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ABSTRACT

Thesis Title:

Investigating the health profile and quality of life of adult marijuana users in the United States: Analysis of self-reported NHANES 2007-2010 data.

Student's Name:

Crystal A. Lane, MS

Thesis Chair:

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Background: Marijuana is the most widely used illicit substance in the United States. Public approval of marijuana has driven its legalization in twenty states and the District of Columbia for medical use; and, this year alone (2013), two states have legalized recreational use of the drug. Despite the nation's growing trend towards marijuana acceptance, the evidence regarding the health effects of its use remains vague. This study was designed to evaluate the health profile of marijuana users by determining the association of marijuana use with quality of life, defined in terms of perceived overall health and as self-reported medical conditions.

Methods: The 2007-2010 National Health and Nutrition Examination Survey data was used to evaluate the health profile and quality of life of marijuana smokers. Chi-square and one-way ANOVA analyses were respectively used to compare prevalence and mean differences of select characteristics across different categories grouped by marijuana use. Logistic regression analyses were then performed to determine the association between the reported number of unhealthy days or medical conditions and marijuana use in the past month. All analyses were performed with SAS 9.2 software using weighted data, while 95% confidence intervals were used to determine statistical significance.

Results: In total, 7716 cases were included in the study analysis. The prevalence of lifetime marijuana use was 59% (N = 3632), while the prevalence of current (past month) marijuana use was 12.6% (N = 861). Current marijuana users differed significantly from never users with respect to age, gender, income-to-poverty ratio, cigarette smoking, and alcohol and drug use. Current marijuana users also reported more unhealthy days per month, but less frequently reported diagnosis of a medical condition. Results of logistic regression analysis demonstrated that after controlling for confounders, there was no significant association between unhealthy days and current marijuana use, but there was an inverse association with reporting 3+ medical conditions and current marijuana use.

Conclusions: This study shows that marijuana users are more likely to engage in health risk behaviors, and report lower quality of life when compared to individuals who have never used marijuana. However, after controlling for confounders, marijuana use was not found to be associated with poor health outcomes.

KEYWORDS: marijuana, *Cannabis*, health, quality of life, unhealthy days, medical conditions

Investigating the Health Profile and Quality of Life of Adult
Marijuana Users in the United States: Analysis of Self-reported
NHANES 2007-2010 Data.

by

Crystal A. Lane

B.S., University Of Rochester

M.S., Emory University

A Thesis Submitted to the Graduate Faculty
of Georgia State University in Partial Fulfillment
of the
Requirements for the Degree

MASTER OF PUBLIC HEALTH

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APPROVAL PAGE

**Investigating the Health Profile and Quality of Life of Adult
Marijuana Users in the United States: Analysis of Self-reported
NHANES 2007-2010 Data.**

by

Crystal A. Lane, MS

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12/20/2013

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DEDICATION

The following thesis is dedicated to the 70,000+ young adults diagnosed with cancer each year in the United States.

ACKNOWLEDGEMENTS

I would like to thank my committee members Dr. Okosun and Dr. Sterling for all of their inspiration and support with the completion of my thesis project; and, I would like to thank Francis Annor for helping me to improve my analytical skills.

AUTHOR'S STATEMENT

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CHAPTER I

INTRODUCTION

1a. Overview

For millennia, the marijuana plant *Cannabis* has been used throughout the world for the production of hemp-based products and alternative medicines. In the United States it was prescribed by physicians and sold openly in pharmacies to treat a variety of illnesses up until the 1930s (Bostwick, 2012). In 1970, the United States' Congress classified marijuana as a Schedule I substance with no medical use and a high potential for abuse (United States Drug Enforcement Administration, n.d.). Concurrent with this prohibition, marijuana became the United States' most widely used illicit drug since it was regarded as pleasurable without the addictive characteristic of recreational drugs (Bostwick, 2012).

Recreational marijuana use continues to be endemic, and the demand for its decriminalization and legalization is growing in the United States (Bostwick, 2012). Advocates of marijuana use propose that it is a harmless natural substance that improves the quality of life for individuals suffering from chronic health diseases (Grotenhermen & Müller-Vahl, 2012; Mendizabal & Adler-Graschinsky, 2007). However, marijuana use has been linked to adverse physical health effects as well as addiction (Bostwick, 2012; Lamarine, 2012; National Institute on Drug Abuse, 2012; Reece, 2009; Vandrey, Umbricht, & Strain, 2011). By and large, the scientific literature regarding the safety of marijuana use remains divided.

1b. Prevalence of marijuana use in the United States

The Controlled Substances Act bans the farming, distribution, and possession of marijuana with the exception of federally sanctioned research (Garvey & Yeh, 2013). Currently, 20 states and the District of Columbia exempt qualified users of medicinal marijuana from

penalties. In 2013, Colorado and Washington became the first states to legalize, regulate, and tax small amounts of marijuana for recreational use by individuals over the age of 21 (Garvey & Yeh, 2013).

According to the 2012 National Survey on Drug Use and Health (NSDUH), marijuana is the most commonly used illicit drug in the United States (2013). Between 2007 and 2012, the number of individuals reporting marijuana use in the past month increased from 14.5 million to 18.9 million. Moreover, it is estimated that marijuana is used by 79% of current illicit drug users, and is the only drug used by 63% of illicit drug users (Substance Abuse and Mental Health Services Administration, 2013).

Marijuana use is widespread among adolescents and young adults, with the 2012 NSDUH estimating that 57.3% of new marijuana users initiated use prior to the age of 18 (Substance Abuse and Mental Health Services Administration, 2013) . There is also evidence that the prevalence of marijuana use among older adults is increasing (DiNitto & Choi, 2010; Han, Gfroerer, & Colliver, 2009a; Substance Abuse and Mental Health Services Administration, 2013).

The prevalence of medicinal marijuana use in the United States is unknown due to variations in state registration laws. ProCon.org, a non-profit organization, estimated the nationwide prevalence of medical marijuana users based on available data from state registries, the Marijuana Policy Project, and the 2011 United States Census Bureau (2012). Publicly available data from 16 states indicated that there were approximately 1 million registered medical marijuana users in 2012 (Procon.org, 2012). When this number was extrapolated to the United States population, it projected approximately 2.4 billion medical marijuana users in 2012.

1c. Purpose of study

The widespread recreational use of marijuana in the United States has raised many concerns over its health effects. As an increasing number of states continue to approve the medicinal use of marijuana, the demand for the legalization of recreational use will continue to rise as well. The scientific evidence surrounding the health effects of marijuana use has not irrefutably supported or unsubstantiated the federal prohibition of marijuana use. However, legal barriers to research make it difficult to obtain reliable data on marijuana's use and long-term health effects. There is a need for large-scale epidemiological studies to examine the overall health of recreational marijuana users. Therefore, the aim of this study is to examine the self-reported health status and quality of life of adult marijuana users who participated in the cross-sectional National Health and Nutrition Examination Survey 2007-2008 and 2009-2010 cohorts.

1d. Research questions

Question #1: Is the perceived health and quality of life different among participants of NHANES 2007-2010 with respect to marijuana use?

Null hypothesis #1: There is no difference in perceived health and quality of life among NHANES participants with respect to marijuana use.

Alternative hypothesis #1: There is a difference in perceived health and quality of life among NHANES participants with respect to their marijuana use.

Question #2: Is the number of self-reported medical conditions different among participants of NHANES 2007-2010 with respect to marijuana use?

Null hypothesis #1: There is no difference in the self-reported number of medical conditions among NHANES participants with respect to their marijuana use.

Alternative hypothesis #1: There is a difference in the number of self-reported medical conditions among NHANES participants with respect to their marijuana use.

CHAPTER II

LITERATURE REVIEW

2a. Forms of marijuana

Marijuana is a mixture of the dried, shredded plant of the genus *Cannabis*. This mixture is a common preparation for the recreational use of the plant to achieve a temporary feeling of euphoria or “high”. Marijuana is often referred to as pot, hash, reefer, weed, herb, or Mary Jane. It can be ingested multiple ways such as smoke inhalation or mixed into foods. Popular methods for smoking marijuana include hand-rolled cigarettes or cigars, called joint and blunts respectively, and the use of pipes or water pipes called bong (National Institute on Drug Abuse, 2012). The medicinal form of marijuana is available in herbal form or as oil capsules of synthetic marijuana extracts (Grotenhermen & Müller-Vahl, 2012; Lamarine, 2012).

2b. Biological mode of action

Garden grown *Cannabis* has been termed a “crude drug”, with the smoke containing more than 2000 chemical compounds (Bostwick, 2012). Tetrahydrocannabinol (THC) is the main chemical component of marijuana and is responsible for the drug’s psychotropic effects (National Institute on Drug Abuse, 2012). Smoked marijuana is reported to be the preferred method of ingestion because it rapidly delivers more abundant THC levels into the bloodstream than eating or drinking the drug (Grotenhermen & Müller-Vahl, 2012). In the body, THC binds to cannabinoid receptors found on the surface of nerve cells (Bostwick, 2012; National Institute on Drug Abuse, 2012). These receptors are part of the widely-distributed endocannabinoid system, which plays a critical role in brain development and function. THC acts as an agonist to naturally occurring chemical found in the body called endogenous cannabinoids (National Institute on Drug Abuse, 2012). When marijuana is smoked, THC overstimulates the body’s

cannabinoid receptors; and this produces the marijuana “high” (National Institute on Drug Abuse, 2012).

2c. Health effects of marijuana use

Acute effects

Within minutes of smoking marijuana an individual may experience acute psychotropic and physical effects (National Institute on Drug Abuse, 2012). Reported psychotropic effects include euphoria, heightened sensory perception, altered perception of time, and reductions in psychomotor performance. Occasionally, the user may experience anxiety, fear, panic, or hallucinations. Physical effects of marijuana smoking include vasodilation of blood vessels in the eye, increase in heart rate by 20-50 beats per minute, increase in blood pressure, and relaxation of bronchial passages. Well known side effects also include muscle relaxation, sleepiness, dizziness, and an increase in appetite (Bostwick, 2012; Lamarine, 2012; National Institute on Drug Abuse, 2012).

Lung damage

Marijuana smoke has been found to contain many of the same toxins as tobacco smoke except for nicotine (Bostwick, 2012; Moore, Augustson, Moser, & Budney, 2005); and, it is well-known that tobacco and marijuana co-use is common (Ramo & Prochaska, 2012). Scientific investigations have shown that smoking marijuana produces higher levels of inhaled and retained tar in the lungs when compared to cigarette smoking (Bowles, O’Bryant, Camidge, & Jimeno, 2012). Furthermore, observational studies have shown that the smoking practices of marijuana are different from cigarette smoking (Lamarine, 2012; Lee & Hancox, 2011; Pletcher *et al.*, 2012). Marijuana smoking is characteristic of deep inhalation, greater smoke volume, and longer duration of breath holding as compared to tobacco smoking.

It is estimated that marijuana smoking causes respiratory symptoms in approximately 20-33% of users including cough, increased sputum production, and wheezing (Lee & Hancox, 2011). The toxic effects of marijuana smoking on the bronchial mucosa are also associated with hoarsening of the voice, pharyngitis, and exacerbations of asthma. Moreover, it has been shown that smoking few marijuana joints per day may have the same degree of airway damage as smoking 20-30 cigarettes per day (Lee & Hancox, 2011).

Although marijuana smoking may cause respiratory symptoms, the evidence linking marijuana smoking to more serious lung diseases is inconclusive. A recent systematic review of observational studies concluded that there was no strong evidence that smoking marijuana causes airflow obstruction, increased risk for chronic obstructive pulmonary disease (COPD), emphysema, or lung cancer after accounting for tobacco use (Lee & Hancox, 2011). Moreover, Pletcher *et al.* (2012) utilized 20-year longitudinal data from the Coronary Artery Risk Development in Young Adults (CARDIA) research study and concluded that occasional and low cumulative marijuana use is not associated with adverse effects on pulmonary function. In contrast, numerous case reports of bullous lung disease suggest that heavy marijuana smokers may be susceptible to bullous emphysema (Lee & Hancox, 2011).

Body mass index and obesity

Early studies have shown that dietary intake differed significantly between marijuana users and non-users, with users reporting lower nutrient intake and increased consumption of sodas, beer, pork, cheese, and salty foods (Smit & Crespo, 2001). Despite the presence high caloric diet among marijuana users, recent studies have shown that users are less likely to be obese or to report diseases such as diabetes mellitus than non-users (Le Strat & Le Foll, 2011; Rajavashisth *et al.*, 2012). The mechanism underlying this phenomenon is not well-understood;

but it has been hypothesized that addictive substances can compete with food for brain “reward sites” and subsequent pleasure (Warren, Frost-Pineda, & Gold, 2005).

Cardiovascular health

There is a growing concern for the risk of cardiovascular disease among the expanding population of middle-aged and older adults who use marijuana in the United States (Mukamal, Maclure, Muller, & Mittleman, 2008). Marijuana use is known to be associated with increase heart rate and blood pressure, and potentially limit oxygen uptake (Lamarine, 2012).

Furthermore, studies have shown that marijuana use leads to elevated levels of blood carbon monoxide and carboxyhemoglobin as compared to tobacco use (Lamarine, 2012; National Institute on Drug Abuse, 2012; Rodondi, Pletcher, Liu, Hulley, & Sidney, 2006). Although case reports have linked marijuana use to cardiovascular events such as heart attack, marijuana use has not been linked to mortality among the general population (Bostwick, 2012; Mukamal *et al.*, 2008). A report utilizing 20-year longitudinal data from the CARDIA study demonstrated that marijuana use was not independently associated with cardiovascular risk factors. However, the study found that marijuana use was associated with such as tobacco use, illicit drug use, and high caloric diet which are cardiovascular risk factors (Rodondi *et al.*, 2006). Thus the above studies fails to demonstrate negative effects of marijuana use, as it relates to cardiovascular disease risk factors.

Cancer

Marijuana contains many of the same carcinogens as tobacco and at higher concentrations (Lamarine, 2012; Ramo & Prochaska, 2012). However, the carcinogenic effect of marijuana is not clearly understood. A review by Bowles *et al.* (2012) summarized that laboratory studies fail to demonstrate that THC alone is carcinogenic; however, marijuana smoke

is carcinogenic in rodents (Bowles *et al.*, 2012). Some studies show that occasional marijuana use is not associated with increased risk for head-and-neck cancers, cervical cancer, or lung cancer (Berthiller *et al.*, 2009; D'Souza *et al.*, 2010; Lee & Hancox, 2011). In contrast, a recent case-control study by Lacson *et al.* (2012) indicated an elevated risk of testicular germ cell tumors among marijuana users.

Addiction

The classification of marijuana as an addictive substance remains controversial, but significant evidence shows that a small percentage of users will show signs of dependence. It is estimated that 9 % of people who use marijuana will develop dependence; and the risk for dependency increases almost 2-fold among individuals who initiated use in their teens and up to 5-fold among daily users. Moreover, marijuana is touted as a “gateway” drug where regular use during adolescence is associated with an increased risk for abuse and dependence on other illicit drugs as well as nicotine (Bostwick, 2012; Lamarine, 2012; National Institute on Drug Abuse, 2012).

According to the 2012 NSDUH, 7.3 million people age 12 or older are classified as illicit drug abusers or drug dependent, of which 4.3 million (58.9%) people reported marijuana dependency (Substance Abuse and Mental Health Services Administration, 2013).. Individuals who attempt to quit marijuana use are likely to experience withdrawal syndrome, which increases the likelihood of relapse. Withdrawal symptoms include anxiety, depression, increased aggression and irritability, sleeping difficulties, changes in appetite, and headaches. The severity of withdrawal syndrome is likely associated with the frequency and duration of marijuana use (Lamarine, 2012; National Institute on Drug Abuse, 2012).

Psychosis

Marijuana use has been shown to be highly prevalent among individuals suffering from mental health disorders; however, the directionality of the relationship remains elusive (National Institute on Drug Abuse, 2012). Several studies provide evidence that adolescent marijuana use is associated with subsequent development of anxiety and depressive disorders in adulthood (Pacek, Malcolm, & Martins, 2012). A recent review by Bostwick (2012) demonstrated that marijuana use advanced the onset of psychosis in vulnerable individuals and worsened the course of illness in established patients. Additionally, the association between marijuana use and major psychosis, such as schizophrenia, was found to be bi-directional (Bostwick, 2012). Marijuana smokers had worse psychosis, while psychotic individuals were more likely to smoke marijuana. Interestingly, heavy marijuana smokers have long been stereotyped as “stoners”, characterized by sluggishness and apathy even when not using the drug. This “stoner” typecast was found to be a negative symptom complex of schizophrenia called amotivational syndrome rather than a characteristic of marijuana use (Bostwick, 2012; Reece, 2009).

2d. Social-behavioral consequences of marijuana use

The general public’s perspective of marijuana use remains divided. When compared to other illicit drugs, marijuana has a reputation as being “harmless and non-addicting” and for this reason marijuana use typically starts at an earlier age (Substance Abuse and Mental Health Services Administration, 2013). In contrast, heavy or long-term use of marijuana is associated with a negative stigma in society, believed to cause psycho-social problems. Evidence suggests that marijuana users are at risk for negative cognitive functioning, lower educational attainment, delinquency, multiple sex partners, drug and alcohol use, and increased injury (Berger, Khan, & Hemberg, 2012; Lamarine, 2012; National Institute on Drug Abuse, 2012; Pacek *et al.*, 2012).

2e. Medicinal marijuana

Marijuana-based medicines have been used to treat a variety of illnesses such as pain, spasms, sleeping disorders, loss of appetite, cough, and sexual dysfunction (Bostwick, 2012; Grotenhermen & Müller-Vahl, 2012; Lamarine, 2012). Currently, medicinal marijuana exists in either botanical form (i.e. dried plant) or as synthetic versions of cannabinoid extracts, such as THC, in an oil capsule. The botanical form is perceived to be more desirable because it provides rapid and predictable onset of desired effects, while oral ingestion is more likely to cause prolonged adverse side effects (Bostwick, 2012; Lamarine, 2012).

In the United States, dronabinol was the first marijuana-based medicine licensed for use in 1985 to treat nausea, vomiting, and loss of appetite in cancer patients and in 1992 for HIV/AIDS patients (Bostwick, 2012; Bowles *et al.*, 2012; Grotenhermen & Müller-Vahl, 2012). In 2011, Germany became the first country to approve medical marijuana for treatment of spasticity in multiple sclerosis (MS) patients. Cannabinoid extracts were found to significantly reduce spasticity as well as improve sleep quality in MS patients. Furthermore, small controlled-trials have demonstrated that marijuana-based medicine was effective in treating chronic pain, tics in Tourette's syndrome, dyskinesia in Parkinson's disease, and bladder dysfunction in multiple sclerosis patients (Grotenhermen & Müller-Vahl, 2012). Despite evidence for the therapeutic potential of medicinal marijuana, the licensed use of these products remains restricted.

The side effects and health risks of medical marijuana are similar to those reported during recreational marijuana use. Patients may experience acute psychoactive and physical effects; however, it has been demonstrated that tolerance to these acute effects can develop over time (Grotenhermen & Müller-Vahl, 2012). Some observational studies suggest that medical users

actually consume less smoked marijuana than recreational users, thereby minimizing the potential for negative long-term health effects. Furthermore, the growing field of synthetic cannabinoids has the potential to treat a wide range of illnesses while circumventing the health concerns of smoked marijuana (Bostwick, 2012).

CHAPTER III

METHODS

3a. Data source

The study subjects came from the National Health and Nutrition Examination Survey (NHANES) 2007-2008 and 2009-2010. NHANES is a major program by the National Center for Health Statistics of the Centers for Disease Control and Prevention, designed to assess the health and nutritional status of civilian, non-institutionalized adults and children in the United States. The survey questionnaires are administered to participants both at home and in mobile examination centers (MEC). For this study, data from the combined NHANES 2007-2010 demographics, questionnaire, and examination files were used.

3b. Inclusion and exclusion criteria

The analysis was limited to adults aged 20-59 who were eligible to complete the Drug Use questionnaire. Pregnant women were not excluded in analysis due to their low number in the study population (N = 125). The resulting study population included 7716 adults.

3c. Variables

Marijuana use

Classification of marijuana use was based on how the following questions were answered: "have you ever used marijuana/hashish" and "last time used marijuana/hashish". Participants who reported marijuana smoking within the past 30 days were classified as "current users", while those who reported lifetime use of marijuana, but not within the past 30 days were classified as "past users". Additional analyses were performed with a modified classification of marijuana use due to variations in previous studies: current marijuana use was defined as using marijuana in the past 12 months, while past use was defined as lifetime marijuana use but not in

the past 12 months (Lev-Ran *et al.*, 2012; Warren *et al.*, 2005). The Appendices demonstrate tables were identical analyses were performed using the modified classification of marijuana use.

Demographic variables

Demographic variables chosen for analysis included age, gender, race/ethnicity, income-to-poverty ratio, and education-level. Select behavioral variables chosen for analysis included current cigarette smoking, regular (≥ 12 drinks) alcohol use for any one year, ever trying illicit drugs, and the number of fast food meals eaten per week. NHANES defines illicit drugs as cocaine, crack-cocaine, heroin, or methamphetamine.

Perceived health and quality of life

Perceived health and quality of life were determined by questions from the Current Health Status and Diet Behavior and Nutrition Questionnaires. Participants were asked to rate the healthiness of their diet and their general health on a Likert scale of 1 to 5 (1 = excellent, 2 = very good, 3 = good, 4 = fair, and 5 = poor). Participants were also asked a series of questions regarding the number of days in the past month they experienced poor mental or physical health, anxiety, or poor physical functioning. The number of “unhealthy days” was calculated from the sum of poor physical health and poor mental health days reported in the past month as recommended by the Centers for Disease for Control and Prevention (Moriarty, Zack, & Kobau, 2003). The frequency of 15 or more unhealthy days per month was classified as having fair/poor health (Whitaker, Becker, Herman, & Gooze, 2013).

Medical conditions

Self-reported medical conditions were determined by the Medical Conditions Questionnaire and Body Measures component. Participants were asked a series of questions to determine if a doctor “ever said” he/she had a particular medical condition. Twelve medical

conditions were of interest for this study and included: current asthma, current chronic bronchitis, emphysema, high blood pressure, high cholesterol, diabetes, heart attack (in the past year), stroke, heart failure, coronary heart disease, cancer, and obesity (BMI \geq 30). BMI was measured by survey technicians during the physical examination portion of the survey. The sum of “yes” responses to the medical conditions of interest was then used to classify participants as having “none”, “1 or 2”, or “3 or more” medical conditions.

3d. Statistical procedures

SAS 9.2 survey procedures were used to account for the complex, multistage, probability sampling design used to select participants. Tables report unweighted sample sizes “N” and weighted frequency or mean. All analyses were performed using weighted data, and 95% confidence intervals were used to determine statistical significance. Results were rounded up to the nearest tenth (or hundredth when necessary).

Chi-square analysis was used to compare rate differences across selected categorical variables between groups of participants with respect to marijuana use. One-way analysis of variance (ANOVA) was used to compare mean values of selected continuous variables between groups of participants with respect to marijuana use. Univariate and multivariate logistic regression analysis was used to determine the association between the number of unhealthy days as well as the number of reported medical conditions and marijuana use in the past 30 days.

Three models were used to estimate odds ratios:

Model 1 (unadjusted): crude

Model 2 (demographics): Model 1 + adjustment for age, race, gender, education, and income-to-poverty ratio

Model 3 (social-demographics): Model 2 + adjustment for cigarette smoking and alcohol use

CHAPTER IV

RESULTS

4a. Socio-demographic characteristics

Table 1 shows the basic socio-demographic characteristics of the study population. As shown, the study population was predominantly non-Hispanic white, making up 66.8% of current users. When compared to never users, current users were predominately male (63.8% of current users versus 43.9% of never users) and on average younger (34.7 years old in current users versus 40.1 years old in never users). Although current users reported the lowest income-to-poverty ratios (statistically significant), there was no difference in post-secondary educational attainment between current and never users. Moreover, current users reported higher frequencies of fast food meal intake, cigarette smoking, alcohol drinking, and lifetime illicit drug use when compared to never users. Marijuana use was also stratified by race/ethnicity; Asians and other mixed races reported the lowest frequency of marijuana use.

Past marijuana users were similar to current users across race/ethnicity, gender, and alcohol and illicit drug use; however, they were similar to never users with respect to age. Past users were more likely to have a college degree (statistically significant compared to current users only) and the highest income-to-poverty ratio across all groups (statistically significant). Moreover, past users were less likely to report cigarette use and eating fast food meals when compared to current users (statistically significant) but not participants who never used marijuana (Table 1).

Table 1. Descriptive analysis of demographic and social characteristics of adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use.

Select Variables	N	Frequency or Mean of Variables ¹		
		<i>Never</i>	<i>Past</i>	<i>Current</i>
Age	6536	40.1 (39.4 – 40.7)	40.6 (39.9 – 41.4)	34.7 (33.8 – 35.6)
Gender				
Male	3219	43.9 (42.2 – 45.6)	51.9 (49.7 – 54.1)	63.8 (60.7 – 66.9)
Female	3317	56.1 (54.4 – 57.8)	48.1 (45.9 – 50.3)	36.2 (33.1 – 39.3)
Race/Ethnicity				
White	2902	54.5 (47.3 – 61.8)	77.6 (74.1 – 81.2)	66.8 (61.1 – 72.6)
Black	1256	11.4 (8.9 – 14.0)	10.2 (8.2 – 12.1)	18.7 (14.4 – 23.1)
Hispanic	2060	23.5 (17.9 – 29.1)	9.1 (6.7 – 11.5)	10.4 (6.4 – 14.4)
Asian/Other	318	10.5 (7.9 – 13.1)	3.1 (2.2 – 4.0)	4.0 (2.6 – 5.4)
Education				
< HS	1673	20.0 (17.5 – 22.5)	13.6 (11.3 – 16.0)	21.1 (16.9 – 25.2)
HS/GED	1560	22.3 (19.7 – 24.8)	22.4 (20.1 – 24.7)	29.2 (25.0 – 33.5)
College	3297	57.7 (55.0 – 60.4)	64.0 (59.8 – 68.1)	49.7 (44.3 – 55.2)
Income:Poverty ratio	6005	3.0 (2.8 – 3.1)	3.3 (3.2 – 3.5)	2.5 (2.4 – 2.7)
Smoke cigarettes*	1765	54.2 (49.3 – 59.0)	48.1 (43.8 – 52.4)	78.6 (74.0 – 83.2)
Drink alcohol**	4973	63.7 (61.0 – 66.4)	89.8 (88.0 – 91.6)	93.3 (91.1 – 95.6)
Lifetime illicit drug use	1270	2.1 (1.4 – 2.9)	28.6 (26.5 – 30.8)	48.7 (44.5 – 52.8)
Fast food meals per wk.	5372	2.1 (1.9 – 2.3)	2.3 (2.1 – 2.4)	2.8 (2.5 – 3.0)

¹Reported as % for categorical variables and mean for continuous variables

*Current cigarette smoking

**Alcohol use refers to having at least 12 alcohol drinks in any one year

4b. Prevalence of marijuana use

Table 2 shows the prevalence of marijuana use among the study population. Among individuals who participated in the Drug Use Questionnaire, 59.1% reported to have used marijuana in their lifetime, while 12.6% of participants were current marijuana users. The rate of

past marijuana use was significantly higher than non-use with values of 45.4% and 42.0%, respectively. To determine the degree of marijuana use, the number of days participants were engaged in drug use during the past month was assessed. Participants were classified as light users if they reported marijuana use 1-8 days or heavy users if they reported marijuana use for at least 9 days in the past month. Among participants who provided information on past month use, 54.4% were classified as light users, while 45.6% were classified as heavy users.

Table 2. Prevalence of marijuana use among adults aged 20-59 who participated in the NHANES 2007-2010 survey (N = 6729).

Marijuana Use	N	Prevalence (%)
Never user	3097	42.0
Lifetime user	3632	59.1
Past user	2578	45.4
Current user	861	12.6
Light user	457	54.4
Heavy user	398	45.6

Notes: Lifetime use refers to having ever used marijuana at least once. Past users have used marijuana, but not in the past 30 days. Current users reported marijuana use within the past 30 days. Light users reported using marijuana 1-8 days in the past month. Heavy users reported using marijuana 9+ days in the past month.

4c. Perceived health and quality of life

Table 3 describes self-perceived health as rated by study participants on a Likert scale of 1 to 5, (1 = excellent, 2 = very good, 3 = good, 4 = fair, and 5 = poor). The result of the analysis shows no difference in perceived general health between current marijuana users and never users. However, current users rated their diet poorer when compared to past or never users (statistically significant).

Table 3. Self-perceived health of adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use (N = 6534).

	Mean Likert Score		
	<i>Never</i>	<i>Past</i>	<i>Current</i>
Perceived health:			
General health	2.6 (2.58 – 2.7)	2.5 (2.48 – 2.6)	2.7 (2.6 – 2.8)
Healthiness of diet	3.0 (2.9 – 3.0)	3.0 (2.9 – 3.0)	3.2 (3.1 – 3.3)

Notes: Based on a Likert scale of 1 to 5 (1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor)

Table 4 describes the quality of life as indicated by the mean number of days in the past-month that study participants experienced various physical and mental health symptoms. Participants who reported at least 15 unhealthy days in the past month were considered to have fair/poor health. Current users reported poorer physical functioning and more unhealthy days than past and never users (statistically significant). Furthermore, past users reported more favorable perceived health and quality of life than current users. However, when compared to never users, past users reported poorer mental health including more days of experiencing anxiety (statistically significant).

Table 4. Self-reported quality of life in adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use (N = 6534).

	Mean number of days in the past 30 days		
	<i>Never</i>	<i>Past</i>	<i>Current</i>
Physical health not good	3.0 (2.6 – 3.4)	3.3 (2.9 – 3.8)	4.1 (3.43 – 4.9)
Mental health not good	3.9 (3.5 – 4.2)	4.7 (4.23 – 5.2)	6.4 (5.6 – 7.1)
Inactive due to poor health	1.5 (1.2 – 1.7)	1.8 (1.5 – 2.1)	2.4 (2.0 – 2.8)
Pain interfered with activities	2.4 (2.1 – 2.7)	3.5 (2.9 – 4.0)	4.1 (3.5 – 4.7)
Felt anxious	5.5 (5.2 – 5.9)	6.8 (6.3 – 7.3)	8.6 (7.6 – 9.5)
Unhealthy Days	6.2 (5.8 – 6.6)	7.2 (6.6 – 7.7)	9.4 (8.6 – 10.3)

Notes: Unhealthy days = sum of days physical and mental health is not good (max. 30 days).

Table 5. Frequency of unhealthy days reported by adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use (N = 6534).

	Frequency of unhealthy days in past 30 days		
	<i>Never</i>	<i>Past</i>	<i>Current</i>
0-14 days	83.4 (81.7 – 85.0)	80.0 (78.0 – 82.7)	73.5 (69.4 – 77.5)
15+ days	16.6 (15.0 – 18.3)	19.7 (17.3 – 22.0)	26.5 (22.5 – 30.6)

Notes: 15+ unhealthy days defined as fair/poor health

Given that current users reported a lower quality of life with respect to unhealthy days (Table 5), logistic regression was then used to determine the association between fair/poor health and past month marijuana use (Table 6). Model 1 (unadjusted odds ratios) shows that participants who reported “15+ unhealthy days” were 80% more likely to have used marijuana in the past month compared to participants who reported “0-14 unhealthy days” (OR = 1.8; 95% CI = 1.5-2.2).

After controlling for demographic variables (age, sex, race/ethnicity, education, and income-to-poverty ratio) in Model 2, the association between “15+ unhealthy days” and marijuana use was reduced but still statistically significant (OR=1.50; 95% CI= 1.0-2.2). Model 3 controlled for demographic variables and current cigarette and alcohol use. As shown in Table 6, adjusting for demographic variables and current cigarette and alcohol use was attenuating; and, participants who reported “15+ unhealthy days” were found to be 30% more likely to have used marijuana in the past month compared to participants who reported “0-14 unhealthy days. However, the association was not statistically significant.

Table 6. Logistic regression analysis to determine the association between number of unhealthy days and current marijuana use in adults aged 20-59 who participated in NHANES 2007-2010.

	Model 1	Model 2	Model 3
# of Unhealthy Days	OR (95% CI)	OR (95% CI)	OR (95% CI)
15+ days versus 0-14 days	1.8 (1.5 – 2.2)	1.5 (1.0 – 2.2)	1.3 (.9 – 2.0)

Model 1: unadjusted

Model 2: adjusted for age, gender, race/ethnicity, income-to-poverty ratio, education

Model 3: Model 2 + adjusted for cigarette and alcohol use

4d. Self-reported medical conditions

Table 7 shows the number of medical conditions reported by study participants with respect to marijuana use. In total, 41.9% of participants did not report a medical condition, 46.2% reported diagnosis of 1 or 2 medical conditions, and 11.9% reported diagnosis of 3 or more medical conditions. When marijuana use was stratified by current and past use, 38.8% of current users reported having 1 or 2 medical conditions (compared to 47.8% of past users) while 8.8% of current users reported diagnosis of 3 or more medical conditions (compared to 12.1% of past users). Similarly, 40.7% of never users did not report a medical condition, 46.7% reported

diagnosis of 1 or 2 conditions, and 12.6% reported diagnosis of 3 or more medical conditions. Current users had statistically significant lower rates of reporting 1 or 2 medical conditions when compared to both past and never users of marijuana. There was no difference in rates of 3 or more medical conditions across groups.

Table 7. Frequency of self-reported medical conditions in adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use (N = 6536).

	Number of Medical Conditions Reported (%)		
	None	1 or 2	3+
<i>Current</i>	52.4 (48.3 – 56.6)	38.8 (35.9 – 41.7)	8.8 (6.2 – 11.4)
<i>Past</i>	40.1 (36.9 – 43.4)	47.8 (44.9 – 50.8)	12.1 (10.4 – 13.7)
<i>Never</i>	40.7 (38.2 – 43.1)	46.7 (44.5 – 48.8)	12.6 (11.4 – 13.9)
Total	41.9 (39.7 – 44.1)	46.2 (44.5 – 48.0)	11.9 (10.7 – 13.1)

Notes: A total of 12 medical conditions were of interest in this analysis

The prevalence rates of select medical conditions among marijuana users and never users are shown in Table 8. When compared to never users, current users were less likely to have a BMI \geq 30 (27.3% of current users versus 40.7% of never users), high blood pressure (15.9% of current users versus 22.7% of never users), or diabetes (3.1% of current users versus 6.1% of never users). These differences were statistically significant.

Current users on average reported the highest rate of respiratory symptoms across all groups, including chronic bronchitis, emphysema, and asthma attack in the past year. However, these results were not statistically significant. Additionally, when compared to never users, current users reported higher rates of stroke, heart failure, and heart attack in the past year but these results were not statistically significant (Table 8).

Table 8. Prevalence of select medical conditions reported by adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use.

Medical Condition (yes)	N	Prevalence of Medical Conditions (%)		
		<i>Never</i>	<i>Past</i>	<i>Current</i>
Obese (BMI \geq 30)	2434	40.7 (37.8 – 43.6)	35.5 (32.9 – 38.2)	27.3 (23.4 – 31.1)
High blood pressure	1464	22.7 (20.1 – 25.3)	22.6 (20.5 – 24.7)	15.9 (12.6 – 19.2)
High cholesterol	1439	35.8 (33.2 – 38.4)	36.6 (33.7 – 39.6)	29.9 (23.1 – 36.7)
Diabetes	429	6.1 (5.2 – 6.9)	4.6 (3.6 – 5.6)	3.1 (1.6 – 4.5)
Current asthma	513	53.5 (46.0 – 61.0)	52.4 (46.1 – 58.7)	49.1 (38.2 – 60.0)
Asthma attack in past year	281	47.1 (38.7 – 55.4)	57.0 (48.0 – 65.9)	60.0 (42.9 – 77.2)
Current bronchitis	146	45.8 (33.9 – 57.6)	40.3 (31.6 – 49.1)	46.9 (32.9 – 60.9)
Emphysema	78	.7 (.3 – 1.1)	1.1 (.6 – 1.5)	1.8 (.7 – 2.8)
Cancer	278	4.3 (3.1 – 5.6)	6.0 (4.5 – 7.6)	4.3 (2.8 – 5.8)
Stroke	100	.8 (.5 – 1.1)	1.6 (1.0 – 2.2)	1.8 (.7 – 2.9)
Heart failure	68	.8 (.5 – 1.1)	.6 (.3 – .9)	1.0 (.2 – 1.9)
Heart attack in past year	114	1.5 (1.0 – 1.9)	1.5 (1.0 – 2.0)	1.7 (.7 – 2.8)
Coronary heart disease	72	1.2 (.7 – 1.6)	1.2 (.8 – 1.6)	.3 (0.0 – .8)

Given that current marijuana users had a lower rate of reporting any medical condition (Table 7); logistic regression was then used to determine the association between the number of medical conditions reported and past month marijuana use (Table 9). Model 1 (unadjusted odds ratios) shows that participants who reported “1 or 2 medical conditions” were 36% (OR=.64; 95% CI=.55-.76) less likely to have used marijuana in the past month compared to participants who reported no medical conditions), while participants who reported 3 or more medical conditions were 46% (OR=.54; 95% CI=.38-.77) less likely to have used marijuana in the past month compared to participants who reported no medical conditions

After controlling for demographic characteristics (age, sex, race/ethnicity, education, and income-to-poverty ratio) in Model 2, participants who reported “1 or 2 medical conditions” were 33% (OR=.67; 95% CI=.46-.99) less likely to have used marijuana in the past month compared to participants who reported no medical conditions. Participants who reported 3 or more medical conditions were 52% (OR=.48; 95% CI=.30-.78) less likely to have used marijuana in the past month compared to participants who reported no medical conditions.

Model 3 controlled for demographic characteristics and current cigarette and alcohol use. Participants who reported “1 or 2 medical conditions” were 27% (OR=.73; 95% CI=.49-1.1) less likely to have used marijuana in the past month compared to participants who reported no medical conditions. Participants who reported 3 or more medical conditions were 42% (OR=.58; 95% CI=.35-.98) less likely to have used marijuana in the past month compared to participants who reported no medical conditions.

Table 9. Logistic regression analysis to determine the association between numbers of reported medical conditions and current marijuana use in adults aged 20-59 who participated in NHANES 2007-2010.

	Model 1	Model 2	Model 3
# of Medical Conditions	OR (95% CI)	OR (95% CI)	OR (95% CI)
1-2 versus None	.64 (.55 – .76)	.67 (.46 – .99)	.73 (.49 – 1.1)
3+ versus None	.54 (.38 – .77)	.48 (.30 – .78)	.58 (.35 – .98)

Model 1: unadjusted

Model 2: adjusted for age, gender, race/ethnicity, income-to-poverty, education

Model 3: Model 2 + adjusted for cigarette and alcohol use

CHAPTER V

DISCUSSION AND CONCLUSION

The objective of the current study was to examine the health profile and quality of life of marijuana users who participated in NHANES 2007-2010. In this study, more than 50% of participants reported lifetime use of marijuana, while almost 13% of the participants reported to have used marijuana in the past month. No difference in the prevalence of light and heavy marijuana use was observed in this nationally representative sample of marijuana users.

When participants were asked to rate their general health and diet, current marijuana users on average rated their diet but not general health poorer than never users. This finding is consistent with previous studies have shown that marijuana use was associated with low nutrition and high caloric diets (Smit & Crespo, 2001). The result of this study also indicates that marijuana users experience poorer mental health, poorer physical functioning and health, and more unhealthy days per month when compared to never users; thus, indicating a lower quality of life. These results are consistent with previous studies that show an increased prevalence of mental health symptoms among marijuana users (Bostwick, 2012; Pacek *et al.*, 2012). However Lev-Ran *et al.* (2012) demonstrated that marijuana users, who tend to be younger than non-users, report increased physical well-being; and, this finding is inconsistent with the results from the current study. After controlling for demographics and tobacco and alcohol use, this study demonstrates that there was no association between fair/poor health (as indicated by “unhealthy days”) and current marijuana use.

When evaluating the prevalence of medical conditions among marijuana users, this study showed that there was a lower rate of reporting any medical condition among current marijuana users when compared to never users (statistically significant). After controlling for confounders,

logistic regression analysis showed that there was an inverse association between reporting 3+ medical conditions and using marijuana in the past month (statistically significant).

When assessing the prevalence of select medical conditions, the lowest prevalence rate of obesity and diabetes among current users was consistent with published reports (Le Strat & Le Foll, 2011; Rajavashisth *et al.*, 2012; Rodondi *et al.*, 2006; Warren *et al.*, 2005). Results of this study also demonstrated the lowest prevalence rate of high blood pressure among current marijuana users. This finding may be related to previous reports whereby long-term marijuana use led to a sustained decrease in blood pressure and marijuana cessation led to an increase in blood pressure (Katsiki, Papadopoulou, Fachantidou, & Mikhailidis, 2013; Vandrey *et al.*, 2011). However, the NHANES 2007-2008 questionnaire did not assess the duration of marijuana use; and, this study cannot conclude that long-term marijuana use was a potential factor in the decreased prevalence of high blood pressure among current users (Mendizabal & Adler-Graschinsky, 2007). Moreover current users had a higher prevalence rate of respiratory symptoms and certain cardiovascular events when compared to never users, but these results were statistically insignificant.

Furthermore, identical analyses were performed where current marijuana use was defined as having used marijuana at least once in the past 12 months. Additional analyses were performed because there is no standardization of marijuana use in the scientific literature. Previous studies have defined current marijuana use as both past-month and past-year use. The results showed that past year users were similar to past month users across social-demographic variables, quality of life measures, and medical conditions reported. Conversely, past year users were more likely to report a history of stroke when compared to never users (statistically significant), and this result is consistent with previous reports that identified marijuana use as a

risk factor for stroke (de los Rios et al., 2012; Katsiki et al., 2013). In contrast to past-month use, there was no statistically significant association between reporting any medical conditions and using marijuana in the past year.

Limitations

The NHANES study has several limitations. The cross-sectional design only provides a snapshot of marijuana use and health at a single point in time, therefore the data does not allow for determination of directionality or causation. The nature of this study was largely dependent upon self-report of drug use and medical conditions, which is subject to recall bias. Moreover, the legal consequences and societal stigma of marijuana use may cause underreporting of drug use. Even if participants were to correctly report marijuana use, the NHANES 2007-2008 survey did not capture information pertaining to the amount of drug use nor the route of consumption. Subsequent NHANES cycles incorporate more detailed questions regarding drug use; however, these questions cannot be used when combining data sets prior to the NHANES 2009-2010 cycle. Furthermore, as with any cross-sectional study, the limitations would best be addressed in a longitudinal prospective study design.

Implications

Given the societal pressures for acceptance of marijuana, there is a critical need for cohesive evidence regarding the risks and benefits of its use. Generally speaking, reclassification of marijuana from a Schedule I substance to a Schedule III, IV, or V substance may allow for advancements in research that will improve scientific knowledge of marijuana usage and its health effects. There is also a need for improved standardization of marijuana use in epidemiologic studies including dosage, length of use, and route of consumption. Based on the results of this study, public health programs should increase drug use prevention and intervention

initiatives geared towards young men, which is consistent with previously reported trends in gender differences among marijuana users (Substance Abuse and Mental Health Services Administration, 2013). Moreover, marijuana use should continue to be considered as a potential health risk despite the lack of statistically significant evidence from this study.

Conclusion

The current study is important because there are only few nationally representative epidemiologic studies that examine the relationship between marijuana use and overall health. To the best of our knowledge, this is the first study describing a comprehensive health profile of adult marijuana users in the United States. The use of NHANES data has some advantages including generality, representativeness, and credibility. The majority of marijuana research is based on small-scale studies to investigate medicinal marijuana use or single facets of health. This study found that marijuana users are more likely to engage in health risk behaviors and report a lower quality of life; however, marijuana was not associated with poorer health outcomes. Furthermore, strong evidence linking marijuana use to chronic health conditions, as is the case with tobacco and alcohol use, is lacking strength. Further studies are needed to accurately assess the long-term health consequences of marijuana use.

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APPENDIX A

A1. Descriptive analysis of demographic and social characteristics of adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use.

Variables	N	Frequency or Mean of Variables ¹		
		<i>Never</i>	<i>Past</i>	<i>Current</i>
Age	6658	40.1 (39.4 – 40.7)	41.2 (40.5 – 41.9)	34.2 (33.2 – 35.2)
Gender				
Male	3287	43.9 (42.2 – 45.6)	51.6 (49.2 – 53.9)	61.2 (58.4 – 64.1)
Female	3371	56.1 (54.4 – 57.8)	48.4 (46.1 – 50.8)	38.7 (35.9 – 41.6)
Race/Ethnicity				
White	2965	54.5 (47.3 – 61.8)	78.0 (74.6 – 81.4)	68.4 (63.0 – 73.8)
Black	1277	11.4 (8.9 – 14.0)	9.9 (8.0 – 11.7)	16.9 (13.3 – 20.4)
Hispanic	2096	23.5 (17.9 – 29.1)	9.1 (6.8 – 11.4)	10.9 (7.0 – 14.8)
Asian/Other	320	10.5 (7.9 – 13.1)	3.0 (2.0 – 4.1)	3.8 (2.4 – 5.2)
Education				
< HS	1707	20.0 (17.5 – 22.5)	13.5 (11.1 – 15.9)	19.7 (16.1 – 23.2)
HS/GED	1588	22.3 (19.7 – 24.8)	22.5 (20.0 – 24.9)	26.7 (23.4 – 30.0)
College	3356	57.7 (55.0 – 60.4)	64.0 (59.7 – 68.4)	53.6 (48.3 – 58.9)
Income:Poverty ratio	6119	3.0 (2.81 – 3.1)	3.4 (3.2 – 3.5)	2.6 (2.5 – 2.79)
Smoke cigarettes*	1815	54.2 (49.3 – 59.0)	46.5 (41.9 – 51.2)	75.4 (71.4 – 79.3)
Drink alcohol**	5091	63.7 (61.0 – 66.4)	89.7 (87.7 – 91.6)	93.4 (91.6 – 95.2)
Lifetime illicit drug use	1312	2.1 (1.4 – 2.9)	28.0 (25.9 – 30.1)	45.0 (41.0 – 49.1)
Fast food meals per wk.	5478	2.1 (1.9 – 2.3)	2.3 (2.05 – 2.5)	2.7 (2.4 – 2.9)

¹Reported as % for categorical variables and mean for continuous variables

*Current cigarette smoking

**Alcohol use refers to having at least 12 alcohol drinks in any one year

APPENDIX B

B1. Prevalence of marijuana use among adults aged 20-59 who participated in the NHANES 2007-2010 survey (N = 6729).

Marijuana Use	N	Prevalence (%)
Never user	3097	41.3
Lifetime user	3632	59.1
Past user	2367	41.1
Current user	1194	17.6
Light user	457	54.4
Heavy user	398	45.6

Notes: Lifetime use refers to having ever used marijuana at least once. Past users have used marijuana, but not in the past 12 months. Current users reported marijuana use within the past 12 months. Light users reported using marijuana 1-8 days in the past month. Heavy users reported using marijuana 9+ days in the past month.

APPENDIX C

C1. Self-perceived health of adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use (N = 6656).

	Mean Likert Score		
	<i>Never</i>	<i>Past</i>	<i>Current</i>
Perceived health:			
General health	2.6 (2.58 – 2.7)	2.5 (2.48 – 2.6)	2.64 (2.6 – 2.7)
Healthiness of diet	3.0 (2.9 – 3.03)	3.0 (2.9 – 3.04)	3.1 (3.07 – 3.2)

Notes: Based on a Likert scale of 1 to 5 (1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor)

APPENDIX D

D1. Self-reported quality of life in adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use (N = 6656).

	Mean number of days in the past 30 days		
	<i>Never</i>	<i>Past</i>	<i>Current</i>
Physical health not good	3.0 (2.6 – 3.4)	3.3 (2.9 – 3.8)	3.9 (3.3 – 4.5)
Mental health not good	3.9 (3.5 – 4.2)	4.6 (4.1 – 5.0)	6.1 (5.5 – 6.7)
Inactive due to poor health	1.5 (1.2 – 1.7)	1.8 (1.5 – 2.2)	2.1 (1.8 – 2.5)
Pain interfered with activities	2.4 (2.1 – 2.7)	3.5 (2.9 – 4.1)	3.8 (3.3 – 4.3)
Felt anxious	5.5 (5.2 – 5.9)	6.5 (6.0 – 7.0)	8.4 (7.6 – 9.2)
Unhealthy Days	6.2 (5.8 – 6.6)	7.0 (6.5 – 7.6)	8.9 (8.2 – 9.6)

Notes: Unhealthy days = sum of days physical and mental health is not good (max. 30 days).

APPENDIX E

E1. Frequency of unhealthy days reported by adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use (N = 6534).

	Frequency of unhealthy days in the past 30 days		
	<i>Never</i>	<i>Past</i>	<i>Current</i>
0-14 days	83.4 (81.7 – 85.0)	80.7 (78.4 – 83.0)	75.5 (72.3 – 78.8)
15+ days	16.6 (15.0 – 18.3)	19.3 (17.0 – 21.6)	24.5 (21.2 – 27.7)

Notes: 15+ unhealthy days defined as fair/poor health

APPENDIX F

F1. Logistic regression analysis to determine the association between number of unhealthy days and current marijuana use in adults aged 20-59 who participated in NHANES 2007-2010.

	Model 1	Model 2	Model 3
# of Unhealthy Days	OR (95% CI)	OR (95% CI)	OR (95% CI)
15+ days versus 0-14 days	1.6 (1.3 – 2.0)	1.4 (.92 – 2.0)	1.3 (.9 – 1.9)

Model 1: unadjusted

Model 2: adjusted for age, gender, race/ethnicity, income-to-poverty ratio, education

Model 3: Model 2 + adjusted for cigarette and alcohol use

APPENDIX G

G1. Frequency of self-reported medical conditions in adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use (N = 6658).

Number of Medical Conditions Reported (%)			
	None	1 or 2	3+
<i>Current</i>	51.6 (47.9 – 55.3)	39.1 (36.3 – 41.9)	9.3 (6.9 – 11.6)
<i>Past</i>	39.6 (36.4 – 42.8)	48.3 (45.6 – 51.1)	12.1 (10.5 – 13.7)
<i>Never</i>	40.7 (38.2 – 43.1)	46.7 (44.5 – 48.8)	12.6 (11.4 – 13.9)
Total	42.1 (39.9 – 44.4)	46.0 (44.3 – 47.8)	11.8 (10.6 – 13.0)

Notes: A total of 12 medical conditions were of interest in this analysis

APPENDIX H

H1. Prevalence of select medical conditions reported by adults aged 20-59 who participated in NHANES 2007-2010 grouped by never, past, or current marijuana use.

Medical Condition (yes)	N	Prevalence of Medical Condition (%)		
		<i>Never</i>	<i>Past</i>	<i>Current</i>
Obese (BMI \geq 30)	3788	40.7 (37.8 – 43.6)	36.2 (33.4 – 39.0)	27.0 (23.6 – 30.4)
High blood pressure	1481	22.7 (20.1 – 25.3)	23.0 (20.6 – 25.4)	16.1 (13.4 – 18.8)
High cholesterol	1461	35.8 (33.2 – 38.4)	36.1 (33.0 – 39.1)	32.5 (26.8 – 38.2)
Diabetes	438	6.1 (5.2 – 6.9)	4.8 (3.7 – 5.9)	3.3 (2.0 – 4.6)
Current asthma	527	53.5 (46.0 – 61.0)	54.4 (47.6 – 61.3)	48.3 (40.0 – 56.5)
Asthma attack in past year	287	47.1 (38.7 – 55.4)	55.9 (47.6 – 64.2)	59.5 (45.5 – 73.6)
Current bronchitis	147	45.8 (33.9 – 57.6)	39.8 (30.0 – 49.6)	46.0 (34.1 – 57.9)
Emphysema	78	.7 (.3 – 1.1)	1.1 (.6 – 1.5)	1.5 (.7 – 2.3)
Cancer	279	4.3 (3.1 – 5.6)	5.8 (4.2 – 7.3)	4.8 (3.5 – 6.2)
Stroke	100	.8 (.5 – 1.1)	1.4 (.8 – 2.0)	2.0 (1.12 – 2.9)
Heart failure	70	.8 (.5 – 1.1)	.6 (.3 - .9)	1.0 (.3 – 1.6)
Heart attack in past year	114	1.5 (1.0 – 1.9)	1.4 (.9 – 1.9)	1.7 (.9 – 2.6)
Coronary heart disease	72	1.2 (.7 – 1.6)	1.2 (.8 – 1.7)	.3 (0.0 - .5)

APPENDIX I

II. Logistic regression analysis to determine the association between number of medical conditions reported and current marijuana use in adults aged 20-59 who participated in NHANES 2007-2010.

	Model 1	Model 2	Model 3
# of Medical Conditions	OR (95% CI)	OR (95% CI)	OR (95% CI)
1-2 versus None	.66 (.54-.77)	.78 (.52-1.2)	.84 (.55-1.3)
3+ versus None	.58 (.43-.78)	.61 (.39-.97)	.71 (.45-1.1)

Model 1: unadjusted

Model 2: adjusted for age, gender, race/ethnicity, income-to-poverty ratio, education

Model 3: Model 2 + adjusted for cigarette and alcohol use