Exploring the Characteristics of Medical Marijuana Users and the Relationship between Medical Marijuana Use and Criminal Involvement among Arrestees in Maricopa County, Arizona

by

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ABSTRACT

Although prior research has identified negative consequences from marijuana use, some states are legalizing marijuana for medical use due to its medical utility. In 2010, the State of Arizona passed medical marijuana legislation, yet, to date, little research has been published about the specific population characteristics of medical marijuana users or their criminal activity. The purpose of this study is to present the characteristics of medical marijuana users and examine the relationship between medical marijuana use and crime, including substance use, by comparing four groups which are medical marijuana users with authorized medical marijuana ID card (authorized medical marijuana users, AuMM users), medical marijuana users without authorized medical marijuana ID card (non-authorized medical marijuana users, NonAuMM users), illegal marijuana users without authorized medical marijuana ID card (non-authorized marijuana users, NonAuM users), and non-marijuana users (Non-users). Data were collected from a sample of recently booked arrestees in Maricopa County, Arizona through the Arizona Arrestee Reporting Information Network (AARIN) project. A total of 2,656 adult arrestees participated in the study. Findings show that authorized medical marijuana users were more likely to be male, younger, and high school graduates. Medical marijuana users, on average, were likely to acquire more marijuana and spend more money on obtaining marijuana compared to non-authorized marijuana users. Whereas the authorized medical marijuana users had a higher probability for DUI and drug selling/making than non-marijuana users, non-authorized medical marijuana users had a higher probability for involvement property crime, violent crime, DUI, and drug

selling/making than non-marijuana users. Authorized medical marijuana users were less likely to use meth compared to non-authorized medical marijuana users and non-authorized marijuana users. This study suggests that it is important to recognize the non-authorized medical marijuana users under medical marijuana policy as well as the DUI regulations and medical insurance.

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CHAPTER 1

INTRODUCTION

Marijuana, also known as cannabis, has an approximately 5000-year history of medical use throughout the world (Pertwee, 2006) and has been used as a traditional medical remedy in Asian countries, Africa, ancient Greece, and medieval Europe (Cohen, 2009). Recently, however, the debate on medical marijuana has been passionately presented in the United States. Marijuana is the most frequently used illicit substance, and marijuana abuse and dependence are highly prevalent in the United States (American Psychiatric Association, 2000; Johnston, O'Malley, Bachman, & Schulenbery, 2010). In 1970, the United States Congress created a series of five schedules establishing varying degrees of control over substances under the federal Controlled Substances Act (Kampia & Thomas, 1996). Marijuana is classified as a Schedule I drug, which means that (1) it has a high potential for abuse, (2) it has no currently accepted medical use in treatment in the United States, and (3) there is a lack of accepted safety for its use under medical supervision (Gerber, 2004). In addition, chronic and/or regular use of marijuana is associated with the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) diagnoses of marijuana use disorders (Grant & Pickering, 1998). Such disorders are associated with negative consequences, such as unemployment, personality dysfunction, crime, respiratory problems, and other psychiatric disorders (Budney & Moore, 2002; Hall & Lynskey, 2009; Hasin, Keyes, Alderson, Wang, Aharonovich, & Grant, 2008; Pedersen & Skardhamar, 2010; Taylor, Poulton, Moffitt, Ramankutty, & Sears, 2000). A recent meta-analysis pointed to an association between marijuana use and criminal

involvement, although the marijuana and crime association was not as strong as the relationship between crime and other illegal substances, such as amphetamines, cocaine, and opiates (Bennett, Holloway, & Farrington, 2008).

Some researchers emphasize its medical benefit and argue that marijuana is safe and efficacious for treating serious illnesses (Abrams, Jay, Shade, Vizoso, Reda, Press, Kelly, Rowbotham, & Petersen, 2007; Corey-Bloom, Wolfson, Gamst, Marcotte, Bentley, & Gouaus, 2012; Ware, Wang, Shapiro, Robinson, Ducruet, Huynh, Gamsa, Bennett, & Collet, 2010). Clinical research shows that marijuana reduces chronic pain, nausea, vomiting, muscle spasms, and loss of appetite (Eddy, 2010; Marmor, 1998; Martinz, 2000; Watson, Benson, & Joy, 2000). Marijuana can be used to treat the side effects of chemotherapy, as well as the symptoms of Acquired Immunodeficiency Syndrome (AIDS), multiple sclerosis, epilepsy, glaucoma, and other serious illnesses (Martinz, 2000). People also argue that there is no documented evidence of non of death resulting from marijuana use, even in large doses, and it is less addictive than other legal drugs, such as alcohol or nicotine (Rosenthal & Kubby, 2003). Recently, several studies have found that marijuana can be used to treat other substance abuse/dependence (e.g., alcohol, prescription drugs, or opiates) as it is perceived to be a safer option than the substances on which individuals were formerly dependent (Cohen, 2009; Reiman, 2009).

Given the medical utility of marijuana, many states have started to consider medical marijuana legalization. In April 2014, Maryland became the 21st state, along with the District of Columbia, to enact a medical marijuana law (ProCon.org, 2014). More states, including New York and Pennsylvania, have recently considered medical

marijuana legalization (Anderson, Hansen, & Rees, 2013); and Washington and Colorado recently legalized recreational marijuana. In 2010, the State of Arizona passed medical marijuana legislation, and the Arizona Department of Health Services (ADHS) began to provide identification cards for qualifying patients, in addition to allocating dispensary registration certificates. The number of qualifying patients and legal marijuana dispensaries has expanded rapidly.

Despite the increasing support for medical marijuana, controversial issues related to legalizing medical marijuana use still exist in terms of social contexts, especially in terms of the crime. Opponents of medical marijuana legalization argue that legalizing medical marijuana will lead to increase a crime. For example, some people who have medical marijuana ID cards can acquire marijuana for non-medical purposes and abuse it. Medical marijuana dispensaries can also be one of the supply sources for recreational use or other criminal activities (e.g., theft, burglary, or robbery at dispensaries). This possibility can lead to an illegal marijuana trade between medical marijuana ID card holders and people who want to access marijuana more easily. Physical fights can occur during such transactions. Vickovic (2011) examined articles describing medical marijuana-related crimes and found that 61.5% (8 of 13) them of focused on either a robbery or murder. He also found that several of these articles described criminal victimization among medical marijuana users because they possessed medical marijuana plants.

Meanwhile, proponents of medical marijuana legalization argue that legalizing medical marijuana can control marijuana-related crime. For example, the legalization of

medical marijuana allows people to obtain marijuana in legitimate ways and avoid involvement in dangerous, illicit marijuana marketplaces (O'Brien, 2013). It will also help individuals who might not have connections to the illegitimate economy (e.g., illegal drug dealers) to attain economic legitimacy (O'Brien, 2013) as people can work at a regulated dispensary system.

However, little is known about the characteristics of those who use medical marijuana, including those who illegally use medical marijuana, and there is little published research about the relationship between medical marijuana use and criminal involvement. The purpose of this study is to examine the characteristics of medical marijuana users who were arrested in Maricopa County, AZ and to examine the relationship between the types of marijuana use and criminal involvement.

As more states are considering medical marijuana legalization, this study will provide a practical explanation of particular social perspectives that need to be considered in the dialogue over legalizing medical marijuana. Chapter 2 will present the literature review, which includes an introduction of medical marijuana, a modern history of medical marijuana legalization in the United States, and a discussion indicating the characteristics of marijuana users in prior empirical research. The crime-related literature will also be discussed. Chapter 3 describes the study methodology including a description of the data collection process, sample, the process for coding variables, and the analytic strategy. In Chapter 4, the results of bivariate and multivariate analyses are presented. Finally, the findings and policy implications of the study are discussed, as well as the limitations of this study and suggestions for future research in Chapter 5.

CHAPTER 2

LITERATURE REVIEW

Medical Marijuana (Cannabis)

According to the National Institute on Drug Abuse (NIDA, 2012), "medical-grade" marijuana sold in legitimate dispensaries is the same quality and carries the same health effects as "street" marijuana, which is generally recognized as a narcotic drug with high potential for abuse. Although medical marijuana and street marijuana are physically the same substance, they can affect people differently, based on their usage patterns and motivations for marijuana use. It is important to understand the fundamental function of marijuana in the human body based on scientific evidence in order to assess its safe and efficacious uses.

Marijuana is a product of the Cannabis Sativa plant and contains more than 400 other chemical compounds that can be biologically active (NIDA, 2012). The main active ingredient of cannabis is delta-9-tetrahydrocannabinol (THC); marijuana usually contains 10% to 25% THC. When THC is ingested by the human body, it mimics endocannabinoids which are naturally produced in the body and play an important role in normal brain development and function. The insights about endocannabinoids have begun helping researchers design treatments to deploy the medicinal properties of the marijuana plant. Endocannabinoids activate specific molecular targets on brain cells, called cannabinoid receptors that influence pleasure, memory, thinking, concentration, sensory, and coordinated movement (NIDA, 2012). A marijuana overdose can lead to the over-activation of the endocannabinoid system, which can cause negative brain

functioning, including distorted perception, difficulty thinking, and disrupted learning and memory (NIDA, 2012).

Cannabinoid drugs, under the appropriate medical supervision, may offer a broader spectrum relief than any other single medication (Jackson, 2013). The cannabinoid receptors in the brain stem and spinal cord play a role in pain control; clinical research has demonstrated the analgesic efficacy of cannabis (Abrams et al., 2007; Ellis, Toperoff, Vaida, Brande, Gonzales, Gouaus, Bently, & Atkinson, 2009; Wilsey, Marcotte, Tsodikov, Millman, Bently, Gouaus, & Fishman, 2008). Abrams et al. (2007) conducted experimental research with a randomized placebo-controlled trial to examine the effect of smoked marijuana on the neuropathic pain of HIV-associated sensory neuropathy. The study found that participants who smoked marijuana felt more reduced daily pain than participants in the placebo group. Over a 5-day inpatient intervention period, greater than 30% reduction in pain was reported by 52% in the cannabis group and by 24% in the placebo group. No serious adverse effects were reported. In addition, Wilsey et al. (2008) found that cannabis reduced pain unpleasantness, as well as its intensity, among the participants with complex regional pain syndrome (CRPS type I), spinal cord injury, peripheral neuropathy, or nerve injury.

The cannabinoid receptors also play a role in controlling the vomiting reflex, appetite, and emotional responses. Meiri, Jhangiani, Vredenburgh, Barbato, Carter, Yang and Baranowski (2007) conducted a placebo-controlled study and found that the synthetic form of THC (Dronabinol) reduced nausea and vomiting among patients who were receiving chemotherapy; the absence of nausea and vomiting/retching were significantly

greater in patients treated with dronabinol (54%) than patients in the placebo group (20%). Walsh, Kirkova, and Davis (2005) conducted a study to research the effects of dronabinol on anorexia among cancer patients and found that dronabinol improved appetite in almost 50% of patients. A recent study conducted by Greer, Grob, and Halberstadt (2014) evaluated the effects of cannabis on PTSD symptoms among patients who were in the New Mexico Department of Health's Medical Cannabis Program for PTSD. The authors found that patients reported a greater than 75% reduction in the Clinician Administered Posttraumatic (CAPS) Scale for DSM-IV symptom scores when they were using cannabis compared to when they were not.

Given these medicinal properties, cannabis has been used to treat the debilitating symptoms of cancer and cancer chemotherapy, AIDS, multiple sclerosis, epilepsy, glaucoma, and anxiety. In the United States, there are three FDA-approved pharmaceutical drugs based on cannabis: Sativex, Dronabinol (Marinol), and Nabilone (Cesamet) (Pisanti, Malfitano, Grimaldi, Santoro, Gazzerro, Laezza, & Bifulco, 2009). Sativex, which is a combination of THC and cannabidiol (CBD), is derived from natural extracts of the cannabis plant. It is approved in several countries, including the UK, Spain, Canada, Denmark, Germany, Sweden, Austria, Italy, and Switzerland, as adjunctive treatment for the symptomatic relief of neuropathic pain in multiple sclerosis and in cancer. Dronabinol, a synthetic form of THC and Cesamet, a synthetic THC analogue, are currently used for chemotherapy-induced nausea and vomiting in patients who have failed to respond adequately to conventional anti-emetic compounds. Dronabinol is also approved for the treatment of anorexia associated with AIDS. Although empirical

research revealed the effectiveness of cannabis on chronic illnesses, medical marijuana use has been an ongoing issue, and regulation of marijuana have been debated in the United States for decades.

Modern History of Medical Marijuana Legalization in the United States

From 1850 to 1941, marijuana was listed in the United States Pharmacopeia and National Formulary (NF) and was used for medical purposes in the United States (Gianutsos, 2010). However, in 1937, the Marijuana Tax Act—the first federal regulation directly concerned with marijuana—was passed after research indicated a link between marijuana smoking and deviant behaviors; this act prohibited marijuana use for recreational purposes (Aderson, Hansen, & Rees, 2013). Yet medical use of marijuana remained acceptable, with permission from physicians and pharmacists, who could prescribe or dispense marijuana after registering and paying a substantial tax (Gianutsos, 2010). Following the Marijuana Tax Act, more laws were established to control marijuana use by imposing harsher penalties, including the Boggs Act (1951) and the Narcotic Control Act (1956). In 1970, Congress enacted the Comprehensive Drug Abuse Prevention and Control Act, also referred to as the Controlled Substances Act, which categorized marijuana as a Schedule I controlled substance. Under this act, marijuana could no longer be prescribed legally by physicians or pharmacists. However, some individuals subsequently recommended the decriminalization of marijuana due to its

unique medical benefits. As a result, many legal battles related to medical marijuana have taken place.[1]

In 1985, the Food and Drug Administration (FDA) approved a pill form of a synthetic version of THC, the medically beneficial component of marijuana, for use in treating vomiting, nausea, and rapid weight loss in AIDS patients. Many patients complained about problems with the synthetic THC (e.g., difficulty in taking the pill orally) and reported significantly better effects in controlling pain and nausea from natural marijuana. Indeed, some of them preferred to use marijuana illegally (Bergstrom, 1997). In 1972, the first petition was filed with the Bureau of Narcotics and Dangerous Drugs (BNDD, now the U.S. Drug Enforcement Administration (DEA) to reschedule marijuana. This petition called for the removal of marijuana from the Controlled Substance Act or reclassification of it as a Schedule V drug—the least restrictive category. However, the petition was rejected. In 1994, the call for marijuana rescheduling from Schedule I to Schedule II was also denied in *Alliance for Cannabis Therapeutics v. Drug Enforcement Administration.* Despite such efforts, marijuana remains a Schedule I drug (Bergstrom, 1997).

Yet since 1996, some states have legalized marijuana as a medicine, and more states are considering the legalization of medical marijuana. In 1996, California became the first state in the United States to legalize medical marijuana use when it passed the

[1] In *State v. Diana*, a man convicted of marijuana possession was allowed to establish that marijuana had a beneficial effect on the symptoms of multiple sclerosis (State, 1979). In *United States v. Randall*, the defendant grew marijuana plants to treat his glaucoma (United States, 1976). In *Jenks v. State*, a couple from Florida was charged with cultivating marijuana plants in their home to treat their AIDS-related symptoms (Jenks, 1991). In all these legal cases, the court acknowledged the special importance of the defendants' right to preserve and protect their own health and bodies.

Compassionate Use Act and removed criminal penalties for using, possessing, and cultivating medical marijuana. People are allowed wide latitude for its use, with permission from their physicians or healthcare professionals. They can use medical marijuana for any serious medical illnesses or any other illness for which marijuana provides relief, including emotional conditions (O'Connell & Bou-Matar, 2007). Maryland recently became the 21st state, along with the District of Columbia, to enact a medical marijuana law. More states, including New York and Pennsylvania, have also recently considered medical marijuana legalization (ProCon.org, 2014).

States have adopted medical marijuana laws with their own specific restrictions in terms of qualifying clinical conditions, possession limitations, and registration fees. For example, states such as Connecticut, Delaware, New Mexico, and Oregon allow the use of medical marijuana to treat mental illnesses (e.g., PTSD), whereas others only allow it for physical symptom relief. Possession limits vary from 1 ounce and 6 plants in Alaska to 24 ounces and 24 plants in Oregon. The registration fees also differ from no cost in New Mexico to $200 in New Jersey. Six states—Arizona, Maine, Michigan, Nevada, New Hampshire, and Rhode Island—accept other states' registry ID cards. Medical marijuana laws might vary, but the states do share some common regulations. For example, all states require dispensaries to install specific security equipment to deter and prevent unauthorized access to medical marijuana, and juvenile patients have to have a designated caregiver, who is at least 21 years old, who can assist with patients' medical use of marijuana.

In November 2012, Washington and Colorado passed voter-initiated legalization of recreational marijuana use (Room, 2013). Adults 21 years old or older can obtain marijuana in both states without legal restrictions. Although some efforts in both states have sought to prevent potential risks associated with marijuana use, the subject remains a hot topic for debate. Moreover, it is unclear whether recent marijuana legalization will decrease or increase crime rates.

Medical Marijuana in Arizona

In November 2010, Arizona passed medical marijuana legislation, becoming the fourteenth state to adopt a medical marijuana law. The Arizona Department of Health Services (ADHS) published it final rules, and the Medical Marijuana Act went into effect in 2011. In December 2012, the first dispensary opened. Arizona requires that individuals who want to obtain medical marijuana apply for certification or a registry identification card (ADHS, 2013). The Arizona Medical Marijuana Act also limits the number of dispensaries and has the support of the various medical boards.

ADHS is responsible for issuing registry identification cards for qualifying patients. Medical marijuana patients must have written certification from two separate physicians confirming diagnosis of the patient's qualifying debilitating medical condition, which must include one of the following illnesses: cancer, glaucoma, positive status for human immunodeficiency virus, AIDS, hepatitis C, amyotrophic lateral sclerosis, Crohn's disease, agitation of Alzheimer's disease, cachexia, chronic pain, nausea, seizures, and muscle spasms (ADHS, 2013). According to the Arizona Medical Marijuana Act (AMMA) end of year report, as of 2014, Arizona had 50,073 active

cardholders: 48,301 are qualifying patients, 597 are designated caregivers, and 1,175 are dispensary agents (ADHS, 2014).

Qualifying patients are allowed to obtain 2.5 ounces of marijuana every 14 calendar days from a licensed dispensary. They can grow their own marijuana (up to 12 plants) in an enclosed, locked facility if they live more than 25 miles from a licensed dispensary. As of 2014, 4,323 qualifying patients and 402 designated caregivers were authorized to cultivate marijuana. They also can "give" (cannot receive any compensation) usable marijuana and marijuana plants to dispensaries (ADHS, 2013).

General Characteristics of Medical Marijuana Users

In the United States, individuals who want to use medical marijuana legally must have a diagnosis from a physician or health professional and must be registered for a medical marijuana ID card (Kleber & Dupont, 2012). These individuals, for the purpose of this manuscript, are recognized as "authorized medical marijuana users." Some people use medical marijuana for medical or recreational purposes, without a medical marijuana identification card. These individuals are called "non-authorized medical marijuana users" in the present study. No studies have distinguished the characteristics of authorized medical marijuana users and non-authorized medical marijuana users, and few studies have reported general characteristics among those who use medical marijuana. In prior population research, Ogborne, Smart, and Adlaf (2000) reported demographic differences among three groups of people: those who have not used marijuana in the previous year, those who use it only non-medically, and those who reported medical use. The authors conducted the study from a general population survey with 2,508 adult

participants from Ontario, Canada. Ontario City allows people to smoke or grow marijuana if they have an authorized medical marijuana license. However, no information was provided regarding whether participants in their sample obtained a medical marijuana ID card or not. The results indicated that those who use marijuana for any reason tended to be male and younger compared to non-users, but there were other no significant differences between people who use marijuana non-medically and who use marijuana medically (Ogborne et al., 2000).

Reinarman, Nunberg, Lanthier, and Heddleston (2011) compared characteristics of medical marijuana patients from nine medical marijuana assessment clinics operating in California, to the United States Census data from California. Their sample of medical marijuana users was younger on average (approximately 28% of people were 25 to 34 years old), reported slightly more years of formal education (most were high school graduates (42.2%), and was more often employed (64.8%). However, the authors did not indicate whether they excluded people who have a medical marijuana ID card or who use marijuana for medical purposes. If a significant number of people included in the sample are also included the United States Census of California, the result could be contaminated. In terms of medical marijuana consumption among medical marijuana patients, 67% of patients reported using medical marijuana daily while half (52.9%) reported using one or two times per day. Amounts of usage per week varied. Patients reported more than one therapeutic benefit of medical marijuana; relief of pain, muscle spasms, headache, and anxiety, as well as improved sleep and relaxation were the most common answers. Physicians reported that back and neck pain - followed by sleep

disorders, anxiety/depression, muscle spasms, and arthritis - were the most frequent conditions as reason for approving medical patient identification cards.

The Arizona Medical Marijuana Program reports demographic information on 48,301 active cardholders (ADHS, 2014) based on data collected between April 14, 2011, and March 28, 2014. A majority of the qualifying patients were male (69.5%; *n* = 33,568). Most of the qualifying patients were between 18 and 30 years old (24.4%; *n* = 11,764) and 51 and 60 years old (21.5%; *n* = 10,389); females were more likely to be older compared to males. During the study period, approximately 8.9% of the qualifying patients (*n* = 4,323) cultivated medical marijuana.

Some anecdotal evidence suggests that people who use marijuana for medical purposes are different from those who use it for recreational purposes. First, medical marijuana users and recreational marijuana users have different goals of consumption for using marijuana. When marijuana is used for recreational purposes, individuals might do so to achieve psychological excitement and to get high (Bostwick, 2012). Recreational marijuana users often report subjective feelings of euphoria, exhilaration, good will, and empathy from marijuana use (Gieringer, Rosenthal, & Carter, 2008), and they seek to use marijuana to obtain these feelings. On the other hand, the fundamental motivation of medical marijuana users is symptom relief. In prior research, Harris, Jones, Shank, Nath, Fernandez, Goldstein, and Mendelson (2000) interviewed 100 members of the Cannabis Cultivator's Club (CCC), a major dispenser of medical marijuana in San Francisco. Fifty-nine percent of the participants reported that they were using marijuana for medical

purposes related to appetite stimulation, nausea, fatigue, lethargy, diarrhea, neuropathic pain, and insomnia.

Second, medical marijuana users and recreational marijuana users differ in the amount of marijuana usage. People who use marijuana recreationally tend to use large doses of marijuana over long periods of time for its psychotropic effect (Mikos, 2009). They often lack control in their use and face adverse personal consequences, such as financial crisis and criminal involvement (Bennett et al., 2008). Clinical and epidemiological evidence shows that a marijuana use disorder can occur in heavy, chronic users, and epidemiological data from a national study indicate that about 10% of regular marijuana users become addicted to it (Mikos, 2009). However, people who use marijuana for medical purposes generally only consume doses sufficient to produce the desired clinical effect and only for as long as is medically necessary (Bostwick, 2012). In addition, states that have passed medical marijuana laws have implemented restrictions on its use. For example, in Arizona, medical marijuana users can only obtain 2.5 ounces of marijuana every 14 calendar days (ADHS, 2013).

Third, patterns in marijuana ingestion differ between recreational marijuana users and medical marijuana users. Generally, most people use marijuana by smoking the dried leaves, flowers, or resin in hand-rolled marijuana cigarettes or water pipes (Hall & Degenhardt, 2003). However, smoking is typically not accepted for medical use. The Food and Drug Administration (FDA) does not approve smoking medical marijuana because this type of ingestion can result in negative health consequences. For example, smoking can deliver various confounding chemicals, including other biologically toxic

substances, and can cause or worsen respiratory symptoms, such as bronchitis and chronic cough (NIDA, 2012). In addition, allowing people to smoke medical marijuana can possibly send the wrong message to children that smoking is an appropriate delivery method (Hall & Degenhardt, 2003). Due to the risks of smoking, there are alternative ways to obtain medical benefits from marijuana, such as through vaporizers, through which essential marijuana compounds are extracted and inhaled. Edible marijuana is also available. Additionally, it is produced as a pill and used in various foods. These alternative ways take effect faster and produce fewer unpleasant reactions (e.g., anxiety, irritability, loss of self-control), and the dosage is easier to control (Gieringer et al., 2008). Little is known about the population's characteristics and patterns of marijuana consumption among those who use medical marijuana.

Marijuana and Crime

In the past 25 years, many studies have revealed a relationship between marijuana use and criminal involvement (Bennett et al., 2008). Derzon and Lipsey (1999) summarized the findings from 30 independent longitudinal studies on the relationship between marijuana use and later delinquency by using meta-analyses. The authors found that there was a strong association between marijuana use and problem behavior. In terms of a predictive relationship, stronger mean correlations were observed when problem behaviors were measured before marijuana use was assessed. However, the study did not claim that reducing marijuana use will appreciably decrease delinquent and problem behaviors. Bennett et al. (2008) also conducted meta-analyses of the relationship between the types of drugs and types of crime. Ten studies compared marijuana use and

offending; only four out of ten studies found a significant association between marijuana use and crime (mean effect size was approximately 1.5) but the outcome measures varied, including property crime (McBride, 1981), conviction (Dembo, Washburn, Wish, Schmeidler, Getreu, Berry, Williams, & Blount, 1987), crime (Johnson, Wish, Schmeidler, & Huizinga, 1991), and arrest (Webb & Delone, 1996).

Many studies about the relationship between marijuana use and crime create controversial issues on medical marijuana legalization. However, little research has been conducted about the relationship between medical marijuana and crime, and there are limitations regarding methodology. As a result, the relationship between medical marijuana use and criminal involvement has not been substantiated. A few prior studies have examined the relationship between medical marijuana and criminal involvement—namely, violent/property crime, driving under the influence (DUI), illegal drug dealing, and other illicit drug use.

Although no individual-level practical research has been conducted to explore the relationship between medical marijuana and violent/property crime, Kepple and Freisthler (2012) used an ecological/cross-sectional design to explore the spatial relationship between the density of medical marijuana dispensaries and violent/property crime rates in the city of Sacramento, California. The study hypothesized that medical marijuana dispensaries would be associated with higher crime rates based on the assumptions derived from routine activity theory; however, no significant association existed between the density of medical marijuana dispensaries and violent and property crime rates, when controlling for ecological variables traditionally associated with routine

activity theory. Because of the nature of the ecological design, individual-level information could not be tested in this study; there is no information about whether people frequenting medical marijuana dispensaries would be more likely to be involved in violent/property crime or not.

Second, most states' medical marijuana laws prohibit qualified patients from "engaging in conduct that endangers others" and/or prohibits the use of marijuana while operating a motor vehicle (Mostaghim, 2008). In Arizona, medical marijuana cardholders who drive after using marijuana can be charged with Driving Under the Influence (DUI) (Arizona Capitol Times, 2013). If a driver's blood level is high enough to charge the motorist with DUI of drugs, the card authorizing the use of medical marijuana no longer gives the driver protection. No empirical research has been conducted to reveal the association between medical marijuana use and DUI. However, Anderson et al. (2011) examined the relationship between medical marijuana laws and traffic fatalities using state-level data obtained from the Fatality Analysis Reporting System (FARS) between 1990 and 2009, during which time 13 states enacted a medical marijuana law. They found that medical marijuana legalization was associated with a 22% decrease in the rate of traffic fatalities. When state and year fixed effects were included and state-level controls were added, legalization was associated with a 7.9% decrease in the fatality rate.[2] Yet this study could not explain individuals' driving behavior under the influence by using an

[2] This study explained the negative relationship between medical marijuana legalization and traffic fatalities by hypothesizing that marijuana and alcohol are substitutes. The authors examined the relationship between medical marijuana laws and alcohol consumption and found that the legalization is associated with a 25% decrease in drinking and a 5% drop in beer sales.

indirect measure of DUI (i.e., traffic fatality rate); therefore, potential risk on the road by medical marijuana users was not substantiated.

Third, in terms of the relationship between medical marijuana use and illegal drug dealing, O'Brien (2013) conducted qualitative research with undergraduate college students who have a medical marijuana ID card. The author suggested using general strain theory to explain crime control with medical marijuana. According to general strain theory, individuals try to avoid painful or aversive situations and frustration through pain-avoidance behaviors, which might lead to illegal attempts or anger-based delinquency (Agnew, 1985a). Based on the assumption of general strain theory, O'Brien (2013) argued that individuals with medical marijuana licenses would reduce their criminal involvement because of the reduced strain caused by the uncertainty of product quality and avoidance of the insecurity of the illicit drug marketplace.

Unlicensed drug transactions in the illicit drug marketplace are unpredictable and unregulated. These unstable situations can incur the risk of criminal sanctions (e.g., arrests, fines, and potential incarceration for marijuana possession), as well as unpredictable quality of marijuana. Yet as medical marijuana users, individuals can avoid these unpleasant situations by acquiring marijuana from regulated industries and getting honest information from professionals. Medical marijuana legalization has reduced the "strain of a substantial segment of society by institutionalizing acceptable and lawful means of accessing marijuana" (O'Brien, 2013, p. 438).

Thurstone, Lieberman, and Schmiege (2011) examined the prevalence of medical marijuana use among 80 adolescents in a substance treatment program in Denver,

Colorado. Although medical marijuana is not permitted for adolescents, there are concerns about the shift in availability having potential impacts on adolescents. The study found that 48.8% of the participants reported having obtained marijuana from someone with a medical marijuana ID card. In addition, these adolescents, compared to those adolescents who had not acquired marijuana in this manner, reported a significantly greater availability of marijuana, fewer friends who disapproved of regular marijuana use, more frequent marijuana use, and more substance use problems. Medical marijuana ID card holders might play a role as a safe supply source for teenagers because people with medical marijuana ID cards can legitimately acquire marijuana for any purpose; this could lead to more negative consequences, such as adolescents' substance abuse or DUI. However, the data used in this study were limited to a small number of adolescents. As no participants with a medical marijuana ID card were included in the study, the authors could not examine actual criminal involvement of medical marijuana ID card holders.

Finally, people have sought to ban medical marijuana legislation because they perceive marijuana as a gateway drug for other illegal drugs, such as cocaine, heroin, and methamphetamines (DuPont, 1984). Prior studies have found a positive relationship between marijuana and other illegal drug use (Kandel & Faust, 1975; Yamaguchi & Kandel, 1984a, 1984b; Kandel, Davies, Karus, & Yamaguchi, 1986; Kandel, Yamaguchi, & Chen, 1992; Stenbacka, Alleback, & Romelsjo, 1993; Fergusson & Horwood, 2000). However, available research on the relationship between medical marijuana and other drug use is limited and has produced mixed findings. Ogborne et al. (2000) reported that medical marijuana users are more likely to have alcohol problems and use cocaine than

recreational marijuana users and non-marijuana users. This study has methodological limitations because it used a general population survey from Ontario, Canada, and simply compared self-reported answers without controlling for other confounding factors that could contribute to respondents' alcohol and cocaine use. On the other hand, Reinarman et al. (2011) found that medical marijuana users show significant lower prevalence of alcohol, cocaine, heroin, methamphetamine, and other opiate use. The authors compared 1,746 patients from medical marijuana evaluation clinics to the United States Census of California. As they conducted their study in a clinical setting, patients might have under-reported their illegal drug use out of fear that their answers could affect their ability to keep their medical marijuana ID cards.

Current Focus

Although the previously discussed research examined the relationship between medical marijuana use and criminal involvement, they have limitations regarding sample and methodology. Moreover, little research has focused on this relationship. The present study fills these gaps by formally comparing authorized medical marijuana users with several comparison groups (e.g., non-authorized medical marijuana users, non-authorized marijuana user, and non-marijuana users) among the at-risk adult population. The purpose of this study is to explore the characteristics of medical marijuana users and to examine the relationship between the types of self-reported medical marijuana use and criminal involvement among recently booked arrestees in Maricopa County in Arizona. More specifically, this study examines three areas related to medical marijuana use among a sample of adult arrestees in Maricopa County:

(1) What are the general characteristics and marijuana acquisition patterns of authorized medical marijuana users, compared to non-authorized medical marijuana users, non-authorized marijuana users, and non-marijuana users?;

(2) Is there a relationship between the types of self-reported marijuana use (authorized medical marijuana users, non-authorized medical marijuana user, non-authorized marijuana user, and non-marijuana users) and criminal involvement (property crime, violent crime, driving under the influence, and drug selling/making)?; and

(3) Is there a relationship between the types of self-reported marijuana use (authorized medical marijuana users, non-authorized medical marijuana user, non-authorized marijuana user, and non-marijuana users) and substance use (e.g., alcohol, cocaine, opiates, and methamphetamines)?

CHAPTER 3

METHOD

Data

The data used in this study were collected through the Arizona Arrestee Reporting Information Network (AARIN), which was established in January 2007 and funded by the Maricopa County Board of Supervisors. The AARIN project was modeled after the Arrestee Drug Abuse Monitoring (ADAM) project which was sponsored by the National Institute of Justice. The ADAM project ran in 35 sites across the United States to monitor drug use trends and other risky behaviors among recently booked arrestees (National Institute of Justice, 2013). The AARIN project adopted the methodology used by ADAM and focused on collecting data to assess the impact of substance use and drug related activities of arrestees in Maricopa County, Arizona. It provides information on drug trends, criminal involvement, victimization, and other characteristics of interest among arrestees, in addition to the urine specimens.

The data used in this study were collected between September 2012 and June 2013, from 2,656 people who were recently booked as adult arrestees in Maricopa County. The data were collected on a quarterly basis - over a continuous two week period - from Maricopa County Central Intake (4th Avenue Jail). In order to ensure representativeness of the results for the population of arrestees in Maricopa County, the AARIN program gathered data through stock and flow processes in any given 24-hour period. Interviews were conducted for eight hours per day during the data collection period; the stock samples were selected from a list of all bookings processed during non-

data collection hours. The flow samples include those randomly selected arrestees who were booked during the eight-hour period data collection.

During the data collection periods, participants completed face-to-face interviews with professionally trained interviewers; the interviews were conducted daily during the eight-hour interview period. Each interview took approximately one hour. The core survey instrument included various special topics as well as demographics/background information. This study focused on the demographic characteristics (e.g., gender, age, race/ethnicity), situational characteristics (e.g., educational level, economic status, mental health status), self-reported number of prior arrests, drug use (including urinalyses), criminal involvement, and type of marijuana use.

Sample

A total of 3,656 arrestees were selected as potential respondents in AARIN, but some of them were ineligible or unavailable to participate. Arrestees who had been in custody for 48 hours or less were eligible to participate in the AARIN project; however, arrestees who constituted a threat to jail personnel and/or interview staff were excluded from participation (n = 558). Participation was determined by voluntary agreement; of the 3,098 eligible arrestees, 87.5% agreed to participate in the study and completed the interview (n = 2,706). In addition, respondents who did not provide answers to the key questions of this study (e.g., whether they have medical marijuana ID card or use (medical) marijuana in the past 30 days) were excluded from this study (n = 50).[3] A total

[3] This study excluded participants with a medical marijuana ID card issued by the State of Arizona who did not report medical marijuana use in the previous 30 days (n = 15) and participants who did not answer the questions for determining their type of marijuana use (n = 35).

of 2,656 cases were used for this study, and 94% of these respondents provided a urine specimen (n = 2,485).

The descriptive characteristics of the respondents are presented in Table 4. The sample consists of more males (75.94%; n = 2,017) than females (24.06%; n = 639). With regard to ethnic background, 47.55% of the sample were White (n = 1,263); 29.67% were Hispanic or Latino (n = 788); 14.61% were African American (n = 388); and 8.17% self-identified as "Other" (n = 217). Age ranged from 18 to 75 years (average age = 32.79). Approximately 68% of the respondents were high school graduates (n = 1,804). In terms of income source, most of the respondents reported having legal income at the time they were arrested (78.40%; n = 2,011), whereas 11.70% reported illegal income (n = 300) and 9.90% reported no income (n = 254). The sample included a small number of current gang members (4.36%; n = 115). Approximately 57% of respondents indicated either substance use disorder or mental disorder risks (n = 1,500). Sample respondents had been arrested on average one time in the preceding 12 months. Approximately 40% of respondents had medical insurance (41.64%; n = 1,106).

Variables

Dependent variable. Self-reported criminal involvement and drug use of arrestees served as the dependent variables in this study. Self-reported criminal involvement comprised four categories: property crime, violent crime, DUI, and drug selling/making. Self-reported drug use consisted of three categories: cocaine, opiates, and methamphetamine. A description of each construct is provided in Table 1.

Table 1. Descriptive Statistics for Dependent Variables (Criminal Involvement and Substance Use)

Variable	Code	n (%)
Property Crimes		
Have you written/drawn graffiti on neighborhood houses, walls, schools, stores, etc.?	1 = Yes; 0 = No	61 (2.3%)
Have you destroyed property worth LESS than $250?	1 = Yes; 0 = No	157 (5.9%)
Have you destroyed property worth MORE than $250?	1 = Yes; 0 = No	104 (3.9%)
Have you stolen property worth LESS than $1,000 (including shoplifting)?	1 = Yes; 0 = No	353 (13.3%)
Have you stolen property worth MORE than $1,000 (including shoplifting)?	1 = Yes; 0 = No	105 (4.0%)
Have you stolen a car or other motor vehicle?	1 = Yes; 0 = No	54 (2.0%)
Have you broken into a house, store, or building to commit a theft?	1 = Yes; 0 = No	102(3.8%)
Have you used someone's ID or identity to commit theft, forgery, or fraud?	1 = Yes; 0 = No	50 (1.9%)
Violent Crimes		
Have you threatened to attack someone without using a weapon?	1 = Yes; 0 = No	406 (15.3%)
Have you threatened to attack someone using a weapon?	1 = Yes; 0 = No	171 (6.4%)
Have you robbed someone by force or by threat of force without using a weapon?	1 = Yes; 0 = No	61 (2.3%)
Have you robbed someone by force or by threat of force using a weapon?	1 = Yes; 0 = No	48 (1.8%)
Have you attacked, assaulted or beaten-up someone without using a weapon?	1 = Yes; 0 = No	333 (12.5%)
Have you attacked, assaulted or beaten-up someone using a weapon?	1 = Yes; 0 = No	79 (3.0%)
Have you participated in a drive-by shooting?	1 = Yes; 0 = No	11(0.4%)
Have you possessed a firearm while prohibited (felony conviction, probation, underage, etc.)?	1 = Yes; 0 = No	164 (6.2%)
Have you committed domestic violence (including assault, disorderly conduct, criminal damage, etc.)?	1 = Yes; 0 = No	348 (13.1%)
DUI		
Have you driven under the influence of alcohol?	1 = Yes; 0 = No	512 (19.3%)
Have you driven under the influence of drugs (not including alcohol)?	1 = Yes; 0 = No	561 (21.1%)
Drug selling/making		
Have you sold or made drugs?	1 = Yes; 0 = No	310 (11.7%)
Substance Use		
Have you used alcohol during the last 30 days?	1 = Yes; 0 = No	1,763 (66.53%)
Have you used powder cocaine during the last 30 days?	1 = Yes; 0 = No	184 (6.9%)
Have you used opiate during the last 30 days?	1 = Yes; 0 = No	232 (8.7%)
Have you used methamphetamine during the last 30 days?	1 = Yes; 0 = No	696 (26.2%)

Criminal involvement. All questions pertained to crimes that the respondents may have committed in the past 12 months and the responses were captured using dichotomous indicators. First, *property crimes* included graffiti, property, theft, burglary and identity theft. Respondents were asked eight questions and individuals who answered "yes" to one out of the eight questions were coded as 1 (1 = committed one or more property crimes; 0 = did not commit property crime): "Have you written/drawn graffiti on neighborhood houses, walls, schools, stores, etc.?"(2.3%; *n* = 61), "Have you destroyed property worth LESS than $250?" (5.9%; *n* = 157), "Have you destroyed property worth MORE than $250?" (3.9%; *n* = 104), "Have you stolen property worth LESS than $1,000 (including shoplifting)?" (13.3%; *n* = 353), "Have you stolen property worth MORE than $1,000 (including shoplifting)?" (4.0%; *n* = 105), "Have you stolen a car or other motor vehicle?" (2.0%; *n* = 54), "Have you broken into a house, store, or building to commit a theft?" (3.8%; *n* = 102), and "Have you used someone's ID or identity to commit theft, forgery, or fraud?" (1.9%; *n* = 50).

Second, *violent crimes* included threat, robbery, assault, possession of a firearm, and domestic violence[4]. Respondents were asked nine questions and individuals who answered "yes" to one out of the nine questions were coded as 1 (1 = committed one or more violent crimes; 0 = did not commit violent crime): "Have you threatened to attack someone without using a weapon?" (15.3%; *n* = 406), "Have you threatened to attack someone using a weapon?" (6.4%; *n* = 171), "Have you robbed someone by force or by

[4] In this study, domestic violence means that a pattern of assaultive and/or coercive behaviors, including physical, sexual, and psychological attacks in a household, not limited to violence against women.

threat of force without using a weapon?" (2.3%; *n* = 61), "Have you robbed someone by force or by threat of force using a weapon?" (1.8%; *n* = 48), "Have you attacked, assaulted or beaten-up someone without using a weapon?" (12.5%; *n* = 333), "Have you attacked, assaulted or beaten-up someone using a weapon?" (3.0%; *n* = 79), "Have you participated in a drive-by shooting?" (0.4%; *n* = 11), "Have you possessed a firearm while prohibited (felony conviction, probation, underage, etc.)?" (6.2%; *n* = 164), and "Have you committed domestic violence (including assault, disorderly conduct, criminal damage, etc.)?" (13.1%; *n* = 348).

Third, in order to capture the respondents' *DUI* history, they were asked "Have you driven under the influence of alcohol?" (19.3%; *n* = 512) and "Have you driven under the influence of drugs (not including alcohol)?" (21.1%; *n* = 561). Individuals who answered "yes" to either one of these question were coded as 1 (1 = committed one or more DUI's; 0 = did not commit DUI). Last, respondents were asked "Have you sold or made drugs?" (11.7%; *n* = 310) to determine their criminal involvement in *Drug selling/making*. If arrestees answer "yes" to this question, they were coded as 1 (1 = sold or made drugs one or more times; 0 = did not sale or make drugs).

Substance use. In terms of respondents' substance use, the study included four types of substances: alcohol, cocaine, opiate, and methamphetamine. All questions obtained information regarding drug use by the respondents may have used in the past 30 days, and the responses were captured using dichotomous indicators. The respondents were asked "Have you used alcohol during the last 30 days?" to determine *alcohol* use (1 = yes; 66.53%, *n* = 1,763), "Have you used powder cocaine during the last 30 days?" to

determine *cocaine* use (1 = yes; 6.9%, *n* = 184), "Have you used an opiate during the last 30 days?" to determine *opiate* use (1 = yes; 8.7%, *n* = 232), and "Have you used methamphetamine during the last 30 days?" to determine *meth* use (1 = yes; 26.2%; *n* = 696).

Independent variables. Types of self-reported marijuana use served as independent variables and are presented in Table 2: authorized medical marijuana user, non-authorized medical marijuana user, non-authorized marijuana user, and non-user. Respondents were asked three questions to be categorized into the four groups: "Did you ever have a medical marijuana card from the State of Arizona?", "Have you used medical marijuana in the State of Arizona in the past 30 days?", and "In the past 30 days, how many days did you use marijuana?"

First, if respondents had a medical marijuana ID card issued by the state of Arizona and reported medical marijuana use in the past 30 days, they would be categorized as an authorized medical marijuana user (AuMM user; 2.3%; *n* = 60). Second, respondents who reported using medical marijuana in the past 30 days without a medical marijuana ID card were coded as 1 for a non-authorized medical marijuana user (NonAuMM user; 10.9%; *n* = 290). Third, if respondents without a medical marijuana ID card did not report medical marijuana use during the past 30 days, but reported marijuana use, were be coded as 1 for a non-authorized marijuana user (NonAuM user; 30.4%; *n* = 808). Last, respondents who reported neither medical marijuana use nor marijuana use in the past 30 days without a medical marijuana ID card were coded as 1 for a non-user (Non-user; 56.4%; *n* = 1,498).

Table 2. Categories of (Medical) Marijuana Users

	Authorized medical marijuana user (n=60; 2.2%)	Non-authorized medical marijuana user (n=290; 10.7%)	Non-authorized marijuana user (n=808; 29.8%)	Non-users (n=1,498; 55.2%)
Medical marijuana ID card	Yes	No	No	No
Medical marijuana use in the past 30days	Yes	Yes	No	No
Marijuana use in the past 30 days	-	-	Yes	No

Three dummy variables were used to reflect respondents' marijuana use: non-authorized medical marijuana user (*NonAuMM user*; 1 = yes), non-marijuana user (*NonAuM user*; 1 = yes), and non-user (*Non-user*; 1 = yes). The reference category was authorized medical marijuana user (*AuMM users*, 1 = yes).

Control variables. To guard against potential spuriousness, nine control variables were included in the present study. A dummy variable was used to reflect respondents' *mental health risk* (1 = yes). Illicit drug use has been associated with violent behavior in past research, and some studies have shown that people who have mental disorders are more likely to commit violent acts than people who do not have any mental problems (Hiday, 2006; Elbogin & Johnson, 2009). If respondents were recognized as having alcohol/drug use disorder risk or mental disorder risk, they were coded as 1. Respondents were asked four questions to determine their mental disorder risk and seven questions which indicated criteria for substance abuse and dependence[5]. If respondents answer

[5] The questions were presented by the DSMIV-TR criteria for substance use disorders. According to DSMIV-TR, if a person meets one or more of those criteria, he or she would be diagnosed as

Table 3. Descriptive Statistics for Mental Health Risk Variables

Variable	Code	n (%)
Mental Disorder Risk		
Have you been told by a counselor, social worker, or doctor that you have a mental illness, or emotional problem in the past 12 months?	1 = Yes; 0 = No	428 (16.1%)
Have you been treated by a counselor, social worker, or doctor for a mental health problem in the past 12 months?	1 = Yes; 0 = No	373 (14.0%)
Have you been given or prescribed medication for a mental health, emotional, or psychiatric problem in the past 12 months?	1 = Yes; 0 = No	359 (13.5%)
Have you been hospitalized for a mental health problem in the past 12 months?	1 = Yes; 0 = No	106 (4.0%)
Substance Use Disorder Risk		
Have you felt sick, shaky, or depressed when you stopped drinking or using drugs in the past 12 months?	1 = Yes; 0 = No	838 (31.6%)
Does your family or friends complain about your involvement with drugs or alcohol in the past 12 months?	1 = Yes; 0 = No	1,022 (38.5%)
Have you continued to use alcohol or drugs despite problems caused by your use in the past 12 months?	1 = Yes; 0 = No	1,007 (37.9%)
Have you engaged in illegal activities in order to obtain alcohol or drugs in the past 12 months?	1 = Yes; 0 = No	539 (20.3%)
Have you neglected your family because of your alcohol or drug use in the past 12 months?	1 = Yes; 0 = No	769 (29.0%)
Has there been a time when you needed to increase the amount you drink or use more drugs to get the effect you want in the past 12 months?	1 = Yes; 0 = No	794 (29.9%)
Have you neglected important work, social or recreational activities or responsibilities because of your alcohol or drug use in the past 12 months?	1 = Yes; 0 = No	715 (26.9%).

"yes" to one out of 11 questions, they were categorized as having mental health risk. A description of each question is provided in Table 3.

There are four questions to determine whether respondents have mental disorder risk or not: "Have you been told by a counselor, social worker, or doctor that you have a mental illness or emotional problem in the past 12 months?" (16.1%; *n* = 428), "Have

substance abuse. Moreover, if a person meets three or more of those criteria, he or she would be diagnosed as substance dependence (APA, 2000).

you been treated by a counselor, social worker, or doctor for a mental health problem in the past 12 months?" (14.0%; *n* = 373), "Have you been given or prescribed medication for a mental health, emotional, or psychiatric problem in the past 12 months?" (13.5%; *n* = 359), and "Have you been hospitalized for a mental health problem in the past 12 months?" (4.0%; *n* = 106).

For detecting the substance use disorder risk, seven questions were asked: "Have you felt sick, shaky, or depressed when you stopped drinking or using drugs in the past 12 months?" (31.6%; *n* = 838), "Do your family or friends complain about your involvement with drugs or alcohol in the past 12 months?" (38.5%; *n* = 1,022), "Have you continued to use alcohol or drugs despite problems caused by your use in the past 12 months?" (37.9%; *n* = 1,007), "Have you engaged in illegal activities in order to obtain alcohol or drugs in the past 12 months?" (20.3%; *n* = 539), "Have you neglected your family because of your alcohol or drug use in the past 12 months?" (29.0%; *n* = 769), "Has there been a time when you needed to increase the amount you drink or use more drugs to get the effect you want in the past 12 months?" (29.9%; *n* = 794), and "Have you neglected important work, social or recreational activities or responsibilities because of your alcohol or drug use in the past 12 months?" (26.9%; *n* = 715).

Gang membership was controlled to capture the independent effect of type of self-reported marijuana use on criminal involvement, and determined by asking the respondents if they are currently in a gang. Prior studies have shown that gang membership is associated with involvement in crime (Decker & Van Winkle, 1996) and drug use (Katz et al., 2005). A dummy variable was used for gang membership (1 = yes).

Respondents' number of *prior arrests* was also controlled. Prior arrests were measured by asking respondents the number of times that they have been arrested in the past 12 months, and they were coded into a continuous variable. Respondents' *age* was measured in years. Gender was captured using a dummy variable (1= *male*). Three dummy variables were used to reflect respondents' *race/ethnicity*: African American (1 = yes), Hispanic (1 = yes) and other (1 = yes). The reference category was White. *Educational achievement* of respondents was coded using a dummy variable (1 = high school graduate). *Income source* was captured through two dummy variables: illegal income (1 = yes) and no income (1 = yes). The reference group was legal income. To demonstrate the respondent's having *medical insurance*, a dummy variable was used (1 = yes).

Analytic Strategy

Bivariate and multivariate analyses were used in this study. First, chi-square and analysis of variance (ANOVA) procedures were used to determine the differences in arrestees' age, gender, race/ethnicity, education attainment, income sources, gang membership, mental health risk, prior arrests, and medical insurance among AuMM users, NonAuMM users, NonAuM users, and Non-users. Similar procedures were used to examine the differences in marijuana acquisition pattern, criminal involvement, and substance use among the four groups. In addition, given the dichotomous coding of the outcome variables, logistic regression analyses were used to examine the relationship between the types of self-reported marijuana use and criminal involvement (four different models for property, violent, DUI, and drug selling/making) and other substance use (three different models for alcohol, cocaine, opiate, and methamphetamine), holding

constant the potential effects of confounding factors, including individual (e.g., age, gender, and race/ethnicity) and situational characteristics (e.g., education attainment, income sources, gang membership, mental health status, prior arrests, and medical insurance).

CHAPTER 4

RESULTS

Demographic Information

Table 4 presents the sample characteristics of participants by the types of self-reported marijuana use. There were more males (AuMM users = 93.33%, NonAuMM users = 84.14%, NonAuM users = 77.10%, and Non-users = 73.03%) than females in all four groups. Most participants were White (AuMM users = 56.67%, NonAuMM users = 51.72%, NonAuM users = 48.39%, and Non-users = 45.93%). Non-users were significantly older (M = 35.29, SD = 10.96) than the three other groups. The majority of all four groups were high school graduates; AuMM users (88.33%) were significantly more likely to have graduated high school compared with three other groups (NonAuMM users = 66.67%, NonAuM users = 64.71%, and Non-users = 70.08%). Most participants reported having legal income; however, AuMM users (20.34%), NonAuMM users (27.01%), and Non-users (15.38%) were significantly more likely to report having illegal income sources compared with Non-users (6.47%), and NonAuM users (10.77%), and Non-users (10.95%) were significantly more likely to report no income compared with AuMM uesrs (1.69%) and NonAuMM users (3.65%). In terms of gang membership, NonAuMM users (10.18%) were significantly more likely to report being a current gang member, followed by NonAuM users (5.24%) and Non-users (2.68%). NonAuMM users (76.21%) were significantly more likely to have mental health risks than three other groups (AuMM users = 58.33%, NonAuM users = 67.70%, and Non-users = 46.56%). Regarding the number of prior arrests, NonAuMM users (M = 1.52, SD = 2.64) and

Table 4. Sample Characteristics by Type of Self-Reported Marijuana Use (*N*=2,656)

Variables	χ^2	AuMM users (n=60; 2.2%) n (%)	NonAuMM users (n=290; 10.7%) n (%)	NonAuM users (n=808; 29.8%) n (%)	Non-users (n=1,498; 55.2%) n (%)	Total (n=2,656; 100%) n (%)	Significant Contrasts
Gender[a]	28.14**						
Male		56 (93.33%)	244 (84.14%)	623 (77.10%)	1,094 (73.03%)	2,017 (75.94%)	4 < 3 < 1, 2
Female		4 (6.67%)	46 (15.86%)	185 (22.90%)	404 (26.97%)	639 (24.06%)	1, 2 < 3 < 4
Race/Ethnicity[a]	32.47**						
White		34 (56.67%)	150 (51.72%)	391 (48.39%)	688 (45.93%)	1,263 (47.55%)	-
African American		13 (21.67%)	47 (16.21%)	136 (16.83%)	192 (12.82%)	388 (14.61%)	4 < 1, 3
Hispanic		12 (20.00%)	81 (27.93%)	226 (27.97%)	469 (31.31%)	788 (29.67%)	-
Other		1 (1.67%)	12 (4.14%)	55 (6.81%)	149 (9.95%)	217 (8.17%)	1, 2. 3 < 4
Age (Mean, SD)[b]	70.81**	30.63 (9.09)	28.13 (8.91)	29.97 (9.42)	35.29 (10.96)	32.79 (10.66)	1, 2. 3 < 4
Education[a]	18.43**						
High school graduate		53 (88.33%)	192 (66.67%)	519 (64.71%)	1,040 (70.08%)	1,804 (68.49%)	2, 3, 4 < 1; 3 < 4
Non-high school graduate		7 (11.67%)	96 (33.33%)	283 (35.29%)	444 (29.92%)	830 (31.51%)	1 < 2, 3, 4; 4 < 3
Income source[a]	126.81**						
Legal income		46 (77.97%)	190 (69.34%)	576 (73.85%)	1,199 (82.58%)	2,011 (78.40%)	2, 3 < 4
Illegal income		12 (20.34%)	74 (27.01%)	120 (15.38%)	94 (6.47%)	300 (11.70%)	4 < 1; 4 < 3 <2
No income		1 (1.69%)	10 (3.65%)	84 (10.77%)	159 (10.95%)	254 (9.90%)	1, 2 < 3, 4
Gang membership[a]	35.71**	4 (7.02%)	29 (10.18%)	42 (5.24%)	40 (2.68%)	115 (4.36%)	4 < 3 < 2
Mental health risk[a]	147.31**	35 (58.33%)	221 (76.21%)	547 (67.70%)	697 (46.56%)	1,500 (56.50%)	4< 3< 2; 1< 2
Prior arrests (Mean, SD)[b]	5.64*	1.33 (3.01)	1.52 (2.64)	1.25 (2.35)	.98 (2.21)	1.13 (2.33)	4 < 2, 3
Medical insurance[a]	17.22*	37 (61.67%)	130 (44.83%)	303 (37.50%)	636 (42.46%)	1,106 (41.64%)	3 < 2, 4 < 1

Notes: Percentage calculated within self-reported (medical) marijuana use.
[a] Pearson's Chi-squared test.
[b] ANOVA F-test and Bonferroni post-hoc test
Significant contrast presents among AuMM users (1), NonAuMM users (2), NonAuM users (3), and Non users (4).
*p<. 05; **p<.001 (two-tailed test).

NonAuM users (*M* = 1.25, *SD* = 2.35) were significantly more likely to have been arrested in the past 12 months compared with Non-users (*M* = .98, *SD* = 2.21). AuMM users were significantly more likely to have medical insurance (61.67%) and NonAuM users were significantly less likely to have medical insurance (37.50%).

Marijuana Acquisition Pattern

Table 5 indicates marijuana acquisition patterns by types of self-reported marijuana use in the past 30 days. AuMM users (91.53%) and NonAuMM users (91.38%) were significantly more likely to acquire any marijuana in the past 30 days. In addition, on average, they spent significantly more money on any marijuana in the past 30 days; AuMM users spent $497.89 and NonAuMM users spent $267.57. However, Non-users, on average, acquired significantly more marijuana in the past 30 days than NonAuMM users and NonAuM users; Non-users acquired, on average, 2,072.46 grams, NonAuMM users acquired 257.12 grams, and NonAuM users acquired 203.64 grams. Non-users acquired more marijuana in the past 30 days compared with other three groups. Post hoc analysis suggested that this result was the consequence of some outliers among the Non-user group. Three respondents reported acquiring more than 1,000 grams of marijuana in the past 30 days[6]. Although they did not report marijuana use in the past 30 days, they reported that they had sold or made drugs in the past 12 months.

In terms of marijuana acquisition method, AuMM users reported that they bought 66.85% of the total marijuana they acquired in the past 30 days and grew their own

[6] Each person reported 90,718 grams, 4,989 grams, and 1,814 grams. If these three individuals were excluded, the average quantity of marijuana acquired in the past 30 days for Non-users is 43.47 grams (*SD* = 149.648) which is lesser than the amounts for three other groups.

Table 5. Marijuana Acquisition pattern by Type of Self-Reported Marijuana Use in the Past 30 Days (*N*=2,656)

Variables	χ^2	AuMM users (n=60; 2.2%) n (%)	NonAuMM users (n=290; 10.7%) n (%)	NonAuM users (n=808; 29.8%) n (%)	Non-users (n=1,498; 55.2%) n (%)	Total (n=2,656; 100%) n (%)	Significant Contrasts
Acquired any marijuana in the past 30 days[a]	1.7e+03**	54 (91.53%)	265 (91.38%)	616 (76.24%)	51 (3.40%)	986 (37.14%)	4 < 3 < 1, 2
Average amount of money spent on any marijuana in the past 30 days (Mean, SD)[b]	7.67**	$491.89 (1105.86)	$267.57 (858.42)	$102.66 (499.41)	$223.61 (1,017.57)	$174.17 (693.59)	3 < 1, 2
Average quantity of any marijuana acquired in the past 30 days in grams (Mean, SD)[b]	4.47*	699.50 (1,712.60)	257.12 (1,467.90)	203.64 (2,171.64)	2,072.46 (13,089,58)	340.39 (3,513.16)	2, 3 < 4
Method (Mean, SD)[b]:							
% of Bought	4.51*	66.85 (43.30)	59.94 (41.76)	52.92 (45.57)	40.86 (47.30)	54.96 (44.78)	4 < 1, 2
% of Grown	24.39**	14.54 (33.45)	1.16 (7.95)	.78 (8.07)	3.73 (16.37)	1.80 (11.92)	2, 3, 4 < 1
% of Traded	.23	3.33 (15.14)	4.05 (15.47)	2.88 (25.17)	1.96 (14.00)	3.18 (21.94)	-
% of Got it for free	10.84**	13.06 (31.31)	33.47 (40.72)	42.42 (45.40)	53.43 (49.10)	38.95 (44.37)	1 < 2 < 3, 4
% of Other	.59	1.85 (13.61)	1.38 (10.27)	2.19 (14.42)	.02 (.14)	1.84 (12.96)	-
Source (Mean, SD)[b]:							
% of Legal dispensary in Arizona	405.75**	32.45 (43.51)	1.15 (9.52)	.56 (7.19)	0 (0)	2.45 (14.55)	2, 3, 4 < 1
% of Dispensary in another state	10.60**	8.11 (26.10)	.83 (8.78)	.58 (7.13)	0 (0)	1.03 (9.60)	2, 3, 4 < 1
% of Friend (Directly)	7.89**	23.30 (39.17)	50.44 (48.22)	53.71 (48.62)	64.90 (47.18)	51.74 (48.49)	1 < 2, 3, 4
% of (Through) a Friend	2.45	8.21 (24.28)	22.23 (40.36)	23.40 (41.31)	18.63 (38.68)	21.99 (40.26)	-
% of Dealer	2.02	7.55 (26.67)	19.29 (37.30)	15.58 (35.57)	11.76 (32.54)	15.94 (35.53)	-
% of Grew their own	23.04**	14.72 (33.73)	.94 (7.75)	.88 (8.87)	2.75 (14.98)	1.76 (12.18)	2, 3, 4 < 1
% of Other	.43	5.66 (23.33)	4.73 (20.58)	5.38 (22.20)	1.96 (14.00)	5.04 (21.46)	-

Notes: Percentage calculated within self-reported (medical) marijuana use.

[a] Pearson's Chi-squared test.

[b] ANOVA F-test and Bonferroni post-hoc test

Significant contrast presents among AuMM users (1), NonAuMM users (2), NonAuM users (3), and Non users (4).

*p<. 05; **p<.001 (two-tailed test).

marijuana about 14.5% of the total marijuana they acquired in the past 30 days. Most of the marijuana NonAuMM users acquired was through buying (59.94%) or getting it for free (33.47%), and Non-users reported buying 40.86% of the marijuana they acquired and reported getting for free 53.43% of the time. AuMM users were significantly more likely to acquire marijuana from legal dispensaries (32.45% from legal dispensary in Arizona and 8.11% from dispensary in other state) and grow their own (14.72%) compared with the three other groups. A small proportion of the NonAuMM group and NonAuM group acquired their marijuana from legal dispensaries. NonAuMM user (50.44%), NonAuM users (53.71%), and Non-users (64.90%) were significantly more likely to get their marijuana directly from friends.

Criminal Involvement

Bivariate relationship. Table 6 presents the bivariate relationships between criminal involvement and types of self-reported marijuana use. All types of criminal involvement are significantly different among the four groups. Non-users were significantly less likely to report engaging in all types of crimes, including property crimes, violent crimes, DUI, and drug selling/making compared with the three other groups. NonAuMM users were significantly more likely to engage in property crimes (35.64%) and violent crimes (52.60%) than NonAuM users (property crimes: 28.29% and violent crimes: 36.56%). NonAuMM users (52.60%) and NonAuM users (37.42%) were significantly more likely to commit DUI than Non-users (22.98%), but the three other groups are not significantly different when compared to AuMM users (51.67%). In terms of drug selling/making, AuMM users (30.00%) and NonAuMM users (24.22%) were

significantly more likely to sell or make drugs compared with NonAuM users (15.76%) and Non-users (6.35%). These bivariate relationship tests demonstrate that arrestees who are using any types of marijuana were significantly more likely to engage in types of crime.

Table 6.

Self-Reported Criminal Involvement by Types of Self-reported Marijuana Use (*N*=2,656)

Variables	χ^2	AuMM users (n=60; 2.2%) n (%)	NonAuMM users (n=290; 10.7%) n (%)	NonAuM users (n=808; 29.8%) n (%)	Non-users (n=1,498; 55.2%) n (%)	Total (n=2,656; 100%) n (%)	Significant Contrasts
Property crimes	84.15**	16 (26.67%)	103 (35.64%)	228 (28.29%)	236 (15.80%)	583 (22.01%)	4 < 1; 4 < 3 <2
Violent crimes	112.62**	28 (46.67%)	152 (52.60%)	295 (36.56%)	362 (24.18%)	837 31.55%)	4 < 1; 4 < 3 <2
DUI	134.91**	31 (51.67%)	152 (52.60%)	302 (37.42%)	344 (22.98%)	829 (31.25%)	4 < 2, 3
Drug selling/making	117.78**	18 (30.00%)	70 (24.22%)	127 (15.76%)	95 (6.35%)	310 (11.69%)	4 < 3 < 1, 2

Notes: Percentage calculated within self-reported (medical) marijuana use.
Pearson's Chi-squared test.
Significant contrast presents among AuMM users (1), NonAuMM users (2), NonAuM users (3), and Non-users (4).
*p<. 05; **p<.001 (two-tailed test).

Multivariate relationships. Table 7 indicates the multivariate relationship between criminal involvement and types of self-reported marijuana use, controlling for individual and situational characteristics by using logistic regression. The coefficient (*b*), standard errors (*SE*), and the odds ratio (*OR*) are presented for each of the independent variables. Several diagnostic tests were performed to determine whether harmful levels of collinearity would bias the multivariate parameter estimates in the logistic regression models. None of the bivariate correlations between the independent variables and control variables exceeded an absolute value of .70 and condition indices failed to approach the

commonly used threshold of 30 (Tabachnick & Fidell, 2007)[7]. These diagnostics indicated that harmful collinearity is not a concern. All models had significant χ^2 values at the $p < .0001$ level for the model-fit diagnosis and the predictive powers of all the models were higher than .7, which is considered acceptable discrimination (Hosmer & Lemeshow, 2000). Table 7 contains four logistic regression equations. There was no significant effect of types of self-reported marijuana use on property crime and violent crime, when controlling for other confounding factors[8]. However, Non-users were significantly less likely to commit DUI compared with AuMM users (b = -.90, p <.05). Being a Non-user decreased the odds of committing DUI by 59% when controlling for other factors[9]. Both NonAuM users and Non-users were significantly less likely to sell/make drugs than AuMM users (b = -.86, p <.05; b = -1.37, p <.05; respectively).

[7] The variance inflation factors (VIF) were also tested and the results were under 3 except when AuMM users used as a reference group. The variance inflation factors were increased to 11.8 which mean that the standard error for the coefficient of AuMM is 3.4 times as large as it would be if AuMM user variable were uncorrelated with other predictor variables. However, none of bivariate correlations between independent variables were problematic, and the other collinearity diagnosis test, condition indices, shown noncollinearity. The possible explanation of high VIF would be the dummy measurement and small sample size (n=60). It is not a problem and can be safely ignored when the proportion of cases in the reference category is small so the dummy variables have high VIFs (Allison, 2012).

[8] Additional logistic regressions were run with a different reference group. The results indicated that NonAuMM users and NonAuM users were significantly more likely to commit property crimes than Non-users (b = .35, p <.05; b = .34, p <.001; respectively). The odds of committing property crimes will increase by 42%for being a NonAuMM user and by 40% for being a NonAuM user. In terms of violent crime, NonAuMM users were significantly more likely to commit violent crimes than NonAuM users and Non-users (b = .44, p <.05; b = .63, p <.001; respectively). Being a NonAuMM user will increase the odds of committing violent crime by 55% compared with NonAuM user and 88% compared with Non-users.

[9] Additional logistic regressions were run with Non-users as a reference group. The result indicated that NonAuMM users and NonAuM users were significantly more likely to be caught by DUI than Non-users (b = .95, p <.001; b = .47, p <.001; respectively). The odds of committing DUI will increase by 158%for being a NonAuMM user and by 61% for being a NonAuM user.

Table 7.

The Effect of Types of Self-reported Marijuana Use on Criminal Involvement in the Last 12 Months

	Property Crimes[a]		Violent Crimes[a]		DUI[a]		Drug Selling/Making[a]	
Variables	*b* (SE)	OR	*b* (SE)	OR	*b* (SE)	OR	*b* (SE)	OR
NonAuMM users[b]	.36 (.38)	1.43	.23 (.32)	1.26	.04 (.31)	1.05	-.70 (.39)	.49
NonAuM users[b]	.35 (.37)	1.42	-.21 (.30)	.81	-.43 (.29)	.65	-.86 (.38)	.42*
Non-users[b]	.01 (.36)	1.01	-.40 (.30)	.67	-.90 (.29)	.41*	-1.37 (.38)	.26*
Gang membership	.17 (.23)	1.18	1.24 (.23)	3.47**	.39 (.22)	1.48	.47 (.28)	1.61
Mental health risk	1.02 (.12)	2.76**	.78 (.10)	2.19**	.78 (.10)	2.19**	1.47 (.20)	4.35**
Prior arrests	.13 (.02)	1.14**	.08 (.02)	1.08**	-.02 (.02)	.98	.02 (.03)	1.02
Age	-.03 (.01)	.97**	-.03 (.00)	.97**	-.02 (.00)	.98**	-.01 (.01)	.99
Male	.08 (.13)	1.09	.24 (.11)	1.28*	.17 (.11)	1.18	.26 (.18)	1.29
African American	-.27 (.17)	.77	.12 (.14)	1.12	-.43 (.15)	.65*	-.35 (.23)	.70
Hispanic	-.08 (.13)	.93	.02 (.12)	1.02	.11 (.11)	1.12	-.02 (.18)	.98
Other	-.25 (.21)	.78	-.10 (.18)	.90	.48 (.17)	1.62*	-.72 (.32)	.48*
High school graduate	.14 (.12)	1.16	.24 (.11)	1.27*	.62 (.11)	1.87**	.36 (.17)	1.43*
Illegal income	1.34 (.15)	3.82**	.76 (.14)	2.13**	.48 (.14)	1.62*	2.15 (.16)	8.55**
No income	.09 (.18)	1.10	-.14 (.16)	.87	-.89 (.20)	.41**	.02 (.29)	1.02
Medical insurance	.28 (.11)	1.33*	.17 (.10)	1.18	.10 (.10)	1.11	-.04 (.15)	.96
Intercept	-1.64 (.44)		-.76 (.37)		-.52 (.36)		-2.51 (.51)	
Model χ^2	400.22**		337.40**		330.34**		439.53**	
McFadden's R^2	.15		.11		. 11		.25	
N	2,514		2,518		2,518		2,517	

Notes: Entries are unstandardized coefficients (*b*), standard errors in parentheses, and odds ratios.
[a] Logistic regression equation.
[b] AuMM users are the reference group.
*p<. 05; **p<.001 (two-tailed test).

The odds of selling/making drugs decreased by 58% for NonAuM users and by 74% for Non- users when controlling for other factors[10]. In terms of effects of control variables on

[10] Additional logistic regression results indicated that NonAuMM and NonAuM users were significantly more likely to sell/make drugs than Non-users (b = .66, p <.05; b = .51, p <.05; respectively). The odds of selling/making drugs will increase by 94% for being a NonAuMM user and by 66% for being a NonAuM user.

criminal involvement, having mental health risk was significantly associated with all four types of criminal involvement. Regarding income source, people who have illegal income sources were significantly more likely to self-report committing all types of crime.

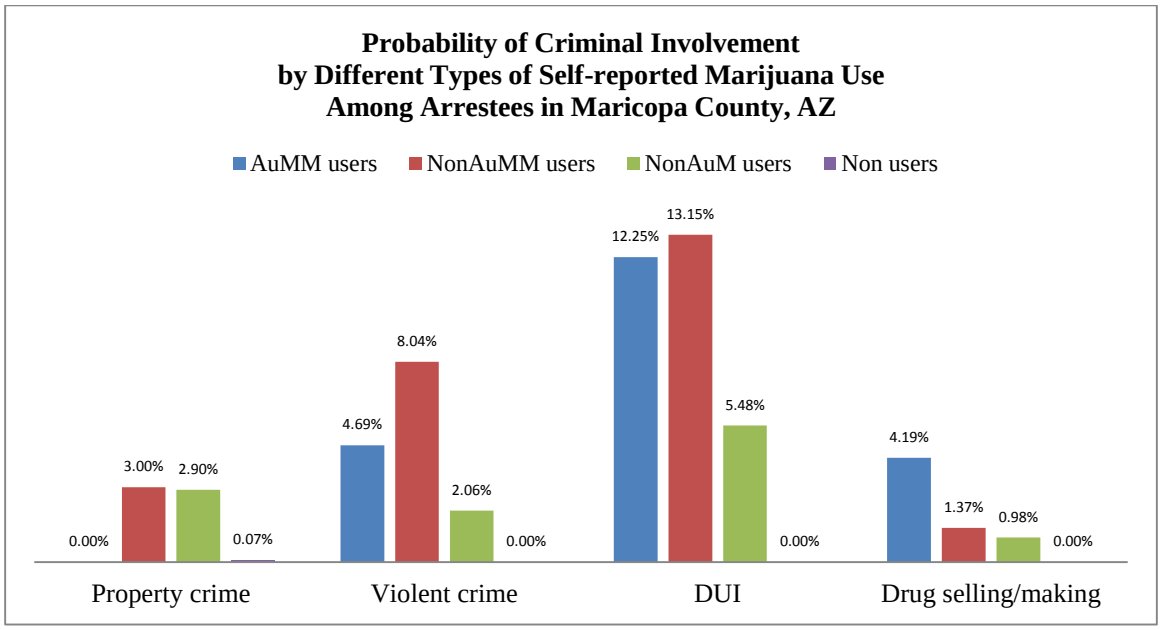

***Figure 1*. Probability of Criminal Involvement by Different Types of Self-reported Marijuana Use among Arrestees in Maricopa County, AZ.**

To illustrate the unit effects of independent variables on the probability of criminal involvement in the past 12 months, Figure 1 shows the estimated probability of criminal involvement by different types of self-reported marijuana use. A base person for comparison is a white female having a legal income source, without mental health risk, at the mean of age and number of prior arrests, no high school diploma, no medical insurance, and not a current gang member. Figure 1 shows that being a NonAuMM user increases the probability of involvement in property crime by 3% during the previous 12

months, and 2.9% for a NonAuM user. In terms of committing violent crime, being a NonAuMM user increases the probability of involvement in violent crime by 8% and 4.69% for an AuMM user. Being a NonAuMM user (13.15%), AuMM user (12.25%), and NonAuM user (5.48%) increases the probability of committing DUI during the past 12 months. Last, being an AuMM user increases the probability of selling/making drugs by approximately 4% during the previous 12 months.

Substance Use

Bivariate relationship. Table 8 presents bivariate relationships between substance use (i.e., alcohol, cocaine, opiate, and methamphetamine) and types of self-reported marijuana use. Substance use was captured in three ways: whether the respondent self-reported using substances in the past 12 months, in the past 30 days, and tested positive for substances through an urinalyses test. First, there was significant difference in self-reported alcohol use in the past 12 months and in the past 30 days by types of self-reported marijuana use, but there was no significant significant difference in urinalysis for alcohol. NonAuMM users and NonAuM users were significantly more likely to drink alcohol than Non-users. Second, there was significant difference in self-reported cocaine use in the past 12 months and in the past 30 days by types of self-reported marijuana use, but there was no significant difference in urinalysis for cocaine. AuMM users and NonAuMM users were significantly more likely to use cocaine than Non-users. Third, self-report and urinalysis for opiate use was significantly different among four groups. AuMM users, NonAuMM users, and NonAuM users were significantly more likely to self-report using opiates in the past 12 months and were

Table 8. Self-reported Substance Use and Urinalyses Results by Types of Self-reported Marijuana Use (*N*=2,656)

Variables	χ^2	AuMM users (n=60; 2.2%) n (%)	NonAuMM users (n=290; 10.7%) n (%)	NonAuM users (n=808; 29.8%) n (%)	Non-users (n=1,498; 55.2%) n (%)	Total (n=2,656; 100%) n (%)	Significant Contrasts
Alcohol							
Past 12 months	66.58**	50 (83.33%)	249 (85.86%)	686 (84.90%)	1,075 (71.76%)	2,060 (77.56%)	4 < 2, 3
Past 30 days	72.29**	41 (68.33%)	223 (76.90%)	607 (75.22%)	892 (59.75%)	1,763 (66.53%)	4 < 2, 3
Positive UA	6.73	3 (5.36%)	31 (11.19%)	70 (9.15%)	170 (12.26%)	274 (11.03%)	-
Cocaine							
Past 12 months	96.47**	12 (20.00%)	73 (25.17%)	114 (14.11%)	102 (6.81%)	301 (11.33%)	4 < 1; 4 < 3 <2
Past 30 days	92.35**	6 (10.00%)	51 (17.59%)	78 (9.65%)	49 (3.27%)	184 (6.93%)	4 < 1; 4 < 3 <2
Positive UA	4.34	2 (3.57%)	28 (10.11%)	69 (9.02%)	105 (7.57%)	204 (8.21%)	-
Opiate							
Past 12 months	45.91**	13 (21.67%)	51 (17.59%)	115 (14.23%)	114 (7.61%)	293 (11.03%)	4 < 1, 2, 3
Past 30 days	29.25**	7 (11.67%)	42 (14.48%)	89 (11.01%)	94 (6.28%)	232 (8.74%)	4 < 2, 3
Positive UA	17.00*	10 (17.86%)	48 (17.33%)	100 (13.07%)	135 (9.73%)	293 (11.79%)	4 < 1, 2, 3
Meth							
Past 12 months	119.68**	9 (15.00%)	123 (42.41%)	337 (41.71%)	337 (22.50%)	806 (30.35%)	1, 4 < 2, 3
Past 30 days	117.01**	8 (13.33%)	107 (36.90%)	301 (37.25%)	280 (18.69%)	696 (26.20%)	1, 4 < 2, 3
Positive UA	45.44**	13 (23.21%)	99 (35.74%)	308 (40.26%)	371 (26.75%)	791 (31.83%)	1, 4 < 3; 4 < 2

Notes: Percentage calculated within self-reported (medical) marijuana use.
Pearson's Chi-squared test.
Significant contrast presents among AuMM users (1), NonAuMM users (2), NonAuM users (3), and Non users (4).
**p*<. 05; ***p*<.001 (two-tailed test).

significantly more likely to test positive than Non-users. Last, self-report and urinalysis for methamphetamine use was significantly different among four groups. NonAuMM users and NonAuM users were significantly more likely to self-report using methamphetamine in the past 12 months and 30 days than AuMM users and Non-users. In terms of urinalysis results, NonAuM users were significantly more likely to test

positive for meth than AuMM users and Non-users, and NonAuMM users were more likely to get positive results on meth use than Non-users. These bivariate relationship tests demonstrate that arrestees who use marijuana of any type are significantly more likely to use cocaine and opiate, and AuMM users and Non-users were significantly less likely to use meth.

Multivariate relationships. Table 9 indicates the multivariate relationship between substance use and types of self-reported marijuana use in the past 30 days, controlling for individual and situational characteristics by using logistic regression. The coefficient (*b*), standard errors (*SE*), and the odds ratio (*OR*) are presented for each of the independent variables. All models had significant χ^2 values at the $p < .0001$ level for the model-fit diagnosis and the predictive powers of all the models were higher than .7, which is considered acceptable discrimination (Hosmer & Lemeshow, 2000).

First, AuMM users did not significantly differ in alcohol drinking compared to NonAuMM users, NonAuM users, and Non-users[11]. Mental health risks, race/ethnicity, and education attainment were associated with drinking alcohol and respondent who did not report income were significantly less likely to drink alcohol. Second, AuMM users did not significantly differ in their use of cocaine compared to NonAuMM users, NonAuM users, and Non-users[12]. Mental health risk and number of prior arrests were

[11] Additional logistic regressions were run with different reference groups. The results showed that NonAuMM users and NonAuM users were significantly more likely to drink alcohol than Non-users ($b = .73$, $p < .001$; $b = .68$, $p < .001$, respectively). The odds of drinking alcohol will increase 106% for being a NonAuMM user and by 97% for being a NonAuM user.

[12] Additional logistic regressions were run with different reference groups. The result showed that NonAuMM users were significantly more likely to use cocaine than NonAuM users ($b = .50$, $p < .05$). The odds of using cocaine will increase by 65% for being a NonAuMM. In addition,

Table 9. The Effect of Types of Self-reported Marijuana Use on Substance Use in the Last 12 Months

Variables	Alcohol[a]		Cocaine[a]		Opiate[a]		Meth[a]	
	b (SE)	OR	*b* (SE)	OR	*b* (SE)	OR	*b* (SE)	OR
NonAuMM users[b]	.39 (.33)	1.48	.54 (.51)	1.71	-.29 (.50)	.75	1.40 (.48)	4.06*
NonAuM users[b]	.34 (.31)	1.41	.04 (.50)	1.04	-.19 (.48)	.83	1.64 (.47)	5.20*
Non-users[b]	-.34 (.30)	.72	-0.79 (.51)	.45	-.20 (.48)	.82	.82 (.47)	2.27
Gang membership	.09 (.23)	1.10	.42 (.29)	1.53	-.02 (.34)	.98	.19 (.25)	1.22
Mental health risk	.48 (.09)	1.61**	.84 (.20)	2.31**	3.12 (.42)	22.74**	1.69 (.13)	5.41**
Prior arrests	-.03 (.02)	.97	.07 (.03)	1.07*	.10 (.03)	1.10**	.11 (.02)	1.11**
Age	.00 (.00)	1.00	-.02 (.01)	.98*	-.04 (.01)	.96**	.03 (.01)	1.03**
Male	.16 (.10)	1.17	.20 (.21)	1.22	-.07 (.18)	.93	-.59 (.12)	.55**
African American	.43 (.13)	1.54*	.12 (.26)	1.13	-1.43 (.33)	.24**	-1.25 (.18)	.29**
Hispanic	.33 (.11)	1.39*	.58 (.20)	1.79*	-.95 (.22)	.38**	-.66 (.13)	.52**
Other	1.08 (.19)	2.94**	-.08 (.36)	.92	-1.67 (.43)	.19**	-1.50 (.24)	.22**
High school graduate	.30 (.10)	1.35*	.00 (.18)	1.00	.46 (.19)	1.58*	-.45 (.12)	.64**
Illegal income	-.21 (.15)	.81	.40 (.21)	.49	1.01 (.18)	2.76**	.97 (.15)	2.64**
No income	-.33 (.14)	.72*	.03 (.31)	1.03	.37 (.27)	1.44	.10 (.18)	1.11
Medical insurance	-.10 (.09)	.91	.13 (.17)	1.14	-.34 (.17)	.71*	-.42 (.11)	.66**
Intercept	-.02 (.36)		-2.90 (.64)		-3.62 (.71)		-3.37 (.53)	
Model χ^2	147.94**		130.19**		357.08**		655.45**	
McFadden's R^2	.05		.10		.24		.23	
N	2,514		2,520		2,519		2,520	

Notes: Entries are unstandardized coefficients (*b*), standard errors in parentheses, and odds ratios.
[a] Logistic regression equation.
[b] AuMM users are the reference group.
*p<.05; **p<.001 (two-tailed test).

positively related to cocaine use, and younger arrestees were significantly more likely to use cocaine. Third, there was no observed difference in opiate use between AuMM users and the other three groups. Mental health risk and number of prior arrests were positively related to opiate use. Younger high school graduate arrestees were significantly more

NonAuMM users and NonAuM users were significantly more likely to use cocaine than Non-users (b = 1.33, p <.001; b = .83, p <.001, respectively). The odds of using cocaine will increase by 276% for being a NonAuMM user and by 128% for being a NonAuM user.

likely to use opiate. Having illegal income sources was positively related to opiate use, and arrestees with medical insurance were less likely to use opiates. Last, with regard to methamphetamine use, NonAuMM users and NonAuM users were significantly more likely to use meth compared with AuMM users (b = 1.40, p <.05; b = 1.64, p <.05, respectively)[13]. The odds of using meth increased by 306% for NonAuMM users and by 420% for NonAuM users when controlling for other characteristics. Other control variables were significantly related to meth use among arrestees; mental health risk, number of prior arrests, age, and having an illegal income source were positively related to meth use. Males were less likely to use meth than females, and arrestees who had medical insurance were less likely to use meth.

To illustrate the unit effects of independent variables on the probability of substance use, Figure 2 shows the estimated probability of substance use at any time during the past 30 days by different types of self-reported marijuana use among arrestees. The results demonstrated that being NonAuMM user (18.04%), NonAuM user (16.84%), and AuMM user (8.43%) were will increase the probability of drinking alcohol at any time during the previous 30 days when other confounding factors are controlled. In addition, being a NonAuMM user will increase the probability of using cocaine at any time during the previous 30 days (3.65%). Types of marijuana used had little impact on opiate use. However, being a NonAuM user increased the probability of using meth at

[13] Additional logistic regressions were run with Non-users as the reference group. The result indicated that NonAuMM users and NonAuM users were significantly more likely to use meth than Non-users (b = .58, p <.05; b = .82, p <.001, respectively). The odds of using cocaine will increase by 78% for being a NonAuMM user and by 127% for being a NonAuM user.

any time during the past 30 days (25.50%), followed by being a NonAuMM user (20.26%) and a Non-user (9.69%).

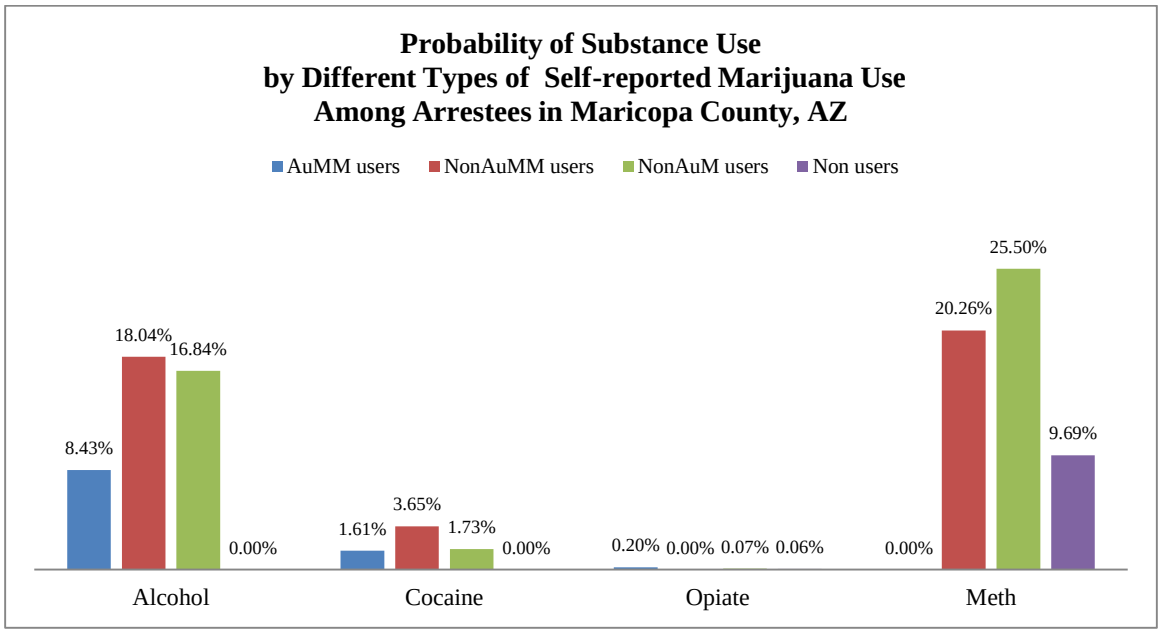

***Figure 2*. Probability of Substance Use by Different Types of Self-reported Marijuana Use among Arrestees in Maricopa County, AZ.**

CHAPTER 5

DISCUSSION

The current study contributes to medical marijuana research in two important ways. First, it explored the general characteristics and marijuana acquisition patterns of medical marijuana users by comparing those characteristics among authorized medical marijuana users (AuMM users), non-authorized medical marijuana users (NonAuMM users), non-authorized marijuana user (NonAuM users), and non-marijuana users (Non-users). Consistent with prior studies, medical marijuana users in the sample of this study were more likely to be a male and younger (Reinarman et al., 2011). There was no difference between AuMM and NonAuMM users with respect to gender, race/ethnicity, age, income source, gang membership, number of prior arrests, and having medical insurance. However, AuMM users were more likely to be high school graduates, but less likely to have mental health risk than NonAuMM users.

In terms of marijuana acquisition patterns, AuMM users and NonAuMM users were likely to acquire more marijuana and spend more money on obtaining marijuana compared with NonAuM users. In terms of marijuana acquisition source, most of the AuMM users obtained marijuana from legal dispensaries or grew their own. Surprisingly, NonAuMM users and NonAuM users also obtained some portion of marijuana from legal dispensaries, although they did not have a legal medical marijuana ID card. It should not be occurring and suggest potential problems, such as illegal medical marijuana trafficking.

Second, because obtaining information about criminal involvement or illegal drug use among medical marijuana users is often too sensitive to obtain, little prior research

has explored this relationship. By using an arrestee sample, this study explored the relationship between medical marijuana use and criminal involvement, including illegal drug use at the individual level. The key findings indicated that AuMM users had a significantly higher probability for DUI than Non-users and had a higher probability for drug selling/making than NonAuM user and Non-users. It may reflect their legal growing of medical marijuana. NonAuMM users were significantly more likely to be involved in property crime, violent crime, DUI, and drug selling/making than Non-users. In terms of other drug use, NonAuMM and NonAuM users had a higher probability for meth use compared with AuMM users, and NonAuMM users were more likely to use cocaine than the other types of users.

While the current study is a step toward a better understanding of the relationship between criminal involvement and medical marijuana users, some limitations should be addressed for future research. First, since the data was limited to a sample of arrestees in Maricopa County, AZ, the findings presented in this study should not be generalized to other samples or populations from different states. For example, since this study uses a sample of arrestees, authorized medical marijuana users' criminal involvement may be overestimated. Second, information from survey questions was limited. This study categorized arrestees by type of self-reported marijuana use. It captured whether they had a medical marijuana ID card, used medical marijuana in the past 30 days, and used marijuana in the past 30 days. However, there was no question asking whether people use marijuana for medical purposes; it would be meaningful to compare people regarding the purpose of their marijuana use. For example, if people who don't have enough money to

apply for a medical marijuana ID card want to use marijuana for only treating their physical illness, it might result in different use patterns than people who use it for recreational purposes. In addition, there was no information about which drug was used when they drove under the influence; this study cannot conclude that AuMM users who committed DUI of marijuana are not different from NonAuMM users who committed DUI of other illegal drugs. In terms of drug selling/making, there was not a distinguishing question between whether the respondent had been sold drugs or whether they had made drugs; it is possible that medical marijuana ID cardholders may be over-represented in illegal drug selling/making behaviors because they can legally cultivate marijuana. Marijuana cultivation cannot be interpreted as criminal involvement among those with a medical marijuana ID card. More specific questions would provide additional insights to understand the relationship between medical marijuana and criminal involvement.

Finally, the study relied on self-reported measures because official data was not available for medical marijuana use and criminal involvements/drug use; using self-reported data could contain several potential biases. For example, the arrestees with medical marijuana ID cards may under-report criminal involvement or illegal drug use for fear of any impact on maintaining their medical marijuana ID card. In addition, if there are individuals who are planning to apply for a medical marijuana ID card, they might feel that self-reporting crimes and illegal drug use could reduce their chances of obtaining a medical marijuana ID card.

This research design, however, included efforts to reduce the possible biases such as assuring participants' anonymity (e.g., by not collecting arrestees' names or

identification numbers). In addition, there is strong evidence that suggests that the self-report methodology is a valid and reliable method of gathering data on delinquency and drug use in general (Junger-Tas & Marshall, 1999; Thornberry & Krohn, 2000). According to Farrington, Jolliffee, Hawkins, Catalano, and Kosterman (2003), it is significantly better than official data from chronic offenders. Katz, Webb, Gartin, and Marshall (1997) examined the validity of self-reported drug use among arrestees using the Drug Use Forecasting (DUF) sample and derived supportive conclusions for validity of self-report methodology. In addition, Webb, Katz, and Decker (2006) used both self-reported and an objective measure of drug use (e.g., urinalysis) from the ADAM project to examine the relationship between drug use and gang membership. The findings also suggested that self-reported data obtained from arrestees is a robust method for understanding their recent behaviors.

Even with these limitations, this study has important implications for medical marijuana policy and future research. First, whereas there was no significant difference in property crime and violent crime between AuMM users and other three groups, NonAuMM users were more likely to be involved in all crime types (e.g., property crime, violent crime, DUI, and illegal drug dealing/making) than Non-users. They were also more likely to use cocaine and more likely to be involved in risky behavior (e.g., having illegal income source, being in a gang, etc.). However, it is unknown how they obtained medical marijuana, what their purpose was for obtaining medical marijuana, why they used medical marijuana and not street marijuana, and so on. It would be important to investigate this population to understand the medical marijuana-related crimes.

Second, a number of states have adopted dissimilar medical marijuana laws. It would be beneficial to establish policies and procedures that adhere to consistent laws across the states in order to adequately respond to certain situations and provide regular education about different regulations by states to medical marijuana users. Especially, the issue with DUI of marijuana for medical marijuana ID card holders, which is still debated heavily, needs to be considered nationally. For example, ten states, including Arizona, Delaware, Georgia, Illinois, Indiana, Iowa, Michigan, Rhode Island, Utah, and Wisconsin, have a zero-tolerance policy on DUI of marijuana even when there is no evidence of impairment for driving. However, under the Nevada, Ohio, Pennsylvania, and Washington law, anyone driving with certain level for THC and/or its metabolites is considered impaired driving [14](Armentano, 2013). In 2013, the Michigan Supreme Court ruled that medical marijuana users aren't automatically guilty of DUI, even if they are caught driving after using the drug. That court found that medical marijuana users should have some protections and that police must show that a driver was actually impaired because of marijuana use (Skoloff, April 24, 2014) because some drivers with severe pains would be more dangerous than with low level of THC in their blood. However, there is no consensus as to what specific blood THC thresholds should be for driving impairment (Armentano, 2013).

[14] The limits in these states are as follows: Nevada: 2ng/ml THC in blood or 15ng/ml of carboxy THC in blood or urine; Ohio: 2ng/ml THC in blood or 35ng/ml of carboxy THC in blood or urine; Pensylvania: 1ng/ml THC in blood or 1ng/ml of carboxy THC in blood or urine; Washington: 5ng/ml THC in blood.

Last, medical marijuana can play a role in reducing costs in the health care system. Medical marijuana, as a prescribed medication, is inexpensive to produce. However, not one major health insurer covers medical marijuana because the FDA has not approved it. According to Montopoli (2009), "Lack of FDA approval means no coverage either by private insurer or through any public plan to be drafted by Congress." Many pharmaceutical companies also greatly oppose its coverage under health insurance because a cheaper alternative, which is medical marijuana, will dramatically reduce health care costs for prescription drug coverage (Jackson, 2013). Since a certain portion of people in the sample of this study were NonAuMM users who were using medical marijuana without a legitimate ID card, and they were more likely to be involved in property or violent crime than non-marijuana users, it is possible that there are some people with chronic pain, but who don't have enough money to get a medical marijuana ID card or medical marijuana. They could steal some money from others and obtain marijuana through illegal drug markets. Under the medical model, these people will be less likely to be involved in illegal drug trafficking.

Studies to date have not yet examined medical marijuana users' criminal involvement specifically; however, the present study suggests that authorized medical marijuana users may have not much impact on escalating criminal involvements as other drug users. Moreover, this study indicates that noon-authorized medical marijuana users may have potential problems regarding criminal involvement. Future research that addresses the limitations discussed in this study would have the potential to add greatly to the literature on medical marijuana.

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