplish highly valued goals, (2) loss of personally valued stimuli, and (3) appearance of negative stimuli (Agnew & White, 1992; Botchkovar, Tittle, & Antonaccio, 2009; Florida State University College of Criminology and Criminal Justice, 2014). According to general strain theory, individuals who live in adverse environments experience a range of negative emotions, which can set off adaptive reactions designed to alleviate strain and negative emotions (Botchkovar et al, 2009, p.132). People who live in disagreeable environments for long periods of time experience more stress than those who have recently moved to a stressful environment. An increase in stress can result in more delinquency (Baron, 2004; Paternoster & Mazerolle, 1994).

Agnew (1992) suggests that delinquency may serve as a maladaptive coping mechanism as a result of the individual trying to prevent the loss of some personally valued stimuli, seeking retaliation or justice for the loss of something positively valued, efforts to find or replace what has been lost, or trying to manage noxious social or environmental conditions by taking illicit drugs. It is important to note that the experience of negative emotions and loss of positively valued stimuli do not always lead to crime or deviance (Ostrowsky & Messner, 2005). Agnew (1992) also suggested that strain can be managed and that coping mechanisms for controlling stress could decrease the influence of strain on behavior. A number of studies have tested general strain theory to determine whether the theory is supported by empirical evidence.

Aseltine, Gore, and Gordon (2000) found limited support for general strain theory. Exposure to strain, especially in harmful relationships and destructive life events, was positively related to deviant behavior. Family conflict also had a positive relationship with marijuana use and aggression among adolescents (Aseltine et al., 2000). The analysis also found that anger mediated deviant behavior, which is consistent with general strain theory. However, the results were only statistically significant in predicting violent and aggressive acts. The findings were not significant when predicting marijuana use, suggesting that general strain theory may not explain drug use and other nonviolent crime outcomes (Aseltine et al., 2000).

Botchkovar et al (2009) examined the effects of the general strain theory in Greece, Russia, and Ukraine. The findings provided mixed results for general strain, suggesting that the effects of strain on behavior depend on context. The results showed

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that general strain failed almost entirely in Greece and Russia and only received moderate support in Ukraine (Botchkovar et al, 2009).

Paternoster & Mazerolle (1994) found that criminal involvement may actually lead to more strain in a person's life. Their results partially supported the general strain hypothesis. Their study showed that people who lived in disadvantaged neighborhoods with high crime rates, those who experienced high levels of stress in the past year, those who had difficulty fitting in with others at school and work settings, and those who had weak familial relationships tended to commit more crime than those individuals who did not experience these types of personal strain. They also found that adolescents who reported having deviant peers were more likely to commit delinquent acts. Paternoster & Mazerolle (1994) failed to find evidence supporting the duration hypothesis that adolescents who lived in adverse social environments for long periods of time would experience higher rates of delinquent behavior than their peers who just moved into these social conditions. They noted that strain can lead to delinquency through weakened ties "to conventional sources of social control", strengthening ties to their delinquent peers (Paternoster & Mazerolle, 1996, p. 251).

Agnew & White (1992) also found support for general strain theory. Five of their six measures of strain—the most influential being negative life events and adversity— had significant effects on delinquency and drug use. Like Paternoster & Mazerolle (1996), they concluded that strain played a stronger role in predicting delinquency and drug use when adolescents surrounded themselves with delinquent peers. Although their study supported general strain theory, the authors cautioned against use of cross sectional designs in testing strain and drawing conclusions about causal relationships.

METHODS

The central focus of this thesis is to examine the social mechanisms that explain why mothers choose to smoke cigarettes and use marijuana during pregnancy. Data from the National Maternal and Infant Health Survey (1988) will be used to measure strain and social learning variables in order to model their relationship with maternal cigarette smoking and marijuana use during pregnancy.

Hypotheses

Using the criminological literature and theoretical framework in the preceding section, this study first hypothesizes that pregnant women who experience financial hardship and strain during pregnancy will have higher rates of MCS than women who do not experience strain during pregnancy. Second, it is hypothesized that pregnant women who experience financial hardship and strain during pregnancy will have higher rates of illegal marijuana use during pregnancy than women who do not experience strain during pregnancy. Third, it is hypothesized that pregnant women who live in households with individuals who smoke cigarettes are more likely to smoke cigarettes or marijuana during pregnancy due to the influence of social learning, even after controlling for the effects of strain. Finally, it is hypothesized that women who use marijuana are more likely to smoke cigarettes during their pregnancy, after controlling for the effects of strain and social learning.

Sample and Procedures

The data source used in this study is the National Maternal and Infant Health Survey conducted in 1988. The data file and codebook for the National Maternal and Infant Health Survey were downloaded from the Inter-university Consortium for Political

and Social Research (ICPSR), a website that assists social science research by providing an assortment of data sets to the public. Maureen Sanderson, Chester Scott, and Joe Fred Gonzalez were the principal investigators of this study. A total of 16 federal agencies, including the Center for Prevention Services of the Centers for Disease Control and Prevention, the Office of Minority Health of the Public Health Service, the National Institute on Alcoholism and Alcohol Abuse, the National Institute of Child Health and Human Development, the National Institute on Drug Abuse, and the National Institute of Mental Health, collaborated with the National Center for Health Statistics in planning and funding the National Maternal and Infant Health Survey (Sanderson, Scott, & Gonzalez, 1988).

Two recent studies used the National Maternal and Infant Health Survey as a data source in their analysis. Jane E. Miller (2000) used the National Maternal and Infant Health Survey in her study to determine the effects of race/ethnicity and household income on childhood asthma. A second study by Chen & Rogan (2004) examined the effect of breastfeeding on post neonatal mortality using the National Maternal and Infant Health Survey as their data source.

The National Maternal and Infant Health Survey was administered by the United States Department of Health and Human Services and the National Center for Health Statistics in 1988 (Sanderson, Scott, & Gonzalez, 1988) in order to study life events and behavioral outcomes relating to pregnancies among disadvantaged women, such as maternal drug use and cigarette smoking. The National Maternal and Infant Health Survey consists of a large, stratified, national sample collected from 48 states, excluding

Hawaii and Alaska. Maternity data were also collected from the District of Columbia and New York City.

This data set consists of information gathered from three different national samples of maternal and infant data occurring in 1988, which included 13,417 live births, 4,772 fetal deaths, and 8,166 infant deaths. The mothers in the sample were mailed questionnaires. Of those mothers who received the questionnaires, 9,953 women had live births, 3,309 had late fetal deaths, and 5,332 had infant deaths (Sanderson, Scott, & Gonzalez, 1988). About 93 percent of the mothers gave researchers permission to contact their health care providers. These health care providers received and filled out questionnaires about maternal behavior and infant health. The mothers' questionnaires included information on healthcare awareness and attitudes, prenatal care, previous pregnancy and miscarriages, and demographic variables, such as maternal and paternal characteristics and household income. Maternal age ranged from 15 years to 49 years of age (Sanderson, Scott, & Gonzalez, 1988).

Overall, 71 percent of the mothers in the National Maternal and Infant Health Survey, 1988, responded to the questionnaires. Of those who responded, 74 percent of the live birth sample responded, 69 percent of the fetal death sample provided data, and 65 percent of the infant death sample completed the questionnaire. Maternal response rates varied by age, race, marital status, and education levels within the three birth categories (1988 National Maternal and Infant Health Survey, 1991). For the purpose of this study, only the maternal data provided by the self-report questionnaires mailed to the mothers will be used. This data set contains information that can be used to measure social learning and strain, as well as relevant demographic variables.

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Measurement of Variables

Dependent Variable

This thesis examines the factors that are associated with participation in maternal cigarette smoking (MCS) and marijuana use during pregnancy, focusing primarily on social learning and strain characteristics in the mothers' lives. Therefore, the two dependent variables in the study are MCS and maternal marijuana use during pregnancy. The variable for MCS was created by drawing from the 1988 National Maternal and Infant Health survey codebook in the mother questionnaire section which identifies responses to the question "On the average, how many cigarettes did you smoke A DAY <u>after</u> you found out that you were pregnant?". This variable, originally coded as a continuous measure, was later recoded as a binary variable. The new question asks, did the subject smoke cigarettes during pregnancy? (yes=1, no=0). The variable for maternal marijuana use was also created by drawing from the mother questionnaire section, in which responses to the question "How often did you smoke marijuana or hash <u>after</u> you found out that you were pregnant?" were used in the following analysis. This was also originally measured as a continuous variable. Maternal marijuana use was subsequently recoded to determine how many mothers used marijuana or hash during pregnancy (yes=1, no=0).

Independent Variables

The strain variables included in the analysis are measures of financial stressors and scarcity of resources, as well as stressors due to unplanned pregnancy. The three strain variables are receiving aid to families with dependent children (AFDC), receiving food stamps, and having an unplanned pregnancy. AFDC was measured using question

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F.3 on the mother's questionnaire, which states "Are you getting AFDC now? (Include Aid to Families with Dependent Children, public assistance, or welfare)" (yes=1, no=0). Food stamps were measured using question F.4 on the mother's questionnaire, which states "Are you getting Food Stamps now?" (yes=1, no=0). Unplanned pregnancy was measured using question A.17 on the mother's questionnaire, which states "Thinking back, just before you became pregnant, did you want to become pregnant at that time?" Originally coded as a continuous variable, the data were recoded as a dichotomous variable asking, did you want to become pregnant? (yes=1, no=0).

As stated in the theoretical framework, social learning theory asserts that deviant behavior can be learned by observing the behavior of significant others. If deviant behavior is normative in a person's household, that individual may be more likely to participate in such behavior because she receives messages that the behavior is acceptable, reasonable or approved of. The social learning variable in the thesis addresses whether the mother was living in a household with specific individuals during her pregnancy (yes=1, no=0). This variable was measured using question A.47 on the mother's questionnaire, respectively. Question A.47 asked, "Other than yourself, how many of these people smoked <u>at home during most of your pregnancy?</u>". This social learning measure was originally a continuous variable; therefore, it was recoded as a dichotomous variable, asking did people smoke at home during most of your pregnancy? (yes=1, no=0).

The last hypothesis examines the relationship between prior marijuana use and MCS while controlling for the effect of strain and social learning. Thus, the relevant independent variable is prior marijuana use which was measured using question A.51 on

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the mother's questionnaire, which asks "How often did you smoke marijuana or hash during the 3 months before you found out that you were pregnant?". This independent variable is a continuous measure. Therefore, it was recoded as a dichotomous variable asking, did you smoke marijuana or hash 3 months before you found out that you were pregnant? (yes=1, no=0).

Control Variables

It is necessary to incorporate into the analysis a number of maternal demographic variables, which can possibly impact a mother's decision to participate in maternal cigarette smoking during pregnancy (MCS) and use marijuana. My analysis controls for total family income, highest level of maternal education, and maternal age, race/ethnicity, and marital status. Maternal age is categorized into three ranges. Mothers who were 24 years of age and younger were grouped into the first category. Mothers 25 to 34 years old were grouped in the second category, and mothers 35 years old and older were grouped in the third category. Maternal race was coded as a dummy variable indicating: white (yes=0, no=1) and non-white (yes=1, no=0). Maternal marital status was also coded as a binary variable (yes=1, no=0). Education was measured as a continuous variable. Finally, the strain and social learning variables described above will serve as controls for the fourth hypothesis test which states that women who use marijuana prior to pregnancy are more likely to smoke cigarettes during pregnancy.

Analytical Strategy

This thesis is a cross-sectional analysis of the pregnant mothers' self-reported data obtained from the 1988 National Maternal and Infant Health Survey mother's questionnaire. The data set was chosen because it contained appropriate measures of key

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theoretical variables as well as maternal cigarette smoking and marijuana use during pregnancy. The data set also contains information about prior marijuana use before pregnancy.

Stata was used to perform logistic regression models in order to estimate the relative effects of strain and social learning on maternal cigarette smoking (MCS) and maternal marijuana use during pregnancy, while accounting for relevant control variables. There were three logistic regression models conducted using the survey data. The analysis plan was as follows.

First, a logistic regression model was conducted using MCS as the dependent variable and the indicators of strain and social learning as independent variables. Then controls were added to the model in order to determine if accounting for family income, maternal education level, race, age, and marital status affected the significance of strain and social learning in predicting MCS. Second, a logistic regression model was carried out using marijuana use during pregnancy as the dependent variable and the indicators of strain and social learning variables as independent variables. Controls were then added in order to see if they impacted the influence of strain and social learning on marijuana use during pregnancy. Finally, logistic regression analysis was carried out using the dependent variable MCS and prior marijuana and hash use as the independent variable, and controlling for strain and social learning factors.

RESULTS

The demographic characteristics of the study sample are reported in Table 1. The race distribution of the study participants was 46.7% white and 52.1% non-white. About 46.8% of the study sample was 15-24 years of age, 50.5% of the sample was 25-34 years of age, and 1.16% of the sample was 35 years old and older. The mean age of the sample was 25.4 years. Approximately 39.6% of the study sample was married, and approximately 60.4% was divorced, single, or widowed. About 3% of the participants (n=761) received between a first through eighth grade education. The majority (49.7%) of the mothers in the sample received between a ninth grade and twelfth grade education (n=13,102). Approximately 21% of the study participants (n=5,602), received at least one year of college education. The modal range for household income was between $20,000 and $24,999. Household income ranged from under $1,000 to more than $60,000. Nearly 17% of mothers (n=4,367) received aid to families with dependent children (AFDC) and approximately 17% of mothers (n=4,475) in the study sample received food stamps.

Nearly 27% of mothers (n=7,234) reported living with individuals who smoked cigarettes during their pregnancy. About 4.3% of women (n=1,144) reported prior marijuana or hash use at least three months before they found out that they were pregnant.

Overall, 18% (4,720 out of 26,355 women) of the mothers in the 1988 National Maternal and Infant Health Survey smoked cigarettes sometime during pregnancy, which is consistent with past literature on maternal cigarette smoking during pregnancy in the United States (Chung, Kowalski, Kim, & Buchman, 2000). Nearly 2 percent of women

(511 out of 26,355 mothers) in this sample used marijuana during pregnancy. This figure

is consistent with Huizink & Mulder's (2006) findings from the 1996 National Pregnancy

and Health Survey which found that 2.9 percent of pregnant women reported using

marijuana during pregnancy.

The Effects of General Strain and Social Learning on MCS during Pregnancy

The results for the logistic regression using measures of maternal strain and social

learning to predict maternal cigarette smoking (MCS) are reported in Table 2. The

logistic regression examined the effects of three strain variables, whether the pregnant

mother was receiving Aid to Families with Dependent Children (AFDC), whether she

was receiving food stamps, and whether pregnancy was planned. The analysis also

examined the effects of social learning using a measure that investigated the effect of

individuals who smoked in the mother's household during pregnancy. Demographic

variables included maternal race, age, education level, marital status and household

income. Overall, the model was found to be statistically significant (LR chi2(10)=

5748.41, p<0.001), meaning that a number of predictors have statistically significant

relationships with the dichotomous outcome, maternal cigarette smoking. The null

hypothesis for the F test predicts that there are no relationships between variables in this

model, which is not the case. Therefore, the model predicts MCS better than chance

alone.

All of the strain variables receiving AFDC (z = 11.48, p<0.001), receiving food

stamps (z = 3.71, p<0.001), and unplanned pregnancy (z = 6.11, p<0.001) were

statistically significant in this model. The regression results show that for every one unit

increase in AFDC received, the log odds of maternal cigarette smoking during pregnancy

increase by 0.652. For every one unit increase in food stamps received, the log odds of

maternal cigarette smoking (MCS) during pregnancy increase by 0.208. Similarly, every

one unit increase in unplanned pregnancy increases the log odds of MCS by 0.232.

The results of the regression in Table 2 show that for every one unit increase in

AFDC received, the odds of maternal cigarette smoking (MCS) during pregnancy

increase by 92 percent.   Likewise, for every one unit increase in food stamps received,

the odds of maternal cigarette smoking during pregnancy increase by 23 percent. A one

unit increase in unplanned pregnancy increases the odds of MCS by 26 percent. The

results suggest that strain has a significant effect on MCS. Therefore, these results

support Hypothesis 1, which predicts that pregnant women who experience financial

hardship during pregnancy will have higher rates of cigarette smoking during pregnancy

due to strain.

Similarly, the social learning variable living with individuals who smoked during

a mother's pregnancy ($z=31.57$, $p<0.001$) was statistically significant. The findings show

that for every one unit increase in the number of smokers living in a household during a

mother's pregnancy, the log odds of MCS occurring during pregnancy increase by 1.152.

The results of the regression analysis in Table 2 show that for every one unit increase in

smokers living in a mother's household during pregnancy, mothers are 3 times more

likely to smoke cigarettes during pregnancy. These findings suggest that social learning

plays a significant role in MCS during pregnancy. Therefore, Hypothesis 3 is supported.

Several control variables were statistically significant in Table 2, including

household income ($z=-10.89$, $p<0.001$), education level ($z=-6.51$, $p<0.001$), being non-

white ($z=-17.10$, $p<0.001$), being between 25 and 34 years old ($z=11.36$, $p<0.001$), being

Table 1: Demographic Characteristics of Study Sample (National Maternal and Infant Health Survey, 1988)

Variable	Categories	N	%
Race	White	12302	46.68
	Nonwhite	13724	52.07
Age (years)	under 24	12,340	46.82
	25-34	13,308	50.50
	35 and up	306	1.16
	Mean age: 25.4		
Married	yes	10,430	39.58
	no	15,925	60.42
Household income	Range:	<$1,000 - $60,000+	
	Modal income (range):	$20,000-24,999	
Education level (grade)	no formal	16	0.06
	1st-8th	761	2.89
	9th-12th	13,102	49.72
	1-5 years of college	5,602	21.26
Mothers receiving AFDC	yes	4,367	16.57
	no	14,227	53.98
Mothers receiving foodstamps	yes	4,475	16.98
	no	14,119	53.57
Households with smokers (not including the pregnant women) during pregnancy	yes	7,234	27.45
	no	10,947	41.54
Mothers used illegal drugs up to three months before pregnancy	yes	1,144	4.27
	no	25,203	95.63
Maternal cigarette use during pregnancy	yes	4,720	17.91
	no	21,635	82.09
Maternal marijuana use during pregnancy	yes	511	1.94
	no	25,844	98.06

Table 2: Logistic regression results for the influence of strain and social learning variables on maternal cigarette smoking during pregnancy, controlling for demographic characteristics

	Slope	SE	z	P>|z|	Odds Ratio
Independent variables					
Mother is receiving AFDC	0.652	0.057	11.48***	0.000	1.919
Mother is getting food stamps	0.208	0.056	3.71***	0.000	1.231
Unplanned pregnancy	0.232	0.038	6.11***	0.000	1.261
Number of people in household who smoked cigarettes during mother's pregnancy	1.152	0.036	31.57***	0.000	3.164
Control variables					
Total household income during pregnancy	-0.043	0.004	-10.89***	0.000	0.958
Mother's education	-0.003	0.0005	-6.51***	0.000	0.997
Mother's race					
Non-white	-0.691	0.040	-17.10***	0.000	0.501
Mother's age					
25 to 34 years old	0.456	0.040	11.36***	0.000	1.579
35 years old and up	0.249	0.075	3.30**	0.001	1.282
Married	0.536	0.261	2.05*	0.040	1.708
Intercept	-1.272	0.068	-18.62	0.000	0.280

LR chi2 = 5748.41, p<0.001
p<0.05*, p<0.01**, p<0.001***

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35 years old and up (z=3.30, p<0.01) and being married (z=2.05, p<0.05). The analysis

revealed that as a mother's household income increases by one unit (i.e., income bracket),

the odds of MCS decrease by 4 percent (1/0.958). As a mother's education level

increases by one unit, the likelihood of MCS decreases by 0.3 percent (1/0.99). The odds

of a white mother smoking cigarettes during pregnancy were almost twice as high as the

odds of non-white mothers smoking cigarettes during pregnancy (1/.501=1.99) after

controlling for income and other demographics. The likelihood of women between 25

and 34 years old smoking cigarettes during pregnancy is 58 percent greater than for the

odds of mothers who were 24 years old or younger. The odds of women 35 years and

older smoking cigarettes during pregnancy is 28 percent greater than for the odds of

mothers who were 24 years old or younger. Finally, the odds of married women smoking

cigarettes during pregnancy are 71 percent higher than for non-married women.

The goodness of fit was tested for this regression model, the lroc and estat clas

commands in Stata to estimate the area under the curve. The area under the curve was

0.8178, indicating that there is acceptable discrimination and a considerable amount of

predictive power in the model. The analysis also found that 82.34% of the variables in

the model were correctly classified, indicating that the model was a good fit for the data.

This model was tested for multicollinearity using the VIF statistic. Overall, all of the VIF

statistics were fairly low with a mean VIF statistic of 1.40. Therefore, there was very

little multicollinearity in the model. Additionally, a correlation matrix was run on the

model. No correlation coefficients were abnormally high or problematic. The correlation

matrix is located in Appendix 1.

The Effects of General Strain and Social Learning on Maternal Marijuana Use during Pregnancy

The results for the logistic regression using measures of maternal strain and social learning to predict marijuana use are reported in Table 3. Overall, the model was statistically significant (LR chi2(10)=636.47, p<0.001), indicating that a number of predictors have statistically significant relationships with the dichotomous outcome, maternal marijuana use during pregnancy. The model predicted maternal marijuana use better than chance alone. The strain variables, receiving AFDC, receiving food stamps, and unplanned pregnancy were used in this analysis. Both receiving AFDC (z=5.68, p<0.001) and unplanned pregnancy (z=3.93, p<0.001) were statistically significant measures of maternal strain in the model.

The regression results show that for every one unit increase in AFDC, the log odds of maternal marijuana use during pregnancy increased by 0.746. For every one unit increase in AFDC, the likelihood of maternal marijuana use during pregnancy doubled. Likewise, for every one unit increase in unexpected pregnancy, the odds of a mother smoking marijuana during pregnancy increased by 47 percent. In short, the results suggest that strain has a significant positive effect on marijuana use during pregnancy. Therefore, Hypothesis 2 is supported.

The social learning measure, living with individuals who smoked during a mother's pregnancy (z=8.13, p<0.001) was statistically significant in this model. The results show that for every one unit increase in the number of smokers living in a mother's household during pregnancy, the odds of marijuana use double. This result

offers strong support for social learning and suggests that living with smokers is associated with a mother's decision to smoke marijuana during pregnancy.

Several control variables were statistically significant in Table 3, including household income (z= -4.73, p<0.001), being non-white (z= -2.81, p<0.01), being a mother between the ages of 25 and 34 (z= 3.69, p<0.001), and being married (z= 2.07, p<0.05). The findings indicate that as a mother's household income increases by one unit, the odds of her smoking marijuana cigarettes during pregnancy decreases by 5 percent (1/0.954). The odds of a non-white mother smoking marijuana cigarettes during pregnancy were 33 percent less (1/0.754) than the odds of white mothers smoking marijuana during pregnancy. The likelihood of women between 25 and 34 years old smoking marijuana during pregnancy were 44 percent higher than for women who were 24 years old or younger. Lastly, the odds of married mothers smoking marijuana during pregnancy were more than 2.5 times higher than for non-married mothers.

The goodness of fit results found that the area under the curve for the analysis was 0.8014, indicating that there is acceptable discrimination and a considerable amount of predictive power in the model. The analysis uncovered that 98.06% of the variables in the model were correctly classified, indicating that the model was a good fit for the data. The VIF statistics for the variables in this model indicate that there is very little multicollinearity. The mean VIF is 1.40. A correlation matrix was made for this model, and is located in Appendix 2. There were no problematic correlation coefficients for this model.

Table 3: Logistic regression results for the influence of strain and social learning variables on maternal marijuana use during pregnancy, controlling for demographic characteristics

	Slope	SE	z	P>|z|	Odds Ratio
Independent variables					
Mother is receiving AFDC	0.746	0.131	5.68***	0.000	2.108
Mother is getting food stamps	0.159	0.129	1.23	0.219	1.172
Unplanned pregnancy	0.387	0.099	3.93***	0.000	1.473
Number of people in household who smoked cigarettes during mother's pregnancy	0.758	0.093	8.13***	0.000	2.135
Control variables					
Total household income during pregnancy	-0.048	0.010	-4.73***	0.000	0.954
Mother's education	0.0005	0.001	0.38	0.707	1.000
Mother's race					
Non-white	-0.282	0.100	-2.81**	0.005	0.754
Mother's age					
25 to 34 years old	0.363	0.098	3.69***	0.000	1.437
35 years old and up	-0.279	0.240	-1.16	0.245	0.757
Married	0.988	0.478	2.07*	0.039	2.686
Intercept	-4.004	0.177	-22.61	0.000	0.018

LR chi2 = 636.47, p<0.001
p<0.05*; p<0.01**; p<0.001***

Effects of Prior Marijuana Use on MCS during Pregnancy

The results for the logistic regression using prior marijuana use to predict maternal cigarette smoking (MCS) during pregnancy are reported in Table 4. The analysis shows that prior marijuana use plays a significant role in whether a mother smokes cigarettes during pregnancy. The prior drug use model was statistically significant (LR chi2(5)=4279.58, p<0.001), suggesting that a number of predictors have significant relationships with the dichotomous outcome, maternal cigarette smoking during pregnancy.

Prior marijuana use up to three months before knowledge of pregnancy (z=-24.17, p<0.001) was statistically significant. The odds of a mother smoking cigarettes during pregnancy decreased by 1.7 percent, when pregnant women reported using marijuana in the past three months. In other words, prior marijuana use is negatively associated with MCS during pregnancy.

All of the control variables in the previous drug use model were statistically significant. The controls included receiving Aid to Families with Dependent Children (AFDC) (z=11.02, p<0.001), receiving food stamps (z=6.25, p<0.001), unplanned pregnancy (z=11.83, p<0.001), and individuals smoking cigarettes in the mother's household during her pregnancy (z=40.90, p<0.001). For every one unit increase in AFDC received by the pregnant mother, the odds of maternal cigarette smoking during pregnancy increased by 88 percent. A unit increase in food stamps received increased the odds of MCS during pregnancy by 43 percent. Similarly, the odds of a mother smoking cigarettes increased by 56 percent if her pregnancy was unplanned. These findings suggest that measures of strain significantly impact MCS during pregnancy.

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Table 4: Logistic regression results for the influence of previous illicit drug use on maternal cigarette smoking during pregnancy, controlling for strain and social learning variables

	Slope	SE	z	P>|z|	Odds Ratio
Independent variables					
Mother used marijuana before pregnancy	-0.017	0.0007	-24.17***	0.000	0.983
Control variables					
Mother is receiving AFDC	0.632	0.057	11.02***	0.000	1.881
Mother is getting food stamps	0.357	0.057	6.25***	0.000	1.429
Unplanned pregnancy	0.444	0.038	11.83***	0.000	1.559
Number of people in household who smoked cigarettes during mother's pregnancy	1.483	0.036	40.90***	0.000	4.404
Intercept	-0.917	0.073	-12.55	0.000	0.400

LR chi2 = 4279.58, p<0.001
p<0.05*; p<0.01**; p<0.001***

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The social learning measure was also statistically significant. The odds of MCS occurring during pregnancy were 4 times higher when individuals smoked cigarettes in the same household as the mother during pregnancy. This result provides strong support for Hypothesis 3, which predicted that mothers who live in environments with significant others who smoke cigarettes are more likely to smoke cigarettes during pregnancy due to social learning influences. Overall, the results suggest that previous marijuana use before pregnancy was statistically significant; however, the relationship between MCS and prior marijuana use was opposite than expected. Therefore, the results do not support Hypothesis 4 which states controlling for effects of strain and social learning, women who use drugs, such as marijuana and hash, are more likely to smoke cigarettes during pregnancy.

A goodness of fit test estimated that the area under the curve was 0.7956, indicating that there is good discrimination and a considerable amount of predictive power in the model. The analysis also found that 82.46% of the variables in the model were correctly classified, indicating that the model was a good fit for the data. The VIF statistics, calculated for the model, showed that there was very little multicollinearity in the model. The mean VIF statistic was 1.52. The correlation matrix, located in Appendix 3, did not produce problematic correlation coefficients for this model.

DISCUSSION

Social learning can influence maternal cigarette smoking and marijuana use during pregnancy. The analysis suggests that currently living with an individual who smokes significantly increases the likelihood that a woman will smoke cigarettes or marijuana during pregnancy. This conclusion is consistent with social learning literature, which proposes that individuals can learn behavior and normative values through their own experiences or vicariously by observing the actions of significant others (Bandura, 1971; Gachter & Thoni, 2005).

The general strain measures were statistically significant in the analyses for all of the models, with the exception of receiving food stamps in the marijuana use model in Table 3. This result was expected since it was hypothesized that personal strain would lead to an increase in MCS and marijuana use during pregnancy. General strain literature predicts that an inability to achieve financial stability during pregnancy may lead to strain, which may lead to deviance or crime (Agnew, 1992). Both illegal marijuana use and MCS during pregnancy are deviant and frowned upon in American culture.

The analysis found that women, who used drugs up to three months before they found out that they were pregnant, were less likely to smoke cigarettes during pregnancy. The findings showed that the odds of maternal cigarette smoking during pregnancy decreased when the mother used illicit drugs, such as marijuana and hash, before pregnancy. The analysis controlled for influences of strain and social learning effects. These findings are inconsistent with previous literature which has found that illicit drug use is often accompanied by the use of multiple substances, such as cigarettes and alcohol (Bendersky et al, 1996; Jacobson, Jacobson, Sokol, Martier, Ager & Shankaran, 1994;

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Zuckerman, 1991). Cigarette smoking has also been seen as a predictor for future drug use among adolescents (Torabi, Bailey, & Majd-Jabbari, 1993). The analysis failed to support Hypothesis 4, which predicted that women who have a history of prior drug use are more likely to smoke cigarettes during pregnancy.

There are several control variables found to be significant which are noteworthy. Expected effects were produced for household income on both the MCS model and the marijuana model. As household income increased, the odds of MCS or marijuana smoking during pregnancy declined. Education levels also had expected effects on the MCS model. As education level increased, the odds of MCS during pregnancy decreased.

The effects of ethnicity on MCS and marijuana use were statistically significant but in the opposite direction than hypothesized. Once controlling for other individual characteristics, non-white mothers were at reduced odds of MCS and marijuana use when compared to white mothers, as represented in both models. Some of the past addiction studies on adolescent tobacco and illicit drug use have also found that Native American, Cuban American, and white high school seniors tend to have higher levels of illicit drug use than Latin American, African American and Asian American students (Johnston, O'Malley, Bachman, & Schulenberg, 2009; Wallace Jr., Bachman, O'Malley, Schulenberg, Cooper, & Johnston, 2003; Wallace Jr., Bachman, O'Malley, Johnston, Schulenberg, & Cooper, 2002). There were sharp declines in marijuana use across all ethnic and racial subgroups between the 1970s and 1990s (Wallace Jr. et al, 2002, p.S72). Likewise, trends for daily cigarette use remained relatively flat for white high school seniors from the early 1980s to the middle 1990s while use by African Americans

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continued to decline during that time (Wallace Jr. et al, 2002, p.S72). The data in the

National Maternal and Infant Health Survey were collected in 1988; therefore, the current

analysis may reflect these trends.

The effects of age on MCS and marijuana use also showed significance, but in the

unexpected direction. MCS and illegal marijuana use during pregnancy were more likely

for women who were 25 to 34 years old than women who were 24 years old and younger.

According to the Department of Health and Human Services Centers for Disease Control

and Prevention (2004), cigarette smoking prevalence is inversely related to age (p.2).

However, the study looked at overall prevalence rates among adults, instead of focusing

on prevalence rates among pregnant women. Ebrahim, Floyd, Merritt II, Decoufle, &

Holtzman (2000) found that cigarette smoking prevalence among pregnant women in

1996 was lowest at 18 to 20 years of age (12%; n=81) and highest at 21 to 30 years of age

(54%; n=541). Ebrahim et al's (2000) results offer some support for the findings of the

current analysis; however, it is not known why the odds of illegal marijuana use did not

change for 25 to 34 year old women when compared to women in the youngest age

bracket.

Marital status was also statistically significant, but in the opposite direction than

hypothesized. The findings for marital status in the MCS and marijuana models showed

that being married substantially increased the odds of MCS and marijuana use during

pregnancy. This result can be associated with social learning. Social learning theory, as

well as the social learning measure in this study, suggest that being married to a smoker

leads to an increased risk of MCS and marijuana use during pregnancy. It is also possible

that the couples experience similar personal strain, which also leads to an increased risk of MCS and marijuana use.

There are a number of limitations that should be addressed in the current study. First, the current analysis is based on a cross-sectional design. Although cross-sectional studies are a useful approach for understanding associations within a data set at one period in time, cross-sectional analysis cannot be used for causal inference. However, cross-sectional analysis is beneficial for studies such as the current one, because it allows for OLS regression modeling and other predictive techniques involving multiple independent and outcome variables (Institute for Work and Health Toronto, 2009).

Another limitation is that the data used in this study were taken from the maternal self-report data in the 1988 National Maternal and Infant Health Survey. It is possible that the mothers in this sample could have misrepresented or withheld their answers about smoking cigarettes or marijuana during pregnancy. Nevertheless, self-report data have been proven to be an accurate and reliable way of obtaining data from research participants when there is an absence of official data or experimental research on outcomes in the field of criminology. An additional limitation to this study relates to the fact that there are few attitudinal and mental health indicators in the maternal sample. This may pose problems pertaining to model specification and to the generalization of the current findings.

The final limitation is that the National Maternal and Infant Health Survey was conducted in 1988. While the data set included many of the critical values needed to test the hypotheses in the current study, cigarette smoking was still widely acceptable in the United States during that time frame. It is possible that different ideologies captured in

older data can affect research on maternal cigarette smoking and marijuana use. However, due to supporting evidence from recent research, I am confident in my findings on maternal cigarette smoking and marijuana use during pregnancy.

Future research may consider examining longitudinal data on criminological factors, such as strain and social learning that can influence MCS and maternal marijuana use during pregnancy. Agnew (1992) stated that many effects of strain tend to be short term; therefore, cross-sectional designs are sufficient in testing strain theory. However, social learning theory states that people learn a behavior over time; therefore, longitudinal data may be more appropriate for testing key variables and processes implicit in this theory. Future research may consider using other theoretical frameworks, such as control theory, to determine why mothers smoke cigarettes and marijuana during pregnancy. Finally, future inquiries would benefit from more current data in order to determine if MCS and illegal marijuana use trends have changed since the recent adoption of smoking bans in public places and government buildings by municipalities across the United States.

Maternal cigarette smoking and marijuana use during pregnancy are complex and controversial issues. With marijuana use becoming more acceptable and being legalized for recreational and medical use in multiple states, it is important now more than ever to investigate the health effects and prevalence of marijuana use during pregnancy, and ways to prevent maternal marijuana use during pregnancy. Although the findings on maternal cigarette smoking during pregnancy are more conclusive than the literature on maternal marijuana use during pregnancy, it is important to look at the factors that

influence a mother's decision to smoke tobacco or marijuana, and research ways to lower

risk factors associated with MCS.

REFERENCES

Agnew, R. (1992). Foundation for a general strain theory of crime and delinquency. *Criminology, 30(1)*, 47-79.

Agnew, R. & White, H.R. (1992). An empirical test of general strain theory. *Criminology, 30(4)*, 475-498.

Alexander, G.R. & Korenbrot, C.C. (1995). The role of prenatal care in preventing low birth weight. *The Future of Children, 5(1)*, 103-120.

Akers, R.L. (2009). Social Learning and Social Structure: A General Theory of Crime and Deviance. Transaction Publishers, New Brunswick, NJ.

Akers, R.L. & Cochran, J.K. (1985). Adolescent marijuana use: a test of three theories of deviant behavior. *Deviant Behavior, 6*, 323-346.

Akers, R.L., La Greca, A.J., Cochran, J., & Sellers, C. (1989). Social learning theory and alcohol behavior among the elderly. *The Sociological Quarterly, 30(4)*, 625-638.

Akers, R.L., & Lee, G. (1996). A longitudinal test of social learning theory: adolescent smoking. *Journal of Drug Issues 26(2)*, 317-343.

Akers, R.L, & Lee, G. (1999). Age, social learning, and social bonding in adolescent substance use. *Deviant Behavior, 19*, 1-25.

Ananth, C.V., Savitz, D.A., & Luther, E.R. (1996). Maternal Cigarette Smoking as a Risk Factor for Placental Abruption, Placenta Previa, and Uterine Bleeding in Pregnancy. *American Journal of Epidemiology, 144*(9), 881-889.

Arnold, C.L., Davis, T.C., Berkel, H.J., Jackson, R.H., Nandy, I., & London, S. (2001). Smoking status, reading level, and knowledge of tobacco effects among low-income pregnant women. *Preventive Medicine, 32*, 313-320.

Aseltine, R.H., Gore, S., & Gordon, J. (2000). Life stress, anger and anxiety, and delinquency: an empirical test of general strain theory. *Journal of Health and Social Behavior, 41,* 256-275.

Astley, S.J. & Little, R.E. (1989). Maternal marijuana use during lactation and infant development at one year. *Neurotoxicology and Teratology, 12*, 161-168.

Bandura, A. (1971). Social Learning Theory. *General Learning Press*, NY, NY.

Baron, S.W. (2004). General Strain, Street Youth and Crime: A Test of Agnew's Revised Theory. *Criminology, 42(2)*, 457.

Bendersky, M., Alessandri, S., Gilbert, P., & Lewis, M. (1996). Characteristics of Pregnant Substance Abusers in Two Cities in the Northeast. *American Journal of Drug and Alcohol Abuse, 22*(3), 249-362.

Botchkovar, E.V., Tittle, C.R., & Antonaccio, O. (2009). General Strain Theory: Additional Evidence Using Cross-cultural Data. *Criminology, 47(1)*, 131.

Brennan, T., Breitenbach, M., Dieterich, W., Salisbury, E.J., & Van Voorhis, P. (2012). Women's Pathways to Serious and Habitual Crime: A Person-Centered Analysis Incorporating Gender Responsive Factors. *Criminal Justice and Behavior, 39*(11), 1481-1508.

Brennan, P.A., Grekin, E.R., & Mednick, S. (1999). Maternal cigarette smoking during pregnancy and adult male criminal outcomes. *Archives of General Psychiatry, 56,* 215-219.

California State University Sacramento (2014). Social Strain Theory. Retrieved from www.hhs.csus.edu.

Chasnoff, I.J, Landress, H.J., & Barrett, M.E. (1990). The Prevalence of Illicit-Drug or Alcohol Use during Pregnancy and Discrepancies in Mandatory Reporting in Pinellas County, Florida. *The New England Journal of Medicine, 322*, 1202-1206.

Chen, A. & Rogan, W.J. (2004). Breastfeeding and the Risk of Postneonatal Death in the United States. *Pediatrics, 113(5)*, 435-439.

Chung, K.C., Kowalski, C.P., Kim, H.M., & Buchman, S.R. (2000). Maternal Cigarette Smoking during Pregnancy and the Risk of Having a Child with Cleft Lip/Palate. *Plastic and Reconstructive Surgery*, *105*(2), 485-491.

Cornelius, M.D., Goldschmidt, L., Day, N.L., & Larkby, C. (2002). Alcohol, tobacco and marijuana use among pregnant teenagers: 6-year follow-up of offspring growth effects. *Neurotoxicology and Teratology, 24*, 703-710.

Curet, L.B. & Hsi, A.C. (2002). Drug Abuse During Pregnancy. *Clinical Obstetrics and Gynecology, 45*(1), 73-88.

Department of Health and Human Services Centers for Disease Control and Prevention. (2004). Cigarette Smoking Among Adults—United States, 2002. *Morbidity and Mortality Weekly Report, 53(20)*, 1-4.

Deren, S. (1986). Children of Substance Abusers: A Review of Literature. *Journal of Substance Abuse Treatment, 3,* 77-94.

DiFranza, J.R., Aligne, C.A., & Weitzman, M. (2004). Prenatal and Postnatal Environmental Tobacco Smoke Exposure and Children's Health. *Pediatrics, 113*, 1007-1015.

Ebrahim, S.H., Floyd, R.L., Merritt II, R.K., Decoufle, P. & Holtzman, D. (2000). Trends in Pregnancy-Related Smoking Rates in the United States, 1987-1996. *JAMA, 283(3)*, 361.

Faden, V.B. & Graubard, B.I. (2000). Maternal substance use during pregnancy and developmental outcome at age three. *Journal of Substance Abuse, 12*, 329-340.

Fergusson, D.M., Horwood, J., & Lynskey, M.T. (1993). Maternal smoking before and after pregnancy: Effects on behavior outcomes in middle childhood. *Pediatrics, 92,* 815-822.

Fergusson, D.M., Woodward, L.J. & Horwood, J. (1998). Maternal smoking during pregnancy and psychological adjustment in late adolescence. *Archives of General Psychiatry, 55,* 721-727.

Florida State University College of Criminology and Criminal Justice (2014). Robert Agnew's General Strain Theory. Retrieved from http://www.criminology.fsu.edu/ crimtheory/agnew.htm.

Floyd, R.L., Jack, B.W., Cefalo, R., Atrash, H., Mahoney, J., Herron, A., Husten, C., & Sokol, R.J. (2008). The clinical content of preconception care: alcohol, tobacco, and illicit drug exposures. *American Journal of Obstetrics and Gynecology,* S333-S339.

Fogelman, K.R. & Manor, O. (1988). Smoking in pregnancy and development into early adulthood. *BMJ, 297*, 1233-1236.

Fried, P.A. & Smith, A.M. (2001). A literature review of the consequences of prenatal marihuana exposure: An emerging theme of a deficiency in aspects of executive function. *Neurotoxicology and Teratology, 23,* 1-11.

Fried, P.A. & Watkinson, B. (1988). 12- and 24- Month neurobehavioural follow-up of children prenatally exposed to marihuana, cigarettes and alcohol. *Neurotoxicology and Teratology, 10,* 305-313.

Fried, P.A., Watkinson, B., & Gray, R. (1998). Differential effects on cognitive functioning in 9 to 12-year olds prenatally exposed to cigarettes and marijuana. *Neurotoxicology and Teratology, 20(3)*, 293-306.

Gachter, S. & Thoni, C. (2005). Social Learning and Voluntary Cooperation Among Like-Minded People. *Journal of the European Economic Association, 3(2/3)*, 303-

314.

Gibson, C.L., Piquero, A.R., & Tibbetts, S.G. (2000). Assessing the relationship between maternal cigarette smoking during pregnancy and age at first police contact. *Justice Quarterly, 17*, 519-541.

Gillies, P. & Wakefield, M. (1993). Smoking in Pregnancy. *Current Obstetrics & Gynaecology, 3,* 157-161.

Giordano, P.C. (2010). Legacies of Crime: A Follow-up of the Children of Highly Delinquent Girls and Boys. NY: Cambridge University.

Gustavsson, N.S. (1991). Chemically Exposed Children: The Child Welfare Response. *Child and Adolescent Social Work, 8*(4), 297-307.

Hanna, E.Z., Faden, V.B., & Dufour, M.C. (1994). The Motivational Correlates of Drinking, Smoking, and Illicit Drug Use During Pregnancy. *Journal of Substance Abuse, 6,* 155-167.

Haynie, D.L. (2001). Delinquent Peers Revisited: Does Network Structure Matter? *American Journal of Sociology, 106(4)*, 1013-1057.

Haynie, D.L. & Osgood, D.W. (2005). Reconsidering Peers and Delinquency: How do Peers Matter? *Social Forces, 84(2)*, 1109-1130.

Hill, S.Y., Lowers, L., Locke-Wellman, J. & Shen, S. (2000). Maternal smoking and drinking during pregnancy and the risk for child and adolescent psychiatric disorders. *Journal of Studies on Alcohol, 61,* 661-668.

Hofhuis, W., de Jongste, J.C., & Merkus, P.J.F.M. (2003). Adverse health effects of prenatal and postnatal tobacco smoke exposure on children. *Archives of Disease in Children, 88*, 1086-1090.

Huizink, A.C & Mulder, E.J.H. (2006). Maternal smoking, drinking or cannabis use during pregnancy and neurobehavioral and cognitive functioning in human offspring. *Neuroscience and Behavioral Reviews, 30*(1), 24-41.

Institute for Work and Health Toronto (2009). What researchers mean by...cross-sectional vs. longitudinal studies. *At Work, 55*. Retrieved from http://www.iwh.on.ca/wrmb/cross-sectional-vs-longitudinal-studies.

Jacobson, J.L., Jacobson, S.W., Sokol, R.J., Martier, S.S., Ager, J.W., & Shankaran, S. (1994). Effects of alcohol use, smoking, and illicit drug use on fetal growth in black infants. *Journal of Pediatrics, 124*(5.1), 757-764.

Johnston, L.D., O'Malley, P.M., Bachman, J.G., & Schulenberg, J.E. (2009). Monitoring the Future: National Survey Results on Drug Use, 1975-2009. National Institute of Drug Abuse, Betheseda, MD.

Lee, G., Akers, R.L., & Borg, M.J. (2004). Social Learning and Structural Factors in Adolescent Substance Use. *Western Criminology Review, 5(1)*, 17-34.

Linn, S., Schoenbaum, S.C., Monson, R.R., Rosner, R., Stubblefield, P.C., & Ryan, K.J. (1983). The association of marijuana use with outcome of pregnancy. *American Journal of Public Health, 73(10)*, 1161-1165.

Lundborg, P. (2006). Having the wrong friends? Peer effects in adolescent substance use. *Journal of Health Economics, 25*, 214-233.

Lyons, P. & Rittner, B. (1998). The Construction of the Crack Babies Phenomenon as a Social Problem. *American Journal of Orthopsychiatry, 68*(2), 313-320.

Maughan, B.M., Taylor, C. & Taylor, A. (2001). Pregnancy Smoking and Childhood Conduct Problems: A Causal Association? *Journal of Child Psychology and Psychiatry, 42*(8), 1021-1028.

McCormick, M.C., Brooks-Gunn, J., Shorter, T., Holmes, J.H., Wallace, C.Y., & Heagarty, M.C. (1989). Factors associated with smoking in low-income pregnant women: Relationship to birth weight, stressful life events, social support, health behaviors and mental distress*. *Journal of Clinical Epidemiology, 43(5),* 441-448.

McGloin, J.M., Pratt, T.C., & Piquero, A.R. (2006). A Life-Course Analysis of the Criminogenic Effects of Maternal Cigarette Smoking During Pregnancy: A Research Note on the Mediating Impact of Neuropsychological Deficit. *Journal of Research in Crime and Delinquency, 43*(4), 412-426.

Milberger, S., Biederman, J., Faraone, S.V., Chen, L, & Jones, J. (1997). ADHD is associated with early initiation of cigarette smoking in children and adolescents. *J. Am. Acad. Child Adolesc. Psychiatry, 36(1),* 37-44.

Miller, Jane E. The Effects of Race/Ethnicity and Income on Early Childhood Asthma Prevalence and Health Care Use. *American Journal of Public Health*. 90, (3), 428-430.

Orlebeke, J.F., Knol, D.L., & Verhulst, F.C. (1997). Increase in Child Behavior Problems Resulting from Maternal Smoking during Pregnancy. *Archives of Environmental Health, 52*(4), 317-321.

Ostrowsky, M.K. & Messner, S.F. (2005). Explaining crime for a young adult population: An application of general strain theory. *Journal of Criminal Justice, 33,* 463-476.

Patchin, J.W. & Hinduja, S. (2010). Traditional and Nontraditional Bullying among Youth: A Test of General Strain Theory. *Youth Society, 43(2)*, 727-751.

Paternoster, R. & Mazerolle, P. (1994). General strain theory and delinquency: A replication and extension. *Journal of Research in Crime and Delinquency, 31(3)*, 235-263.

Phung, H., Bauman, A., Nguyen, T.V., Young, L., Tran, M., & Hillman, K. (2003). Risk factors for low birth weight in a socio-economically disadvantaged population: Parity, marital status, ethnicity and cigarette smoking. *European Journal of Epidemiology, 18,* 235-243.

Piquero, N.L. & Sealock, M.D. (2004). Gender and General Strain Theory: A Preliminary Test of Broidy and Agnew's Gender/GST Hypotheses. *Justice Quarterly, 21(1)*, 125.

Piquero, N.L., Gover, A.R., MacDonald, J.M., & Piquero, A.R. (2005). The Influence of Delinquent Peers on Delinquency: Does Gender Matter? *Youth Society, 36(3)*, 251-275.

Powell, L.M., Tauras, J.A., & Ross, H. (2005). The importance of peer effects, cigarette prices and tobacco control policies for youth smoking behavior. *Journal of Health Economics, 24*, 950-968.

Pratt, T.C., Cullen, F.T., Sellers, C.S., Winfree, L.T., Jr., Madensen, T.D., Daigle, L.E., Fearn, N.E. and Gau, J.M. (2010). The Empirical Status of Social Learning Theory: A Meta-Analysis. *Justice Quarterly, 27(6)*, 765.

Pratt, T.C., McGloin, J.M., & Fearn, N.E. (2006). Maternal Cigarette Smoking During Pregnancy and Criminal/Deviant Behavior: A Meta-Analysis. *International Journal of Offender Therapy and Comparative Criminology, 50*(6), 672-690.

Preston, P. (2006). Marijuana use as a coping response to psychological strain: racial, ethnic, and gender differences among young adults. *Deviant Behavior, 27,* 397-421.

Rantakallio, P. (1983). A follow-up study up to the age of 14 of children whose mothers smoked during pregnancy. *Acta paediatrica Scandinavica, 72,* 742-753.

Rantakallio, P., Laara, E., Isohanni, M., & Moilanen, I. (1992). Maternal smoking during pregnancy and delinquency of the offspring: an association without causation? *International Journal of Epidemiology, 21*, 1106-1113.

Rasanen, P, Hakko, H., Isohanni, M., Hodgins, S., Jarvelin, M.R., & Tiihonen, J. (1999).

Maternal smoking during pregnancy and risk of criminal behaviour among adult male offspring in the Northern Finland 1966 birth cohort. *American Journal of Psychiatry, 156*, 857-862.

Richter, K.P., Ahluwalia, H.K., Mosier, M.C., Nazir, N. & Ahluwalia, J.S. (2002). A population-based study of cigarette smoking among illicit drug users in the United States. *Addiction, 97*(7), 861-869.

Sadowski, K. & Parish, T.G. (2005). Maternal Smoking Contributes to the Development of Childhood ADHD. *The Internet Journal of Allied Health Sciences and Practice, 3*(1), 1-6.

Sanderson M, Scott C, Gonzalez JF. 1988 National Maternal and Infant Health Survey: Methods and response characteristics. National Center for Health Statistics. Vital Health Stat 2(125).

Scher, M.S., Richardson, G.A., Coble, P.A., Day, N.L., & Stoffer, D.S. (1988). The Effects of Prenatal Alcohol and Marijuana Exposure: Disturbances in Neonatal Sleep Cycling and Arousal. *Pediatric Research, 24(1),* 101-105.

Shieh, C. & Kravitz, M. (2006). Severity of Drug Use, Initiation of Prenatal Care, and Maternal-Fetal Attachment in Pregnant Marijuana and Cocaine/Heroin Users. *Journal of Obstetric, Gynecologic, & Neonatal Nursing, 35(4)*, 499-508.

Streissguth, A.P., Martin, D.C., Barr, H.M., Sandman, B., Krichner, G.L., & Darby, B. (1984). Intrauterine alcohol and nicotine exposure: attention and reaction time in 4-year-old children. *Developmental Psychology, 20*, 533-541.

Torabi, M.R., Bailey, W.J., & Majd-Jabbari, M. (1993). Cigarette Smoking as a Predictor of Alcohol and Other Drug Use by Children and Adolescents: Evidence of the "Gateway Drug Effect". *The Journal of School Health, 63(7)*, 302.

United States Department of Health and Human Services, National Center for Health Statistics. NATIONAL MATERNAL AND INFANT HEALTH SURVEY, 1988. ICPSR09730-v3. Hyattsville, MD: United States Department of Health and Human Services, National Center for Health Statistics [producer], 1991. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2008-08-19. doi:10.3886/ICPSR09730.v3

Unnever, J.D., Cullen, F.T., & Pratt, T.C. (2003). Parental Management, ADHD, and Delinquent Involvement: Reassessing Gottfredson and Hirschi's General Theory. *Justice Quarterly, 20,*471-500.

Wakschlag, L.S., Lahey, B.B., Loeber, R., Green, S.M., Gordon, R.A., & Leventhal, B.L. (1997). Maternal smoking during pregnancy and the risk of conduct disorder in

boys. *Arch Gen Psychiatry, 54*, 670-676.

Wallace Jr., J.M., Bachman, J.G., O'Malley, P.M., Johnston, L.D., Schulenberg, J.E., & Cooper, S.M. (2002). Tobacco, Alcohol, and Illicit Drug Use: Racial and Ethnic Differences Among U.S. High School Seniors, 1976-2000. *Public Health Reports, 117(1)*, S67-S76.

Wallace Jr., J.M., Bachman, J.G., O'Malley, P.M., Schulenberg, J.E., Cooper, S.M., & Johnston, L.D. (2003). Gender and ethnic differences in smoking, drinking and illicit drug use among American 8th, 10th, and 12th grade students, 1976-2000. *Addiction, 98*, 225-234.

Walsh, R.A. (1994). Effects of Maternal Smoking on Adverse Pregnancy Outcomes: Examination of the Criteria of Causation. *Human Biology,66*(6), 1059-1092.

Weissman, M.M., Warner, V, Wickramaratne, P., & Kandel, D.B. (1999). Maternal Smoking During Pregnancy and Psychopathology in Offspring Followed to Adulthood. *Journal of the American Academy of Child & Adolescent Psychiatry, 38*(7), 892-899.

Weitzman, M. Gortmaker, S., & Sobol, A. (1992). Maternal smoking and behavior problems of children. *Pediatrics, 90*, 342-249.

Zuckerman, B. (1991). Drug-Exposed Infants: Understanding the Medical Risk. *The Future of Children, 1*(1), 26-35.

APPENDIX A

CORRELATION MATRIX FOR MCS (MODEL 1)

	MCS	receiving AFDC	receiving food stamps	unplanned pregnancy	living with people who smoked during pregnancy	household income	education	Non-White	25-34 years of age	35 years old and up	Married
MCS	1.0000										
receiving AFDC	0.2324	1.0000									
receiving food stamps	0.2174	0.7234	1.0000								
unplanned pregnancy	0.2033	0.3080	0.2981	1.0000							
living with people who smoked during pregnancy	0.3393	0.1825	0.1906	0.2589	1.0000						
household income	-0.3030	-0.2923	-0.2967	-0.4745	-0.3987	1.0000					
education	-0.0755	-0.0681	-0.0783	-0.0905	-0.0850	0.1091	1.0000				
Non-White	-0.0640	0.2186	0.1967	0.1329	-0.0090	0.0920	-0.0979	1.0000			
25-34 years of age	0.0206	-0.1115	-0.1071	-0.1262	-0.0812	-0.0423	0.0357	-0.1128	1.0000		
35 years old and up	-0.0198	-0.0482	-0.0420	-0.0292	-0.0433	-0.0182	0.0317	-0.0506	-0.2531	1.0000	
Married	0.0249	0.0119	0.0189	0.0258	0.0102	-0.0340	0.0040	0.0125	0.0061	0.0486	1.0000

APPENDIX B

CORRELATION MATRIX FOR MARIJUANA (MODEL 2)

	marijuana use during pregnancy	receiving AFDC	receiving food stamps	unplanned pregnancy	living with people who smoked during pregnancy	household income	education	Non-White	25-34 years of age	35 years old and up	Married
marijuana use during pregnancy	1.0000										
receiving AFDC	0.1150	1.0000									
receiving food stamps	0.1006	0.7234	1.0000								
unplanned pregnancy	0.0856	0.3080	0.2981	1.0000							
living with people who smoked during pregnancy	0.1010	0.1825	0.1906	0.2589	1.0000						
household income	-0.0916	-0.2923	-0.2967	-0.4745	-0.3987	1.0000					
education	-0.0139	-0.0681	-0.0783	-0.0905	-0.0850	0.1091	1.0000				
Non-White	0.0069	0.2186	0.1967	0.1339	-0.0090	-0.0920	-0.0979	1.0000			
25-34 years of age	0.0029	-0.1115	-0.1071	-0.1262	-0.0812	-0.0423	0.0357	-0.1128	1.0000		
35 years old and up	-0.0191	-0.0482	-0.0420	-0.0292	-0.0433	-0.0182	0.0317	-0.0506	-0.2531	1.0000	
Married	0.0190	0.0119	0.0189	0.0258	0.0102	-0.0340	0.0040	0.0125	0.0061	0.0486	1.0000

APPENDIX C

CORRELATION MATRIX FOR PRIOR MARIJUANA USE (MODEL 3)

	MCS	Prior marijuana use	receiving AFDC	receiving food stamps	unplanned pregnancy	living with people who smoked during pregnancy
MCS	1.0000					
Prior marijuana use	-0.2408	1.0000				
receiving AFDC	0.2325	-0.1212	1.0000			
receiving food stamps	0.2175	-0.1048	0.7234	1.0000		
unplanned pregnancy	0.2033	-0.1197	0.3080	0.2981	1.0000	
living with people who smoked during pregnancy	0.3393	-0.1448	0.1826	0.1906	0.2590	1.0000