THESIS

THE ASSOCIATION BETWEEN PARENTAL MARIJUANA USE AND MOTHER-CHILD INTERACTIONS

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Bryer Barmore

Department of Human Development and Family Studies

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Master's Committee:

Advisor: Erika Lunkenheimer

Nathan Riggs
Bradley Conner

ABSTRACT

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Little is known about parents who use marijuana even though it is the most commonly used illicit substance in the world (Cooper & Haney, 2014). Previous research has shown negative outcomes for children of parents who use illicit substances (Kelley, Lawrence, Milletich, Hollis, & Henson, 2015; Riggs, Chou, & Pentz, 2009). Regular marijuana use has been linked to overall poorer mental health, and parents with poor mental health has been linked to maladaptive outcomes for their children later in life (Arseneault et al., 2002; Van Loon et al., 2014). Dynamic systems theory was used to quantify mother-child dyadic interaction patterns, with a specific focus on adaptive flexibility, negativity, and rigidity. Higher levels of flexibility has been shown to moderate the transmission of risk from parent to child (Granic & Lamey, 2002). This was a longitudinal study at two time points using a non-randomized community sample and focused on associational differences in mother-child dyads based on lifetime frequency of parental marijuana use. Mothers who had a higher frequency of marijuana use had reduced levels of dyadic adaptive flexibility, even after controlling for maternal depressive symptoms and mother's race. When fathers had a higher frequency of marijuana use, mother-child dyads had increased rigidity, however, after controlling for maternal depressive symptoms and mother's race, the association became insignificant.

Key words: marijuana, parent-child, depressive symptoms, flexibility, rigidity, negativity, dynamic systems theory, dyadic interactions

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Chapter 1: Review of the Literature

Introduction

Marijuana is the most commonly used illicit substance among teenagers and young adults in the United States, and throughout the world (Cooper & Haney, 2014; Lessem et al., 2006; Meier et al., 2012). Currently, as marijuana continues to become decriminalized in a greater number of states across the United States, the need for research on the longitudinal effects of marijuana on the user, and those around them, is increasing. As marijuana's popularity grows, initiation and continued use has been increasing in young adults (von Sydow et al., 2001) for decades and is continuing to increase still (National Survey of Drug Use and Health, 2015). As young, and even older, adults are continuing use, and the average age of users increases (National Survey of Drug Use and Health, 2015) young parents may also experience growing rates of use, though this is yet to be determined. It is important to study the population of parents who use marijuana, given the known negative outcomes for children of parents who use illicit substances (Kelley, Lawrence, Milletich, Hollis, & Henson, 2015; Riggs, Chou, & Pentz, 2009). Marijuana use has been shown to be related to increased anxiety, difficulties learning, and reduced motivation in users (Battistella et al., 2014; Marijuana, 2016). These characteristics in parents are also related to parents having reduced flexibility and hostility when interacting with their child, as well as being more likely to have children with behavior problems (Hollenstein, Granic, Stoolmiller, & Snyder, 2004). However, the link between marijuana use and parenting has not been extensively examined. Thus, more research is warranted to better understand how marijuana use is related to parent-child interactions. The present study examined how parental marijuana use was associated with parents' dyadic interactions with their children. Specifically I

examined affective and behavioral flexibility, negativity, and rigidity, in mother-child interactions, accounting for the level of maternal depressive symptoms.

Prevalence of Marijuana Use

Marijuana is the most commonly used illicit substance in the world by young adults (Cooper & Haney, 2014; Lessem et al., 2006; Meier et al., 2012). In the United States, marijuana has the highest rate of abuse compared to other illicit substances (Cooper & Haney, 2014). Aside from alcohol and tobacco, marijuana dependence is the most commonly treated substance use problem (Hall & Degenhardt, 2014). Between 2000 and 2010 there has been a 21% increase in people from the United States seeking treatment for marijuana use (Cooper & Haney, 2014). Regular marijuana users who seek treatment commonly report anxiety, insomnia, depression, and appetite disturbance while withdrawing (Hall & Degenhardt, 2014).

In a 2014 National Survey on Drug Use and Health, investigators discovered that over half of people have tried marijuana at least once in their lifetime by the age of 25, with 19.6% of them having used marijuana in the past month (National Survey of Drug Use and Health, 2015). However, only 6.6% of people ages 26 or older reported using marijuana in the past month (National Survey of Drug Use and Health, 2015). More than 99% of all people who will ever use marijuana have tried it at least once by the time they turn 25 (SAMHSA, 2002), which coincidently, was also the average maternal age for first childbirth in 2006 (Matthews & Hamilton, 2009). Around 60% of all marijuana users stop use between the ages of 23 and 30, likely related to the period where young adults are transitioning into careers, marriage, and parenthood, with new social rules that are not compatible with marijuana use (von Sydow et al., 2001). While a fraction of the remaining users may have stopped prior to age 23, presumably this would still leave a significant percentage of marijuana users who have chosen to continue

using while raising their children. Given that 6.6% of adults 26 and over who reported using marijuana in the past year is significantly higher than the year previous (National Survey of Drug Use and Health, 2016), I can speculate that the percentage of parents using marijuana has also increased in the past year. If this trend of growth continues and more parents are raising children while using marijuana, it increases the urgency to understand how parental marijuana use influences parenting and parent-child relationships.

The Mental and Physical Effects of Marijuana Use

Upon consumption or inhalation of marijuana, depending on the strain of marijuana, the user will generally feel euphoria resulting from tetrahydrocannabinol (THC) triggering the reward system in the brain and releasing dopamine (Marijuana, 2016). Although individuals experience different euphoric symptoms, the most common are: relaxation, laughter, increased appetite, and altered perceptions of time (Marijuana, 2016). The euphoria often subsides and users can experience panic, distrust, anxiety, and fear (Marijuana, 2016). While the majority of marijuana users enjoy the euphoric effects, there are many impairments associated with the state of intoxication. These impairments can include the inability to form new memories or shift the user's focus; and the parts of the brain that regulate balance, coordination, and reaction time are greatly inhibited which causes users to have a difficult time learning or doing complicated motor tasks (Marijuana, 2016).

Currently, researchers have found some of the best examples of the longitudinal effects of marijuana through Magnetic Resonance Imaging (MRI) scans of the brain (Battistella et al., 2014). It was discovered that there is a strong negative correlation between the frequency of marijuana use per month and the volume of grey matter in specific areas of the brain associated with motivational, emotional, and affective processing (Battistella et al., 2014). Researchers

demonstrated altered brain activity in those regions of the brain governing motivation and decision-making (Battistella et al., 2014). Parenting seems to often require the frequent need for motivation and decision-making, especially around discipline and boundary setting, this altered brain activity could impair parenting efforts. Specifically, parents who use drugs have been shown to give children inconsistent consequences, be less emotionally and physically responsive, and have poorer attachment quality with their children (Barnard & Mckeganey, 2004). Marijuana use also reduced activation during learning tasks, both verbal and visual, in individual adults (Battistella et al., 2014). Parents who use marijuana may be less able to derive creative solutions to problems, especially when complex decision making is involved (Vaidya et al., 2012), that arise in the course of parenting, contributing to rigid or maladaptive parenting behaviors.

The majority of marijuana users first begin use in adolescence, and research recognizes that the age of initiation is the most consistently influential variable in determining outcomes associated with marijuana use; an earlier initiation is associated with more maladaptive outcomes (Battistella et al., 2014; Hall & Degenhardt, 2014). Neuropsychological impairment is more severe and enduring in individuals with an earlier initiation; even after long periods of abstinence the impairment may remain (Meier et al., 2012) into adulthood. Given that adolescence is a crucial period for brain development, substance use during this time has lasting impacts throughout early adulthood and also potentially into parenthood (Battistella et al., 2014).

Parenting and Substance Use

When conjecturing the potential effects on children of parents who regularly use marijuana, I can draw from related literature on parents who use and/or abuse alcohol and other substances. An experimental study has shown similar effects of alcohol and marijuana use,

across ages, on people's reaction times, task management, and driving ability (Lenné et al., 2010). Other studies have found similarities between the responses of parents who use marijuana, alcohol, and other drugs, specifically related to warmth and responsiveness (Barnard & McKeganey, 2004; Riggs et al., 2009; Slesnick, Feng, Brakenhoff, & Brigham, 2014). These findings provide preliminary evidence that marijuana use may have similar influences on parenting as the use and abuse of alcohol other drugs.

When a mother or father abuses drugs, it can negatively influence interactions with his or her children and partner (Burns, Chethik, Burns, & Clark, 1997). Early in a child's development, parents can support complexity in the child's play and social interactions (Hagan & Myers, 1997). However, research has found that mothers with a preoccupation with drugs tend to exhibit reduced warmth and lower levels of emotional and physical responsiveness (Barnard & McKeganey, 2004); these behaviors are associated with poor parental scaffolding as well as reduced affective flexibility. Increased drug use by parents is also associated with less child supervision, less discussion and positive involvement with children, and increased conflict and disagreement with partners, especially in regards to discipline (Barnard & Mckeganey, 2004).

Parents with substance abuse disorders generally exhibit psychosocial characteristics that can cause disrupted parenting, including child abuse and neglect (Grant et al., 2011; Kelley et al., 2015). The majority of child welfare cases investigated each year involve some degree of parental drug or alcohol abuse (Grant et al., 2011). Parents with a Substance Use Disorder (SUD) are known to use harsher discipline and respond to their children with less sensitivity and warmth than parents without an SUD (Kelley et al., 2015). Mothers with SUDs have been shown to struggle with both parental control and parental warmth (Slesnick et al., 2014). Mothers who use pain killers, alcohol, or both, have been shown to use greater levels of

psychological control, maternal discipline, and inconsistent discipline (Slesnick et al., 2014). Children with mothers exhibiting these traits have been associated with more externalizing problems, maladjustment in school, and depression (Slesnick et al., 2014). Children may have more medical or nutritional disorders because parents with drug dependency are more likely to neglect those aspects of parenting (Barnard & Mckeganey, 2004). Cocaine-using mothers have been shown to have higher incidences of both neglect and unintentional injury with their children (Barnard & Mckeganey, 2004). Mothers with cocaine, opiate, or PCP problems have children who were significantly more likely to display insecure and disorganized attachment (Barnard & Mckeganey, 2004). Parental neglect and maladaptive attachment could be a serious concern for children of marijuana using parents given the similar patterns of behavior exhibited like harsh and inconsistent discipline, reduced warmth, and fewer positive interactions (Kelley et al., 2015; Riggs et al., 2009).

Often when parents use and abuse narcotics, their children's needs can become secondary to their own (Barnard & Mckeganey, 2004). These children often lack proper feeding, clothing, and care (Barnard & Mckeganey, 2004). Both parental misuse of alcohol and drugs are the most likely reasons for children being put into the foster care system and these parents are also the least likely to follow court mandates so their children are less likely to be released back into parental care (Barnard & Mckeganey, 2004). Fathers who abuse alcohol exhibit more negative affect and emotion and less positive involvement when interacting with their children (Kelley et al., 2015). Paternal binge drinking has also been associated with over reactivity by both parents, suggesting that one parent's substance abuse can impact the parenting style of their partner (Kelley et al., 2015). Harsh parenting from parents with alcohol use disorders (AUDs), and presumably SUDs, are associated with child anxiety and poor parent-child relationships (Kelley

et al., 2015). Problem drug use was associated with less obedient children as measured by aggression, withdrawing, and poorer adjustment (Barnard & Mckeganey, 2004).

Research shows when one or both parents abuse drugs, their children have a higher risk of developing problem behaviors that impair their social and psychological development (Kumpfer & Bluth, 2004), but less is understood regarding the mechanisms involved. Thus, it is important to examine the mechanisms by which parental marijuana use is associated with children's outcomes. Current evidence suggests that the problem behaviors commonly experienced by children of substance abusing parents (COSAPS) include both internalizing and externalizing behavior problems (Burlew et al., 2014). While internalizing and externalizing behaviors are not directly examined in this study, these behaviors have repeatedly been show to lead to problems later in life, such as clinical levels of depression and aggression (Farrell & Barrett, 2007; King, Iacono, & McGue, 2004; Mueser et al., 2006). Internalizing behaviors are characterized by negative emotional states or moods, such as depression and anxiety, and have been associated with future substance use (King et al., 2004). Externalizing behaviors include impulsivity and disinhibition, such as disruptive behaviors, and lead to early involvement in substance use (Blader, 2006; King et al., 2004). From an intervention and prevention standpoint, it is important to understand the associations between parental substance use, including marijuana, and interaction patterns that have been shown to lead to internalizing and externalizing behaviors, in the hopes of lessoning long-term maladaptive outcomes. It has been shown that COSAPS are at an increased risk for development of behavioral and emotional problems (Peleg-Oren & Teichman, 2006), and it has been suggested that the early onset of these problems are associated with poor or impaired psychological functioning later in life (Mueser et al., 2006).

The majority of the research conducted on marijuana use has been limited to the individual user of the substance, with only a few studies focusing on the negative effects on the children of parents who use it (Riggs et al., 2009). Though limited, past research has demonstrated that higher levels of marijuana use are negatively associated with parental warmth towards their child, and further, that lower parental warmth is related to higher levels of impulsivity in children (Riggs et al., 2009). Maladaptive outcomes for children (e.g., negative mood, angry behavior, and temper tantrums) are positively associated with parents' marijuana use (Brook et al., 2007). Thus, it appears that marijuana use could have similar effects on children's development as when parents abuse other substances like alcohol and opioids.

Marijuana Use, Mental Health, and Parenting

The discovery of a strong negative correlation between marijuana use frequency per month during adolescence and the volume of gray matter in specific areas of the brain in adulthood (Battistella et al., 2014) could be associated with maladaptive outcomes for young parents moving forward. As mentioned above, marijuana has been found to affect areas of the brain associated with motivational, emotional, and affective processing (Battistella et al., 2014). Marijuana use also reduced hippocampal activation during both verbal and visual learning tasks (Battistella et al., 2014). Regular marijuana use has been linked to psychotic disorders and symptoms as well as overall poorer mental health (Arseneault et al., 2002; Hall & Degenhardt, 2014; McGee, Williams, Poulton, & Moffitt, 2000). Regular marijuana use is related to psychotic symptoms, including disordered thinking, hallucinations, and delusions (Hall & Degenhardt, 2014). Surveys of clinical populations found higher rates of people with bipolar disorder to also have marijuana use disorders, and that those diagnosed with bipolar disorder have more manic episodes with continued marijuana use (Hall & Degenhardt, 2014).

Although a causal link between marijuana use and depression has not been found, there tends to be a positive relationship between the two that becomes more strongly related when the inclusion of certain mediating variables increases (Hall & Degenhardt, 2014), such as negative urgency (Pang et al., 2014). Negative urgency is defined as a disposition toward an active response when in an emotional state, where the response is considered rash, and is considered a major mediator for the relationship between marijuana use and depression (Pang et al., 2014). Mothers with depressive symptoms exhibit the same or similar behaviors as those with SUDs mentioned above, examples being: fewer positive interactions, less responsiveness, and increased hostility when interacting with their children (Kelley et al., 2015; Lovejoy, Graczyk, O'Hare, & Neuman, 2000; Slesnick et al., 2014). Mothers with depressive symptoms are more likely to express negative affect with their children (Tronick & Reck, 2009), showing increased negativity compared to children of mothers without depressive symptoms (Cohn & Tronick, 1983). A similar effect has been discovered for parents who use marijuana. Mothers who have used marijuana also tend to express reduced maternal warmth when interacting with their children (Riggs et al., 2009); behaviors that contribute to parental warmth include: showing interest in the activities of their child, comforting their child when needed, and doing things 'just for fun' with their child. For mothers with depressive symptoms, during problem solving tasks, there are increased rates of conflict between the mother and child, and there is an increased risk of negative parenting practices by the mother (e.g. scolding and criticism) (Caughy, Huang, & Lima, 2009).

Due to a persistent relationship between marijuana use and major depressive disorder (e.g., Hall & Degenhardt, 2014), with both presenting similar structural changes in the brain , it appears important to account for depressive symptoms when measuring the influence of

marijuana use on outcomes (in this case, parent-child interactions) that require significant cognitive and behavioral effort on the part of the parent. When a parent has a mental health diagnosis, regardless of the specific diagnosis, their child is at risk for problems later in life (Van Loon et al., 2014). Children with a parent who has a mental illness may receive less support from their parents, with mentally ill parents being less emotionally available and nurturing to their children (Van Loon et al., 2014). The aforementioned brain and behavioral similarities raise the question as to whether marijuana use and depressive symptoms could have comparable associations on parenting behaviors.

Theoretical Foundation and Dyadic Interaction Patterns

While parent-child interactions are well documented in the literature, dynamic systems modeling is relatively new in the field (Lunkenheimer, Albrecht, & Kemp, 2013). Given that emotions are changing frequently and continuously within the parent-child system during interactions, it is likely that an analytic strategy examining dynamic changes might be more informative, or provide different information, in addressing variability and change in a dyadic system (Hoeksma, Oosterlaan, & Schipper, 2004). Dynamic systems theory addresses how new forms of interaction arise, organize, and stabilize into working patterns that serve the parent and child's needs. In terms of parents who use marijuana, inconsistent parenting due to drug use could be associated with the dyad's inability to efficiently organize their affect and behavior (Slesnick et al., 2014). The current study focuses on affective flexibility and its opposite, rigidity, known to moderate the transmission of risk maladaptive behaviors from parent to child (Granic & Lamey, 2002).

Affective flexibility can be modeled and measured using state space grids (SSG), which are a dynamic systems-based method (Lewis, Lamey, & Douglas, 1999). SSGs allow

researchers to visualize and model parent-child interactions in real time as they happen (Lunkenheimer et al., 2013). Typical parent-child interactions that revolve around problem-solving should be characterized by dyadic affective flexibility as the dyad moves towards a common goal and has the possibility of sharing different affective states, such as positive, neutral and negative states (Lunkenheimer et al., 2013). Dyads with more affective flexibility show more transitions among dyadic affective states, utilize a greater range of dyadic affective states, and/or show a more even dispersion of behaviors across the affective states as plotted in the SSG than those dyads that are less flexible (Lunkenheimer, Hollenstein, Wang, & Shields, 2012). Conversely, some dyadic interactions are organized in such a way that demonstrates attraction to certain affective states, e.g., when significantly more time is spent in the negative than the positive region of the grid. When the dyads organize their affect into these more rigid interactions by becoming attracted to specific states, the dyad may be more likely to become "stuck" in a particular exchange pattern, reflecting rigidity in their affective repertoire (Lunkenheimer & Dishion, 2009; Lunkenheimer et al., 2012).

Higher levels of affective flexibility are beneficial and related to fewer child behavior problems (Lunkenheimer, Olson, Hollenstein, Sameroff, & Winter, 2011). The opposite has also been shown to be true with lower levels of flexibility being related to higher risk of family conflict, hostility, and increased child behavior problems (Hollenstein et al., 2004). Dyads with lower levels of affective flexibility also have tendencies of being attracted to particular states or getting "stuck," as is the case with parents who have increased levels of depressive symptoms where the dyad tends to be attracted to negative affective states (Lunkenheimer et al., 2013). This feeling of being "stuck" in an affective state may cause dyads to become rigid in their problem solving skills or coping skills, especially once a stressor is introduced. Having high

levels of flexibility is important as a parent, given the correlational link between parent-child interaction rigidity and future internalizing and externalizing behaviors for the child (Hollenstein et al., 2004).

Differences between Mothers and Fathers

This study also examined the moderating association that the sex of the primary caregiver has on marijuana use and outcomes. Men are more likely to initiate and continue to use marijuana compared to women, with 51.4% of men self-reporting use in their lifetime compared to 37.4% of women (SAMHSA, 2012). Men are at greater risk of becoming dependent on marijuana compared to women (Wagner & Anthony, 2007). Thus, men potentially are transitioning into parenthood with a greater likelihood of continued marijuana use than women. Given that men may be more likely to use marijuana regularly, and that fathers' substance use has an effect on their partners' parenting behavior (Kelly et al., 2014), I investigated the associations of both maternal and paternal marijuana use on mother-child interaction patterns.

Present Study

The present study seeks to better understand the relationship between parental marijuana use on mother-child interactions through the examination of affective flexibility, negativity, and rigidity. These patterns were of particular interest because previous research has shown that affective flexibility and positivity are compromised in families at risk due to parental mental and behavioral problems (Hollenstein et al., 2004). The hypothesis is that parents' higher levels of lifetime marijuana use will be related to increased negativity (Cummings & Davies, 1994), reduced adaptive flexibility, and increased rigidity (Lunkenheimer et al., 2013), in mother-child interactions. The findings of this study will help to build a knowledge base regarding the

associations of parental marijuana use, with the goal of preventing problem behaviors in children that can lead to poor outcomes later in life. Due to the existing link between marijuana use and depressive symptoms (Hall & Degenhardt, 2014), and given that parental depressive symptoms have been shown to produce greater negativity and lower affective flexibility in parent-child interactions (Lunkenheimer et al., 2013), maternal depressive symptoms will be examined as a covariate.

Chapter 2: Method

Study Design

This was a longitudinal study of two time points that utilized parent self-report survey data on substance use when children were 2 ½ years of age (Time 1; M = 29.51 months) to predict mother-child dyadic interaction patterns when children were 3 years of age (Time 2; M = 36.12 months). Mothers and children were assessed at Time 2 while engaging in problem-solving interactions in the laboratory, designed to challenge them (e.g., a puzzle task that was beyond the child's ability level which the parent needed to instruct the child to complete in order to win a prize). The participants consisted of a non-randomized community sample of convenience, recruited from in and around northern Colorado, post-legalization of recreational marijuana use in Colorado. The current study focused on differences in dyadic interaction patterns related to parents' lifetime marijuana use. Mother-child observations were coded with an established coding system, and then State Space Grids were used to analyze patterns among these behavioral codes.

Participants

Participants were representative of a typical Western city from the United States and survey data was collected from 100 mothers and 59 fathers; 53% of children in these families were female. Of the families, 68% earned less than $40,000 annually, with 21% of the families being non-white. Forty-four percent of parents in the sample reported not having a degree past high school. Of the mothers in the sample, 18% reporting being separated, divorced, or single. The children in the sample are on average 2.46 years of age at T1 and 3.01 years at T2. The mothers' self-reported marijuana use was skewed, skewness statistic = .419. Over forty percent

of mothers reported no life-time usage and 22.3% reported usage in the highest two categories. Father's self-reported marijuana use followed a U-shaped distribution with 35.6% reporting no instances, and 30.5% reporting 250 or greater instances of lifetime use.

Procedure

The current study analyzed a subset of data collected in the context of a broader longitudinal study. The subsample selected was based on families whose laboratory observation data was available and coded at Time 2 (T2); dyadic interaction data was available from 42 families, specifically mother-child interactions (too few father-child sessions were available at the time of analysis to be included). Recruitment of participants took place by placing flyers in local preschools, commercial daycare facilities, and businesses, and by sending LISTSERV emails from local agencies that serve the families of young children (e.g., Colorado Department of Human Services and Child Protective Services). Dyads were excluded from the study if their child had a diagnosed developmental disorder or if either member in the dyad had a known heart or respiratory condition that would potentially affect the collection of physiological data that was used as part of the larger longitudinal study.

After recruitment, a researcher visited families in their homes at Time 1 (T1) when their child was 2.5 years of age. The purpose of this visit was to educate the families about the experiment and obtain written informed consent for participation, including consent to be videotaped and have their heart and respiratory rates monitored during laboratory observations. The parents filled out a series of surveys, including the AOD survey utilized in the current study. Upon completion of T1, the family was compensated $30 regardless of whether one or both parents agreed to participate.

At T2, when the child was 3 years of age, parent-child dyads came into the observation laboratory for a 2-hour visit in which the parent and child were asked to participate in a series of three dyadic interaction tasks. The tasks included a 7-minute free play task, a 4 minute cleanup task, and a 10 minute Parent-Child Challenge Task (Lunkenheimer, Kemp, Lucas-Thompson, Cole, & Albrecht, 2016; Lunkenheimer et al., 2013). Before the initiation of the three behavioral tasks, the heart rate and respiration monitoring devices were placed on the parent and child and the dyad watched a neutral nature video to obtain their resting physiological data. After dyadic tasks were completed, the parent was asked to fill out surveys, including a measure of substance use, while the researcher played games with the child that tested the child's capacity for executive functioning and effortful control. Upon the completion of each T2 laboratory visit, families were compensated $40.

Measures

Marijuana use. Parents completed an abbreviated version of the Alcohol and Other Drugs (AOD) measure, which is a self-report survey of adult drug and alcohol use. For the purposes of this study, one item from this survey was used to represent parental marijuana use. Parents reported their history of marijuana use based on the question: "On how many occasions (if any) have you used marijuana (grass, pot, weed, ganga) or hashish (hash, hash oil)?" "During your lifetime?" The question provided a scale where the parents could respond with 0, 1-2, 3-5, 6-9, 10-19, 20-39, 40-99, 100-249, or 250-499+ for how many individual times they used marijuana within their lifetime. Based on this scale, marijuana use was treated as quasi-ordinal continuous variable, with a higher score representing greater frequency of use.

Sociodemographic variables. Demographic surveys at T1 asked participants to select the race and ethnicity that they identify as, and the race and ethnicity they identify their child as.

Provided choices for race were, “Unknown, White, Black/African American, Native Hawaiian/Pacific Islander, Native American, Asian, Multi-race, or Other.” Provided choices for ethnicity were, “Unknown, Hispanic/Latino, Not Hispanic/Latino.” Since the data regarding participants’ race had a higher potential for giving culturally relevant information, it was examined further in the study. The majority of mothers (84.5%) and children (76.6%) were classified as “White” on the survey, therefore, participants were divided into two groups based on race, where mothers and their child were either from a majority race or minority race, to examine the influence of race on study outcomes.

Maternal depressive symptoms. At T1, mothers completed the Brief Symptom Inventory (BSI) survey to measure psychological symptoms. A number of items on the survey measure an individual’s depressive symptoms. For example, “In the last month, how often have you: “Felt lonely,” “Had trouble falling asleep,” “Feeling worthless,” etc.” Participants answered each question on a scale of 0 – 4, with 0 = none of the time and 4 = all of the time. Maternal depressive symptoms were operationalized by creating a new variable, by adding multiple responses from the maternal BSI survey data. The survey questions thus combined were, “Feelings of worthlessness,” “Thoughts of death or dying,” “Feeling hopeless about the future,” “Feeling blue,” and “Feeling lonely.” These five variables are considered symptoms of depression and were interrelated, Cronbach’s Alpha = .82.

Observed dyadic tasks. Prior to making observations in response to a challenge task, a dyadic free-play and cleanup task were included to examine the emotional affect of the dyadic members during a positive experience. The mother and child were given a large set of toys and then instructed to play together as they normally would without cleaning up, because that would occur later. The dyads were then left alone to play together for 7 minutes while their interactions

were captured on both the video and physiological recording devices. After the 7 minutes, the experimenter came into the room and asked the dyad to clean up the toys. The experimenter would ask the mother to only use their words and instruct their child to clean up without actually touching any of the toys themselves. Once the experimenter left the room, the mother then had 4 minutes to verbally guide their child to clean up the toys.

The Parent-Child Challenge Task (PCCT) (Lunkenheimer et al., 2016) was developed to study dyadic interaction patterns between parents and children during a difficult, problem-solving situation, and utilized in this study at T2. The PCCT was designed to be above the child's cognitive ability level, and to increase in difficulty as each of three puzzles is presented in turn. The mother was instructed by the experimenter to help their child complete the task, but the mother was only allowed to use their words. The dyads were told that if they could complete the three puzzles they would win a prize for their child. After 4 minutes of working on the puzzles, the experimenter reentered the room and gave the dyads a sudden time restraint by telling them they had 2 minutes left. The purpose of the time constraint was to perturb the dyadic system and incentivize the dyad to complete all 3 puzzles within the time limit. After an additional 3 minutes, the experimenter gave the child the prize, regardless of completion. Then the dyads were allowed a "repair" period for three minutes, during which mother and child colored or played with play dough together, with no instruction other than to play together. For more complete instructions for the PCCT, see Lunkenheimer et al. (2016).

Coding of parent and child affect. The behavioral observations were collected with the Noldus Observer 10.5 XT software and were coded with the Dyadic Interaction Coding system (Lunkenheimer, 2009). Coders coded the facial and vocal affect of both the parent and child during the PCCT. Coded affective data was then entered into Gridware 1.15 (Lamey,

Hollenstein, Lewis, & Granic, 2004) to examine dyadic affective patterns. The affect was divided into five states: medium-high negative, low negative, neutral, low positive, and medium-high positive, with the child affect on the X-axis and the parent affect on the Y-axis. The 5 states for both the parent and child create a 5x5 or 25-cell grid referred to as the State Space Grid (SSG). The affective states for the dyad were plotted on the grid in real time. When any member of the dyad switched affective states, the new state was recorded. For more details on State Space Grids please see Lunkenheimer et al. (2016).

Dyadic affective flexibility, negativity, and rigidity. Dyadic affective flexibility was operationalized using the number of transitions into positive dyadic states. Mother-child dyads who had a greater number of transitions into positive dyadic states had higher levels of dyadic affective flexibility. Negativity was operationalized as the number of transitions into negative dyadic states. Mother-child dyads who had a greater number of transitions into negative dyadic states had higher levels of negativity. Rigidity, or attraction, was operationalized in two ways. First, rigidity was represented as the increased average duration per event (DPE) for dyads on the SSG; the duration per event is the mean duration of each trajectory divided by the total number of events (Hollenstein, 2013). Second, rigidity was represented as an increased average duration per visit (DPV) for dyads on the SSG; the duration per visit is the mean duration of each trajectory divided by the total number of visits (Hollenstein, 2013). An event is each new occurrence of an affective or behavioral display, without necessarily leaving a state space square, where as a visit is each occurrence of the dyad entering a state. In this way, DPE and DPV represent the overall rigidity of the dyad, demonstrating how long on average they remain in a given dyadic state once they enter it. As an example from Figure 1, the mother neutral/child high positive state has one visit and two events.

Analytic Plan

First, descriptive statistics were run to assess distributions of variables and normality of variance. A linear regression was run with marijuana use as a quasi-ordinal continuous variable to determine differences between higher and lower frequency of use in regards to dyadic affective flexibility, by looking at adaptive flexibility, negativity, and rigidity. Analyses of variance (ANOVAs) were run to examine frequencies of marijuana use in relation to sociodemographic factors and maternal depressive symptoms, to determine if potential confounding variables existed. Once normality assumptions were met for T2 variables, independent samples T-tests were run to determine relationships between frequency of marijuana use and adaptive flexibility, negativity, and rigidity.

Chapter 3: Results

Preliminary Analyses

Descriptive statistics were performed and are presented in Table 1 and Table 2. Skewness and kurtosis analyses were run to determine normality of the distribution of T1 sociodemographic data. A Kolmogorov-Smirnov Test of normality was also conducted to assess statistical assumptions of normality. The Kolmogorov-Smirnov Test assumes normality of distribution within variables, so significance on this test indicates a non-normally distributed variable. All tests conducted on T1 data rejected normality (Table 1). Two preliminary ANOVAs were run to determine which sociodemographic variables, if any, were related to maternal or paternal lifetime marijuana use. The ANOVA indicated a statistically significant association between mother's ethnicity on paternal marijuana use frequency, $F(1, 56) = 7.39$, $p < .05$. When the mother was of a minority ethnicity, her partner was significantly more likely to have a higher instance of lifetime marijuana use. Pearson's Correlation analysis demonstrated that maternal and paternal lifetime marijuana use were positively correlated, $r = .62$, $p < .001$. A greater frequency of paternal marijuana use was significantly correlated with their partner and child having increased rigidity (DPE), $r(27) = .395$, $p < .05$. About 15% of the variance in the dyadic challenge task was explained by paternal marijuana use, $R^2 = .156$.

Maternal marijuana use had significant skewness, skewness = .419, SE = .249, and kurtosis, kurtosis = -1.497, SE = .493. Over 40% of the sample had a 0 value for maternal lifetime marijuana use (Figure 3). Paternal marijuana use also had significant skewness, skewness = .228, SE = .311, and kurtosis, kurtosis = -1.728, SE = .613. Over 35% of the sample had a 0 value and 30.5% of the sample had an 8 value for paternal lifetime marijuana use (Figure 4). Due to these results, a median split was performed on both maternal and paternal marijuana

use to divide the samples into two groups with the hope of reducing variability and better represent the relationship between marijuana use and dyadic interactions. Mothers who had a value of 0 – 1 were placed in the low lifetime marijuana use group and those with a value of 2 – 8 were placed in the high lifetime marijuana use group. Fathers who had a value of 0 – 2 were placed in the low lifetime marijuana use group and those with a value of 3 – 8 were placed in the high lifetime marijuana use group. For mothers, 48.9% were put into the group of 2 or fewer lifetime instances or marijuana use and 51.1% in the higher frequency group of 3+ lifetime instances. For fathers, 50.8% reported 5 or less instances of use and 49.2% were placed into the higher frequency group of 10+ instances of lifetime marijuana use.

Primary Analyses

Before analyzing dyadic affective patterns associated with high and low frequencies of marijuana use, a Kolmogorov-Smirnov Test of normality was conducted for the T2 variables and it was determined that none of the variables, except one measure of rigidity (DPE), were normally distributed (Table 1). Log and square root transformations of the variables were performed to meet assumptions of normality, however neither successfully satisfied normality. Thus, a nonparametric Mann-Whitney U for two-independent samples was performed to examine parental marijuana use (high vs. low) in relation to parent-child adaptive flexibility, negativity, and rigidity. A Mann-Whitney U test is appropriate for examining mean differences between groups when a normal distribution of variables is not assumed. Results demonstrated that maternal lifetime marijuana use and adaptive dyadic flexibility were negatively related, $U = 90$, $p = .01$. Mothers in the high use group had less dyadic adaptive flexibility than mothers in the low use group. There was a trend between maternal use and negativity, $U = 114.5$, $p = .069$ such that dyads with mothers in the high marijuana use group were less likely to transition from

positive affect into negative affect than those with low-use mothers. The relationship between paternal use and dyadic rigidity (DPE) was also statistically significant, $U = 47$, $p < .05$. For families with fathers in the high marijuana use group, their mother – child dyads exhibited increased rigidity compared to those with fathers in the low-use group.

Maternal depressive symptoms were significantly skewed so that 44.4% of participants had a 0 value. Thus, this variable was also split into two groups, 0 maternal depressive symptoms and 1+ depressive symptoms. To examine whether maternal depressive symptoms was related to maternal marijuana use, a Mann – Whitney U test was conducted with the maternal depressive symptom groups as the test variable and high and low frequency of maternal marijuana use as the grouping variable. This relationship was found to be statistically significant, $U = 795$, $p < .05$. A Mann-Whitney U test was performed to assess the relationship between maternal depressive symptoms and adaptive flexibility, negativity, and rigidity, however, no significant relationships were found. Using a Mann-Whitney U test, mother's ethnicity was examined to determine any relation to adaptive flexibility, negativity, and rigidity. Mother's ethnicity was significantly related to both measures of rigidity, DPE, $U = 47$, $p < .05$, and DPV, $U = 40$, $p < .05$, such that mothers belonging to an ethnic minority group showed increased rigidity compared to mothers of an ethnic majority.

A linear regression analysis was performed to assess maternal depressive symptoms as a covariate in the relationship between frequency of parental marijuana use and adaptive flexibility, negativity, and rigidity (Table 4). Higher levels of maternal lifetime marijuana use was related to lower levels of adaptive flexibility between mother and child, controlling for maternal depressive symptoms. After controlling for maternal depressive symptoms, higher levels of maternal marijuana use lost its trending relationship with decreased negativity.

Controlling for maternal depressive symptoms did not change the already insignificant relationship between maternal marijuana use frequency and dyadic rigidity. Maternal depressive symptoms was found to have a confounding relationship on the accociations between father's marijuana use frequency and the T2 variables (Table 6). Higher levels of paternal marijuana use was no longer significantly related to increased rigidity, DPE, after controlling for maternal depressive symptoms. Controlling for maternal depressive symptoms did not change the already insignificant relationships between paternal marijuana use frequency and adaptive flexibility or negativity.

Mother's ethnicity was also included as a covariate in this analysis, but showed no significant main effects on the relationship between maternal marijuana use and mother-child interaction outcomes (Table 5). Higher levels of paternal lifetime marijuana use was not related to higher levels of dyadic rigidity, DPE, between mother and child, after controlling for mother's ethnicity (Table 7). Mother's ethnicity showed no significant effects on the relationship between paternal marijuana use and the DPV measure of rigidity, adaptive flexibility, or rigidity.

I considered that the examination of adaptive flexibility rested on the assumption that dyads had the opportunity to visit the negative region of the SSG. Therefore to inform the prior findings, I examined whether visits to the negative region of the SSG differed overall between the high and low marijuana use groups. Dyads were split into two groups: those who had any visits to the negative region of the SSG, and those who had no visits to the negative region. A Chi-square test was run to test the relation between the higher frequency of maternal lifetime marijuana use and whether or not dyads entered negative affective states. Another Chi-square test was performed to examine relationships between the higher frequency of maternal lifetime marijuana use and the frequency of visits to positive regions for dyads. No significant

relationships were identified. Thus, the prior findings that higher maternal marijuana use was related to lower levels of adaptive flexibility was not driven by the fact that dyads with higher-use mothers were less likely to enter the negative region of the SSG.

Chapter 4: Discussion

The purpose of this study was to explore a deeper understanding of parental lifetime marijuana use and the association it has with mother-child dyadic interactions. As legalization of recreational marijuana use increases nationally, and young parents continue to increase frequency of use (National Survey of Drug Use and Health, 2015; von Sydow et al., 2001), more research is needed on the influence parental marijuana use has on the family and on parent-child interactions specifically. Although research supports the presumption that there are negative outcomes for children whose parents use marijuana (Riggs et al., 2009), there is a general paucity of research on the association marijuana has on dyadic interactions within the family. Previous research has demonstrated the negative and lasting impacts parents have on their children when they use and abuse other illicit substances (Kumpfer & Bluth, 2004), and the current study found similar associations with parental marijuana use.

Dynamic systems methods were used in the present study to model interaction patterns as they have been shown to be an effective way to assess dynamic dyadic processes (Lunkenheimer et al., 2013). The main hypothesis for this study was that higher levels of parental lifetime marijuana use would be associated with increased negativity and reduced adaptive flexibility in parent-child interactions. This study also examined whether parents who reported more frequent marijuana use would exhibit increased rigidity during parent-child interactions. These hypotheses were motivated by previous research which demonstrated that when fathers abuse alcohol they exhibit increased negativity and less positive involvement (Kelley et al., 2015), and that mothers who abused substances were shown to have inconsistent parenting and discipline styles (Barnard & Mckeganey, 2004) as well as reduced maternal warmth (Riggs et al., 2009).

Some of the present findings supported these hypotheses. Mothers who reported higher frequencies of marijuana use had significantly reduced dyadic adaptive flexibility. In other words, mothers who used higher levels of marijuana had fewer visits to the positive region of the state space grid, reflecting reduced warmth or positivity, during dyadic interactions. This finding highlights the potential long-term maladaptive implications of reduced flexibility in marijuana using parents, some of which being future internalizing and externalizing behaviors in their children (Hollenstein et al., 2004). Dyads with higher-use mothers also had a trend related to reduced negativity. While this trend contradicts my hypothesis that increased maternal use would result in greater negativity during dyadic interactions, these findings were only marginally significant. Dyads with mothers with higher lifetime marijuana use seemed to appear less likely to enter either positive or negative affective states, reflecting greater time spent in neutral affective states, however, I did not find definitive proof or significance to fully support that claim. While there is a trend, and mothers and their children in this study may display less negative affect with each other, they do significantly exhibit less positive behaviors. Based on previous research, the greater time spent in neutral affect could reflect that parents are less emotionally available, which could be a potential risk factor for children's internalizing and externalizing behaviors (Van Loon et al., 2014). While more research needs to be conducted, this finding could be potential evidence for the notion that parents who use marijuana are less physically and emotionally responsive to their children (Barnard & Mckeganey, 2004).

Paternal marijuana use was significantly related to rigidity during mother-child dyadic interactions. This is important given the relationship between dyadic rigidity and the transmission of risk (Granic & Lamey, 2002). Dyads in which the father reported higher lifetime marijuana use more often became "stuck," with each affective state lasting much longer than in

those dyads where the father had a lower frequency of marijuana use. Since fathers are part of the family system, it is supported by research that their substance use impacts the mother-child dyad (Burns et al., 1997). When fathers have problems with substance abuse, they can require additional attention from the mother, thus taking attention away from the child (Burns et al., 1997). Marijuana use has also been shown to be related to increased partner aggression for both men and women, resulting in adverse effects for the whole family system (Moore et al., 2008). When either parent uses substances, they disrupt the entire family system, by increasing negative urgency and overall chaos (Kelley et al., 2015; Pang et al., 2014).

The relationship between marijuana use and depressive symptoms found in this study is consistent with other research, further supporting theoretical presuppositions (Hall & Degenhardt, 2014). While depression and marijuana use were related, when run as a covariate, maternal depressive symptoms did not statistically significantly show in the model variable on the interactions between maternal marijuana use and adaptive flexibility, negativity, and rigidity. The statistically significant relationship between increased maternal marijuana use and reduced adaptive flexibility remained when maternal depressive symptoms were included. The trend between increased maternal marijuana use and reduced negativity disappeared completely after including maternal depressive symptoms as a covariate and the relationship between maternal marijuana use and dyadic rigidity remained insignificant. Maternal depressive symptoms were also not independently related to any of the T2 mother-child interaction variables of adaptive flexibility, negativity, or rigidity. This finding somewhat contradicts previous research that demonstrated an attraction to negative states for dyads where the mother had higher levels of depressive symptoms (Lunkenheimer, et al., 2013). Maternal depressive symptoms were found to have a confounding relationship with the association between increased parental marijuana use

and increased mother – child rigidity. After including maternal depressive symptoms, that relationship disappeared.

Mother's ethnicity was also run as a covariate since marijuana use has been found to have different rates of use and abuse across ethnicities (Pacek, Malcolm, & Martins, 2012), which could contribute to variance in the mother – child interactions. Mother's ethnicity was not found to have a relationship with the associations between maternal marijuana use and adaptive flexibility, negativity, and rigidity, when run as a covariate. However, mother's ethnicity did negate the relationship between paternal marijuana use and rigidity in the mother – child dyadic relationship, when run as covariates. Ethnicity of the mother did not change the relationships between paternal marijuana use and adaptive flexibility and negativity, however, there was never found to be a significant relationship between those, with or without covariates.

It was determined that the frequency of maternal and paternal lifetime marijuana use was significantly related to one another. This demonstrates that co-parents tended to have more similar frequencies of lifetime use. When both parents use marijuana, this could exacerbate the risk for children's negative outcomes. A child with two parents who use marijuana regularly could experience more inconsistent parenting from both parents, which could be a risk factor for behavior problems and/or insecure or disorganized attachment (Barnard & Mckeganey, 2004).

Implications for Intervention

The purpose of this study was to gather a better understanding of the association between parental marijuana use and mother-child dyadic interactions, with an interest in understanding its implications for family interventions. Considering that parents with young children are showing these effects related to lifetime marijuana use, this suggests it does not require regular marijuana use for parent-child dyads to show less positivity in typical interactions. Thus, intervening early

with education programs, in order to prevent higher levels of lifetime use, could be an important starting point. Creating and implementing effective programs in middle and high schools would be a beneficial point of entry to begin educating individuals in hopes of delaying age of initiation and overall frequency of lifetime use, given their known negative long term associations (Battistella et al., 2014; Hall & Degenhardt, 2014). By reaching adolescents, there is the potential of reducing or eliminating the long term effects of marijuana use before they even become parents.

For parents who currently use marijuana, or have used significant amounts in the past, therapeutic interventions like Parent Child Interaction Therapy (PCIT) could prove beneficial and could be recommended to increase parental warmth and adaptive flexibility with which past research and the current study have shown to be negatively associated with parental drug use (Riggs et al., 2009). PCIT involves a therapist observing the mother-child or father-child dyad as they engage in play (PCIT, n.d.). The therapist typically observes from behind a one-way mirror and instructs the parent on how to therapeutically engage with their child using a "bug-in-ear" system (PCIT, n.d.). PCIT is evidence based and has been shown to foster more adaptive and responsive interactions between parents and children (PCIT, n.d.), which may benefit marijuana using parents and their interactions with their children. Therapists, in the moment, can tell parents when they need to respond to their child, how to show warmth, and how to be consistent with parenting. PCIT has been shown to significantly reduce behaviors in parents that lead to internalizing and externalizing behaviors in their children (Chase & Eyberg, 2008), creating more adaptive long-term outcomes.

Limitations and Implications for Future Research

While some interesting findings were discovered, there were significant limitations that should be addressed in future studies. The self-report measures of marijuana use lacked items related to age of initiation and frequency of use during critical ages and periods of brain development, such as adolescence. The limited data categorization likely impacted results by not allowing small effects to be discovered. Increasing the sample size of the participants would give the study more power and would determine if trends were significant and could allow for more normal distribution of variables. Using self-report measures is another limitation in this study. Social biases could cause parents to under-report marijuana use if they feared they would face judgment or negative attitudes if reporting high levels of past or present use.

The findings from this study raise an interesting question regarding dyadic interactions and flexibility; is it more adaptive for dyads to go into a maladaptive or negative region and then repair, by both moving into a neutral or adaptive region, together, or to never go into the negative region at all? Although dyadic flexibility has been shown to be related to favorable outcomes in children (Hollenstein et al., 2004; Lunkenheimer et al., 2013; Lunkenheimer et al., 2011), there appears to be a gap in the research addressing maladaptive flexibility, i.e., flexible interactions with a high occurrence of visits and events that take place predominantly in negative affective regions. Future research should examine negative affective spaces, and concepts such as chaotic negativity, to determine if it is more or less beneficial for the dyad than rigidity in neutral affective states, especially with parents who use marijuana frequently.

Future studies should also include father-child dyadic interactions. Studying father-child dyads would allow researchers to examine direct associations of paternal marijuana use instead of having to look at indirect associations of paternal use on mother-child dyads. Paternal

depressive symptoms and father's ethnicity could also be included to further examine if confounding relationships exist. Expanded measures, especially those related to parental marijuana use, would be advised for others looking to explore this area further. Specifically, measures should look at age of initiation, levels of use during critical phases of brain development, and reasons for use. Those measures could give researchers broader insight into the associations and potential impacts of parents' marijuana use.

Table 1. Descriptive Data

	Mean	SD	Range	Skewness	Kurtosis	K-S (D)
Time 1 variables						
1) Maternal depressive symptoms (n=117)	1.57	1.96	0-8	1.34	1.28	.25**
2) Maternal marijuana use (n=94)	3.00	3.12	0-8	.419	-1.50	.24**
3) Paternal marijuana use (n=59)	3.63	3.46	0-8	.228	-1.73	.21**
Time 2 variables						
1) Rigidity - DPE (n=42)	2.45	.579	1-4	.769	.252	.13
2) Rigidity - DPV (n=42)	12.41	10.44	3-61	3.00	11.14	.23**
3) Adaptive Flexibility (n=41)	5.54	4.91	0-17	.718	-.750	.21**
4) Negativity (n=41)	21.20	22.61	0-104	1.60	3.17	.20**

* = $p \leq .05$; ** = $p \leq .01$.

Table 2. Summary of Means

	Maternal Use				Paternal Use			
	Low		High		Low		High	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Rigidity - DPE	2.45	.50	2.45	.59	2.22*	.42	2.58*	.52
Rigidity - DPV	11.26	8.27	13.80	12.37	11.81	10.69	14.54	13.67
Adaptive Flexibility	7.44*	5.01	3.73*	4.12	5.55	5.32	5.00	5.01
Negativity	28.00ǂ	25.76	16.77ǂ	20.68	18.00	18.24	22.67	29.84

* = $p \leq .05$; ** = $p \leq .01$.; ǂ = $p < .07$

Table 3. Mann – Whitney U: Marijuana use and T2 variables

	Maternal Marijuana Use		Paternal Marijuana Use		Child's Race		Mother's Race	
	U	p value	U	p value	U	p value	U	p value
Rigidity - DPE	175.00	.747	47.00	.037*	105.00	.230	47.00	.037*
Rigidity - DPV	152.00	.333	54.00	.083	92.00	.106	40.00	.017*
Adaptive Flexibility	90.00	.010**	77.00	.799	138.50	.975	93.00	.835
Negativity	114.50	.069ǂ	80.50	.919	137.00	.949	90.50	.747

* = $p \leq .05$; ** = $p \leq .01$.; ǂ = $p < .07$

Table 4. Linear Regression: Maternal Marijuana use with Depressive Symptoms as a Covariate

	Rigidity – DPE		Rigidity – DPV		Adaptive Flexibility		Negativity	
	B	SE	B	SE	B	SE	B	SE
(Constant)	2.56**	.14	12.47**	2.86	7.43**	1.22	28.72**	6.19
Maternal Marijuana Use	.03	.17	2.85	3.49	-3.71*	1.52	-10.82	7.73
Maternal Depressive Symptoms	-.08	.04	-.86	.82	.005	.37	-.64	-.64

* = $p \leq .05$; ** = $p \leq .01$

Table 5. Linear Regression: Maternal Marijuana Use with Mother's Ethnicity as a Covariate

	Rigidity – DPE		Rigidity – DPV		Adaptive Flexibility		Negativity	
	B	SE	B	SE	B	SE	B	SE
(Constant)	2.93**	.24	22.55**	4.72	7.66**	2.15	35.13**	10.86
Maternal Marijuana Use	-.02	.18	1.54	3.40	-3.23*	1.57	-9.44	7.95
Mother's Ethnicity	-.56*	.23	-12.58**	4.53	-.85	2.06	-10.90	10.40

* = $p \leq .05$; ** = $p \leq .01$

Table 6. Linear Regression: Paternal Marijuana use with Maternal Depressive Symptoms as a Covariate

	Rigidity – DPE		Rigidity – DPV		Adaptive Flexibility		Negativity	
	B	SE	B	SE	B	SE	B	SE
(Constant)	2.30**	.14	13.18**	4.30	6.09**	1.77	21.47*	8.75
Paternal Marijuana Use	.266	.166	2.59	5.07	-.32	2.12	5.84	10.51
Maternal Depressive Symptoms	-.04	.04	-.72	1.14	-.35	.50	-2.25	2.49

* = $p \leq .05$; ** = $p \leq .01$

Table 7. Linear Regression: Paternal Marijuana Use with Mother's Ethnicity as a Covariate

	Rigidity – DPE		Rigidity – DPV		Adaptive Flexibility		Negativity	
	B	SE	B	SE	B	SE	B	SE
(Constant)	2.45**	.29	26.49**	7.34	3.90	3.33	25.10	16.33
Paternal Marijuana Use	.33	.20	-2.38	5.13	.30	2.35	4.10	11.55
Mother's Ethnicity	-.29	.25	-14.36*	6.43	1.20	2.88	-9.80	14.14

* = $p \leq .05$; ** = $p \leq .01$

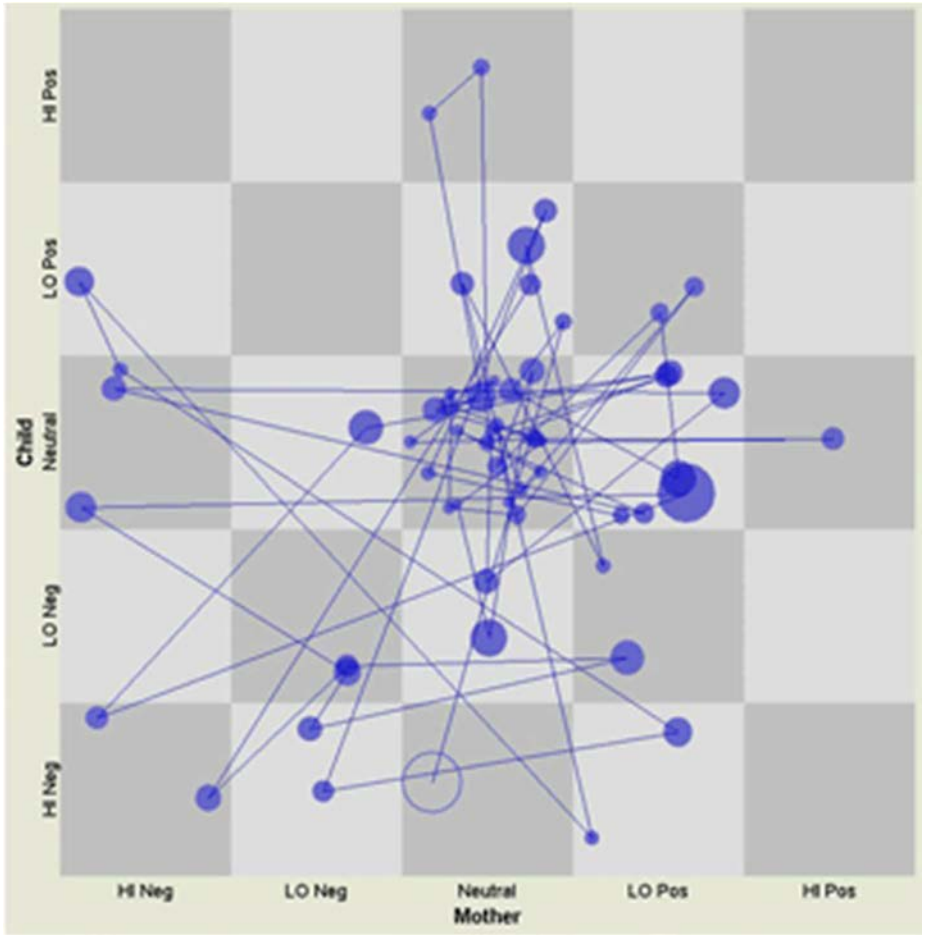

Figure 1. Example of a State Space Grid: A sample state space grid of dyadic interaction from one mother – child dyad. Circles at the vertices represent durations per events and visits with larger circles representing increased durations (Department of Psychology, n.d.).

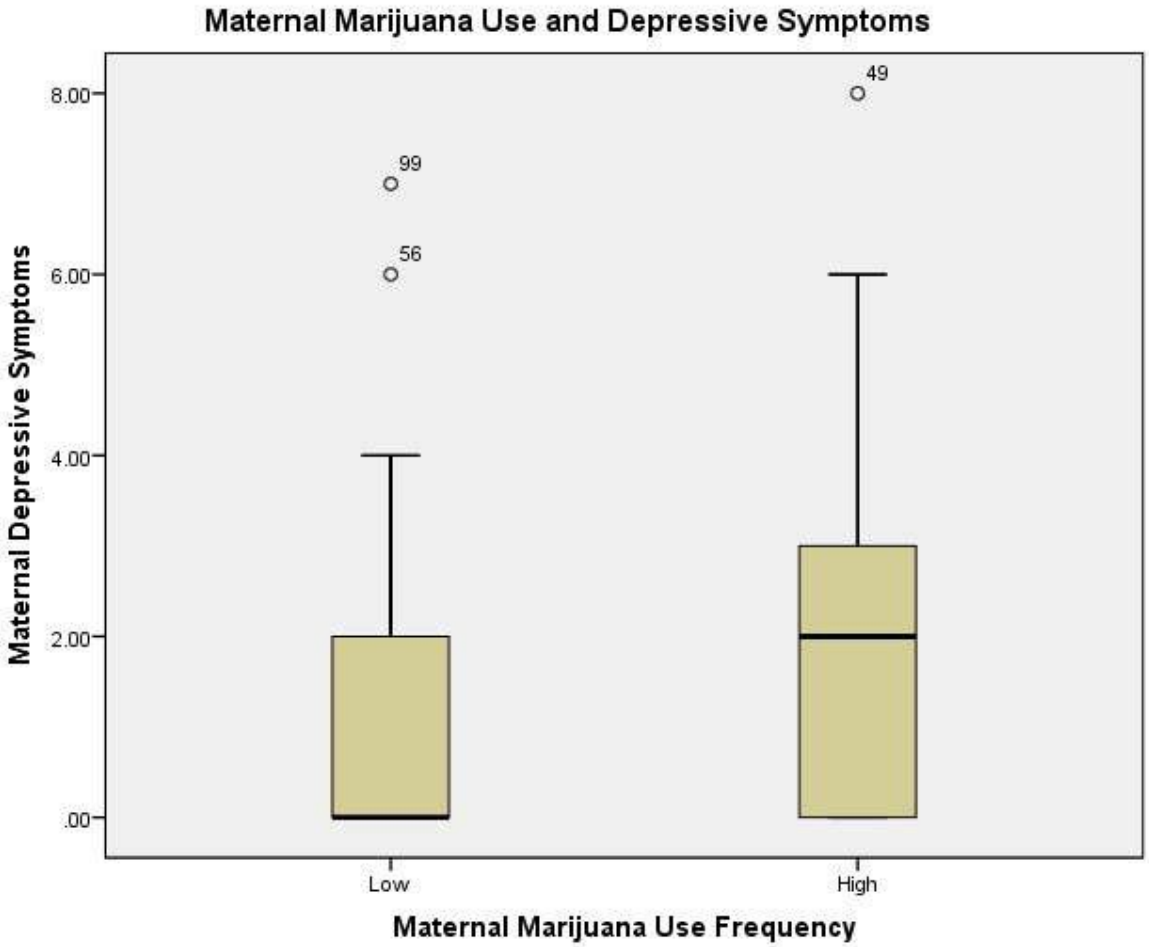

Figure 2. Maternal Marijuana Use and Depressive Symptoms: Maternal marijuana use frequency was significantly related to maternal depressive symptoms with high use mothers reporting higher levels of depressive symptoms.

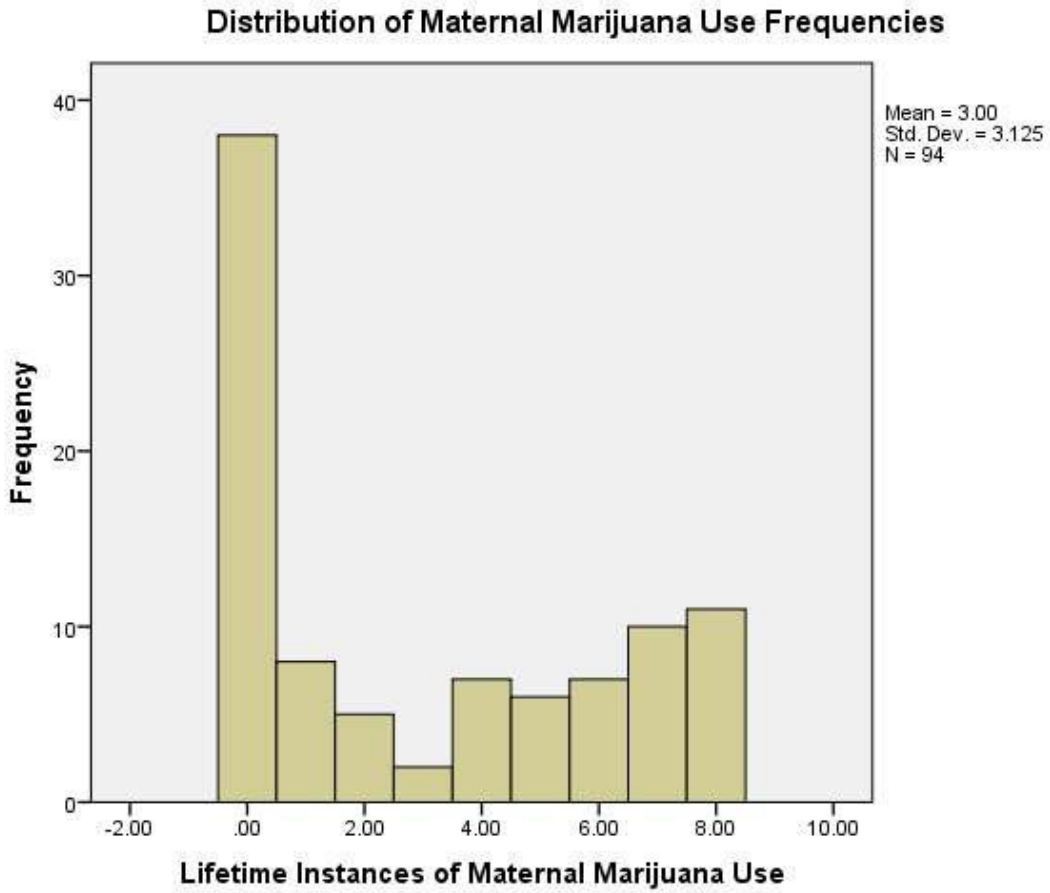

Figure 3. Distribution of Maternal Marijuana Use Frequencies: Histogram showing distribution of frequencies of lifetime instances of maternal marijuana use.

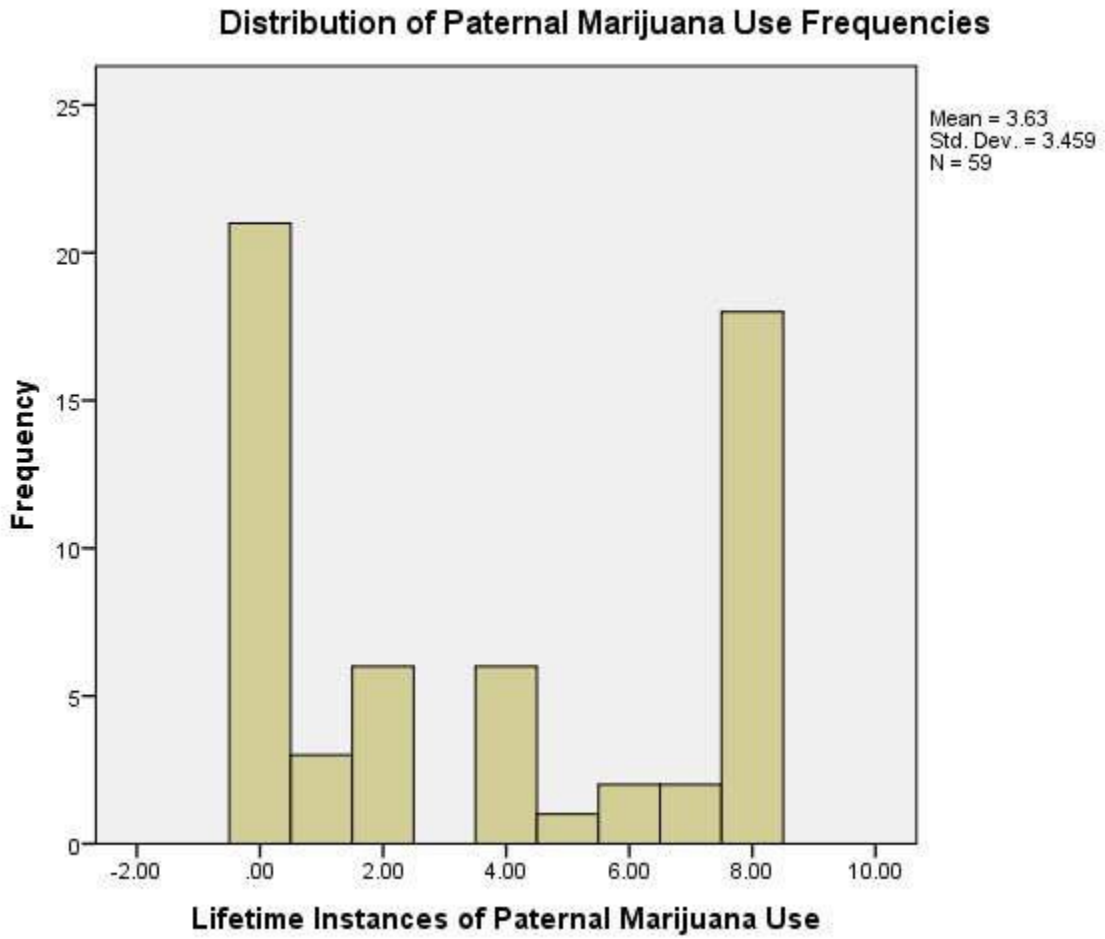

Figure 4. Distribution of Paternal Marijuana Use Frequencies: Histogram showing distribution of frequencies of lifetime instances of paternal marijuana use.

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